MEASURING SUSTAINABLE DEVELOPMENT

APPLICATION OF THE GENUINE PROGRESS INDEX TO NOVA SCOTIA

THE 2008 NOVA SCOTIA GPI ACCOUNTS

INDICATORS OF GENUINE PROGRESS

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April 2009

SUMMARY OF KEY RESULTS

FOR THE 2008 NOVA SCOTIA GENUINE PROGRESS INDEX BY COMPONENT

DOMAINS / COMPONENTS / INDICATORS	RESULTS
DOMAIN: TIME USE	
1. Civic and Voluntary Work	
Trends in formal volunteer hours per capita	Volunteer hours have declined nationwide. Fewer volunteers are now putting in longer hours in order to maintain services.
Hours per volunteer and volunteer burnout	In 2000, volunteers in Nova Scotia increased their volunteer hours by 32%. The sharp increases in annual volunteer hours—occurring at the same time as a significant decline in the number of volunteers—may provide a warning signal of potential future burnout among volunteers struggling to maintain the same level of services with fewer human resources.
Composition and distribution of voluntary work	
Trends in formal plus informal voluntary work	Between 1992 and 2005, the most dramatic declines in civic and voluntary work contributions occurred in Newfoundland and Labrador (down 27%) and Nova Scotia (down 21%).
Economic value of civic and voluntary work	Canadian volunteers contribute the equivalent of $64.9 billion ($2007) worth of services annually to the national economy either through voluntary organizations or by informal volunteer work—far more than a wide range of other industries. In Nova Scotia, volunteers contributed the equivalent of $1.8 billion ($2007) worth of services in 2005. The decline in volunteerism in Nova Scotia between 1998 and 2005 cost the province $370 million in lost voluntary services in 2005.
2. Unpaid Housework and Childcare	
Total workload (paid and unpaid)—men and women	Between 1992 and 2005, total work hours (paid and unpaid) per week for both men and women in dual-earner families have increased. Women continue to do the lion’s share of unpaid work.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
Total work hours of full-time, dual-earner parents and lone-parent mothers	The 2005 total work hours data for these two groups are not publicly available; therefore, it is not possible to ascertain a trend at this time. However, 1998 Statistics Canada data show that the total weekly paid and unpaid work hours of full-time, employed, dual-earner parents aged 25–44 amounted to 71.4 hours for men and 73.2 hours for women. Total paid and unpaid work hours for full-time working mothers amounted to 74 hours a week and for full-time, employed, single mothers, it added up to 75 hours a week. Trend data are available for women aged 25–54. Counting both full-time and part-time workers, the average time spent on paid and unpaid work by women aged 25–54 increased from 57.4 hours a week in 1986 to 61.6 hours a week in 2005.
Time stress	Between 1998 and 2005 there was an increase in severe time stress among Nova Scotians from 16.2% to 18.3% of the population. The proportion of Nova Scotian women suffering from severe time stress jumped from 17.4% in 1998 to 22.7% in 2005. Nova Scotian women are nearly 70% more likely to be severely time stressed than Nova Scotian men.
Value of unpaid housework and childcare	Unpaid household work and childcare contributed $10.4 billion to the Nova Scotia economy in 2005.
3. Leisure Time	
Trends in free time—men, women, and single mothers	Free time in Nova Scotia has declined by an average of half an hour a day, or 186 hours a year, since 1998 as Nova Scotians work longer hours. The biggest losers of free time are single working mothers, who saw their free time shrink by 2.7 hours a day—or nearly 19 hours a week.
Value of free time	Nova Scotians are losing $1.25 billion worth of free time each year compared to what they had ten years ago.
Composition of free time	Watching television comprises 40% of free time use in Nova Scotia. Nova Scotians spend 31% less time reading for pleasure than in 1992 and 35% less time socializing outside their homes.
4. Paid Work Hours	
Unemployment rate	There have been decreases in both the official unemployment rate and the supplementary unemployment rate for Canada and Nova Scotia since 2001. Unemployment last year was at its lowest level in more than 30 years.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
Economic costs	The output loss (productivity) costs and fiscal costs associated with the official unemployment rate in 2006 of 7.9% were $3.6 billion, or $3,941 per Nova Scotian, compared to $4.4 billion ($4,846 per capita) in 2001 when the unemployment rate was 1.8 percentage points higher. The potential economic burden of illness in Nova Scotia that may be associated with the 2006 official unemployment rate of 7.9% is estimated to be $162.2 million—down from $202 million in 2001 when the jobless rate was 1.8 percentage points higher.
Hours polarization	There has been a move away from hours polarization, with fewer people working at the extreme ends of the scale.
Overtime	Between 1997 and 2007, there was an increase in the incidence of overtime in Canada and Nova Scotia.
Temporary work rate	The incidence of temporary work in Nova Scotia remained fairly steady between 2001 and 2007, but remains above 1997 levels.
Involuntary part-time rate	Rates of involuntary part-time work have declined since 2002, though they remain considerably higher than 30 years ago.
Work effort	Forty percent of the increase in real earnings between 1980 and 2001 for dual-earner Nova Scotian couples with children was purchased with increased work hours. The proportion is higher for couples shifting from single-earner to dual-earner status. Due to the high cost of data purchase from Statistics Canada, it is not possible at this time to assess progress for this indicator since 2001.
Work stress	Due to data comparability issues, it is not possible to ascertain a trend at this time.
DOMAIN: LIVING STANDARDS	
5. Employment	
Please see the previous component, "Paid Hours of Work," which falls into both the Time Use and the Living Standards domains.	
6. Income Distribution	
Income inequality (gap between rich and poor)	The gap between rich and poor Canadians has widened substantially since 1981, while it has narrowed somewhat in Nova Scotia. The regional income gap (between the richest and poorest provinces) continues to widen.
Prevalence of low income	There has been a decline in the prevalence of low income in both Canada and Nova Scotia. However, economic vulnerability remains highly concentrated among certain groups.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
Gini coefficient	Since 1976, inequality as measured by the Gini coefficient has increased in all provinces, except Prince Edward Island.
Gender wage gap: hourly female to male wage ratio	In Canada, the gender wage gap narrowed between 2001 and 2008.
7. Financial Security and Debt	
Wealth distribution by quintile	Since 1999, Canada's wealth gap has widened, with the richest 20% of Canadians increasing their wealth by 43% and the poorest 20% going deeper into debt—so deep, in fact, that they could not get out of debt even if they sold off everything they owned. The evidence points to declining financial security for millions of Canadians.
Regional distribution of wealth	Atlantic Canadians have a declining share of Canada's growing wealth, owning only 4.9% of the country's total household wealth—down from 5.3% in 1999—even though they make up 7.4% of Canada's households.
Debt growth versus asset growth	The rate of household debt growth is far outpacing the rate of household asset growth, particularly in Atlantic Canada and Ontario. Between 1999 and 2005, household debt grew by 62% in Atlantic Canada, while assets grew by only 35%.
Debt growth versus income growth	In both Atlantic Canada and nationwide, debt growth is far outpacing income growth. Only the richest Canadians have seen income grow at a faster pace than debt.
8. Economic Security	
Index of economic security	Economic security in Nova Scotia declined during the 1981–2007 period, as it did nationwide. In 2007, the overall index of economic security in Nova Scotia was 0.581, a decline of 12.9% from its level of 0.667 in 1981. Nationwide, the economic security index declined from 0.666 to 0.555, a drop of 16.7%. The declines were driven by increased economic risks due to illness, and the higher share of household budgets spent on private health care.
Minimum wage	There has been virtually no change in the real (inflation-adjusted) minimum wage in Nova Scotia over a 26-year period. In 2006, employable persons on minimum wage in Nova Scotia had to work more hours per week than they did in 1981 in order to reach the low income cut-off (LICO).
Social assistance benefits	Welfare benefits decreased nationwide in real terms over the period 1986–2006, but Nova Scotia saw a substantially sharper decline in welfare benefits than the Canadian average.
Child benefits	Total child benefit investments more than doubled in Nova Scotia from $11.1 million in 1998/1999 to $27 million in 2006/2007—an increase of 144%. This was somewhat below the national increase of 162%.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
DOMAIN: HUMAN AND SOCIAL CAPITAL	
9. Population Health	
Self-rated health	Between 1994/1995 and 2007, the percentage of men and women rating their health as excellent or very good declined in both Canada and Nova Scotia.
Mortality due to selected causes	Mortality rates for selected diseases declined in both Canada and Nova Scotia between 1979–2004, except for the rate of mortality due to lung cancer, which increased in that time period.
Health conditions / diseases	**Asthma:** There has been no improvement in asthma rates among Nova Scotians or Canadians between 1994/1995 and 2007. In 2007, Nova Scotia had the highest prevalence of asthma in the country. **Diabetes:** In both Canada and Nova Scotia, the prevalence of diabetes increased between 1994/1995 and 2007 from 3.6% to 6.8% in Nova Scotia and from 3% to 5.8% in Canada. In 2005, the prevalence of diabetes in Nova Scotia peaked at 9.3%. **High blood pressure:** The prevalence of high blood pressure increased in both Canada and Nova Scotia between 1994/1995 and 2007. The incidence in Nova Scotia has consistently been higher than the Canadian average, but the gap appears to be narrowing in recent years. **Cancer:** Between 1976 and 2006, cancer rates in Nova Scotia increased significantly—by 39% for men and by 24% for women. Cancer rates in Nova Scotia are higher than the Canadian average.
Mental health	**Life stress:** Fewer Canadians and Nova Scotians reported high levels of life stress in 2007 than seven years earlier. **Perceived mental health:** There was little change in the self-rated mental health of Nova Scotians between 2003 and 2007. **Self-esteem:** There was a significant improvement in the levels of self-esteem among Nova Scotian men and women between 1994/1995 and 2003.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
Behavioural (lifestyle) risk factors	**Smoking:** Rates of smoking decreased in both Canada and Nova Scotia between 1994/1995 and 2007 from 29.3% to 21.9% in Canada and from 32.7% to 24.4% in Nova Scotia. **Obesity:** Between 1994/1995 and 2005, the rates of obesity increased in Canada from 12.7% to 15.5% and in Nova Scotia from 16.7% to 20.7%. Nova Scotia has consistently had higher rates of obesity than the national average. **Physical inactivity:** Between 1994/1995 and 2007, there was a decrease in the percentages of Canadians and Nova Scotians who were physically inactive—from 54.6% to 48.2% in Canada and from 62.5% to 50% in Nova Scotia.
Economic costs	**Tobacco use:** Smoking costs the Nova Scotian economy an estimated $943.8 million a year ($2007), or about $1,000 for every person in the province. $171.3 million of this total is from direct health care costs. **Obesity:** Obesity costs Nova Scotia an estimated $148 million ($2007) a year in direct health care costs—or roughly 5% of the total health budget—and an additional $173 million ($2007) a year in indirect productivity losses, or more than $320 million in total costs. **Physical inactivity:** When direct medical costs and economic productivity losses are combined, the total economic burden of physical inactivity in Nova Scotia is estimated to exceed $395 million ($2007) annually. **Chronic disease:** Seven categories of chronic disease were estimated to cost Nova Scotia a total of $3.4 billion in direct health care costs and indirect productivity losses in 2007—$1.4 billion in direct health costs and more than $2 billion in indirect costs including lost productivity due to premature death and disability.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
10. Safety and Security	
Crime rates	**Total:** Since 1997, there has been a decline in the official crime rate in both Canada (by 18%) and Nova Scotia (by 12%), where the chances of being of victim of crime declined from one in 11 in 1997 to one in 13 in 2007. However, the overall crime rate in Nova Scotia now exceeds the national average and remains considerably higher than 30–40 years ago. **Violent crime:** Nova Scotia's violent crime rate increased between 1998 and 2004, and has since declined somewhat. However, in 2007, the provincial violent crime rate was nearly 15% higher than the Canadian rate, indicating a reversal of the "comparative advantage" enjoyed by Nova Scotia for roughly the two decades from 1967–1987. **Homicides:** There was a decline in the average homicide rate in Nova Scotia between the 1992–1997 and 2002–2007 time intervals. **Property crime:** The property crime rate in both Canada and Nova Scotia has been decreasing since the early 1990s.
Perceptions of crime	Satisfaction with personal safety from crime has improved nationwide—from 86% of Canadians in 1993 to 94% in 2004—and is highest in all four Atlantic provinces: Newfoundland and Labrador (99%), Prince Edward Island (98%), New Brunswick (97%), and Nova Scotia (95%).
Domestic violence	The rate of police-reported spousal violence in Canada peaked in 2000, but since then has steadily decreased.
Economic costs	The total comprehensive estimate for the cost of crime in Nova Scotia is $1.5 billion—a marginal decrease of 0.5% (or $8 million) over the last decade and about twice the magnitude of the conservative estimate ($704 million). If increases in the official crime rate are discounted by one-third to account for higher reporting rates in some areas in 2007 than in 1962, and if crime costs are roughly proportional to crime rates, then Nova Scotians could have saved $851.2 million in 2007 if crime rates were still at 1962 levels, according to the comprehensive estimate.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
11. Educated Populace	
Government student debt and tuition fees	Postsecondary students in Nova Scotia today are graduating with unprecedented debt loads. Nova Scotia has the second highest level of university student debt in the country. Nova Scotia has the highest average undergraduate tuition fees in Canada. Over the last 30 years, tuition has accounted for an increasing share of university operating revenue.
Public expenditures per full-time student (K–12)	Nova Scotia spent the second lowest amount of money per public school student in the country in 2004/2005.
Public versus private share of sponsored research at universities	The ratio of private to public funding of research has increased markedly since the early 1970s, posing a potential threat to the academic integrity and independence of Canadian university research.
Trends in prose and document literacy	Despite higher rates of postsecondary graduation, there was no real improvement in the literacy profiles of Canadians between 1989 and 2003.
Trends in general political knowledge by age cohort	The political knowledge of Canadians is in general decline. This decline is particularly marked among younger people, who tend to have considerably less political knowledge today than younger people did a generation ago.
Ecological Footprint by educational attainment	Those with the highest levels of educational attainment have the greatest impact on the environment.
DOMAIN: NATURAL CAPITAL	
12. Soils and Agriculture	
Net farm income	Net farm income has dropped an average of 91% in Nova Scotia since 1971, and in 2007 reached the lowest levels ever recorded in the province. Nova Scotia farms have recorded negative net farm income in four of the last six years.
Expense to income ratio	The expense to income ratio increased from an average of 82% in the 1970s to an average of 97% in the last decade—far exceeding the 80% threshold estimated as needed for a healthy farm sector. In 2006, the expense to income ratio reached 100% for Nova Scotia farms.
Debt to net farm income ratio	Total farm debt increased by 146% in Nova Scotia between 1971 and 2006 and the debt to income ratio grew steadily. For recent years, it is not mathematically possible to calculate a ratio of debt to net income for Nova Scotia when the latter is zero or less.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
Solvency ratio	The solvency ratio increased by 106% in Nova Scotia between 1971 and 2006, indicating that Nova Scotia farms are becoming much less sustainable with the rate of farm debt increase rapidly outstripping any appreciation in the capital value of farms.
Percentage of Nova Scotia consumer dollar going back to Nova Scotia farmers	In Nova Scotia, it appears that only about 7% of the consumer food dollar is returned to farmers—down from 10% in the 1990s.
Soil cover days	According to the most recent data for 2001, the average number of soil cover days in Nova Scotia has remained fairly steady since 1991 but has increased slightly since 1981. The average number of soil cover days in Nova Scotia has remained consistently higher than the Canadian average.
Ratio of productive value of agricultural land to market land value	The net productive capacity of Nova Scotia's farm land has declined significantly relative to market land values, with the most dramatic decline occurring between 1996 and 2006 when farm income plunged dramatically.
Intensity of synthetic input use	The intensity of synthetic input use has decreased in Nova Scotia since 2000.
Proportion of farm land occupied by forest and wetland	In 2006, 49% of Nova Scotia farm land, 34% of Kings County farm land, and 8% of Canadian farm land was occupied by forest and wetlands. Due to changes made in the 2006 Census of Agriculture, it is not possible to assess a trend at this time.
13. Forests	
Forest age class distribution	There has been a sharp and significant loss of old forests in Nova Scotia since the province's first major forest inventory in 1958, with no significant improvements in age class distribution in recent times and a continuing shift to ever younger forests.
Number of known forest-dependent species at risk	There has been an increase in the number of known forest-dependent species at risk in Nova Scotia since 2001.
Protected areas as percentage of total provincial landmass	There has been an increase in the percentage of Nova Scotia's total landmass under protection from 8.1% in 2001 to 8.5% in 2007.
Harvest methods	There has been a marginal increase in the use of selection harvesting in the province. However, clearcutting remains by far the predominant harvest method in use.
Value added per cubic metre of wood harvested	Between 1998 and 2004, the rate of value-added forest product per cubic metre of wood harvested declined in Nova Scotia—giving it the second lowest ranking among the provinces in 2004.
Jobs per unit of biomass	Jobs per unit of biomass in the forest industry in Nova Scotia have not increased since 2001.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
14. Fisheries and Marine Resources	
Quantity and value of fish stocks	**Groundfish:** Using groundfish in the Eastern Scotian Shelf region as an indicator of fish abundance, this measure has decreased substantially since the 1980s. The cod biomass shows no sign of recovery, while the haddock and pollock stocks show limited recovery. The value of the groundfish stocks in the Eastern Scotian Shelf region has decreased since the late 1980s, signifying a depreciation of natural capital. Despite modest increases in the value of the haddock and pollock stocks, the value of all groundfish stocks in the region remains low compared to the historically high levels of the mid- to late 1980s. **Lobster:** Landings have increased nearly five fold since the 1970s, leading to a perception that lobster stocks are healthy, but increased levels of fishing effort on lobster may have contributed considerably to the increased catches since 2001. In Nova Scotia, 2007 lobster landings suddenly dropped to 70% of the 2006 record level, returning to the lower levels of the 1990s. It is too early to determine the cause of this sharp decrease—in particular, what it says about the sustainability of the high catch levels of the previous few years. There is concern that lobster stocks could be in potentially serious trouble—possibly for the first time in recorded history.
Fish size: a measure of health and quality of individual fish	The "size at age" of some finfish stocks around Nova Scotia have remained relatively stable over time, while other stocks show either increasing or decreasing trends over the past 10–15 years.
Mean trophic level of harvested species	There has been a steady decline in the mean trophic level of the species landed in Nova Scotia's fisheries since the mid-1980s. Species at the top of the marine food web have been depleted, and lower trophic level species are now the primary target and source of revenue in Nova Scotia's fisheries.
Marine species at risk	The two species groups examined here—marine mammals, and sharks and rays—have experienced substantial population declines in Atlantic Canada. While the mortality rate and birth rate of the North Atlantic right whale population have both increased since the 2002 *Nova Scotia GPI Fisheries and Marine Environment Accounts*, the increased birth rate is insufficient to counter the rate of population decline and the population is now in even greater jeopardy.
Shellfish closures	The number of shellfish closures in Nova Scotia has increased steadily since 1940, and has more than doubled since 1985.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
Employment	The number of fishers employed in Nova Scotia decreased greatly from the highs experienced in the late 1980s and early 1990s, to much lower levels later in the 1990s following the collapse of the groundfish fishery. After 2001, the number of fishers rose somewhat, then fell again, and certainly has not returned to the high, likely unsustainable, pre-collapse levels.
Fishery GDP: a conventional economic measure	Nova Scotia's fishery GDP was steady at high levels for several years up to the time of the groundfish collapse. Between 1992 and 1995, that fishery GDP decreased by almost half. After 1995, the fishery GDP increased again, and by 2006, it had grown to nearly 80% of the 1992 level.
Age structure of fishers	The proportion of older fishers has increased since 1931, while the proportion of younger fishers has decreased. The proportion of middle-aged fishers has remained relatively stable.
Institutional expenditures to effectively manage fisheries and the marine environment	Expenditures by the federal Department of Fisheries and Oceans in Nova Scotia declined in the second half of the 1990s, jumped substantially in 2000, and then decreased steadily from 2000–2003. Provincial Department of Fisheries and Aquaculture expenditures show an overall increasing trend since 1996. However, both federal and provincial government expenditures as a proportion of the landed value of Nova Scotia fisheries have decreased over time.
15. Air Quality	
Criteria Air Contaminant emissions	**CO:** Nova Scotia's carbon monoxide emissions have declined steadily since 1990 and are projected to reach about half of 1990 levels by 2015, but they remain higher on a per capita basis than other OECD countries. **TPM:** Total particulate matter emissions declined by 42% from 1990–2005 but are projected to increase by about 50% from 2005 levels in the coming decade. **PM_{10}:** Emissions of particulate matter less than 10 microns declined by nearly 40% from 1990–2005 but are projected to increase by about 30% over the coming decade. **$PM_{2.5}$:** Emissions of particulate matter less than 2.5 microns declined by one-third from 1990–1995, but have seen no further improvement since then and are projected to remain stable at 1995–2005 levels over the coming decade.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
Criteria Air Contaminant emissions (continued)	**SO_X:** Sulphur oxide emissions declined by 22% from 1990–2005 and are projected to decrease by another third by 2010. Due, however, to its heavy reliance on coal for electricity generation, per capita SO_X emissions in Nova Scotia are more than double the Canadian average and higher than in all other provinces and all of 30 reporting OECD countries—more than three times the level in the United States and more than 20 times that in Germany. **NO_X:** Nitrogen oxide emissions increased by more than 20% between 2000 and 2005 to reach their highest level since the 1980s but are forecast to decline by more than 40% from peak 2005 levels in the coming decade. Per capita NO_X emissions in Nova Scotia were about 10% above the Canadian average and higher than in all but one of 30 reporting OECD countries—65% above US levels and 5.5 times German levels. **VOCs:** Volatile organic compound emissions declined by over 40% between 1990 and 2005 and are expected to remain stable at 2005 levels over the coming decade. Per capita VOC emissions in Nova Scotia were about 30% below the Canadian average but still higher than in all 30 OECD countries and more than three times the levels in Germany. **Hg:** Coal-fired power generation accounts for more than 90% of recorded mercury emissions in Nova Scotia. Nova Scotia Power mercury emissions declined sharply between 2000 and 2002, have remained relatively stable since then, and are mandated to decrease by 70% from pre-2001 levels by 2010.
Ambient air quality	Atmospheric concentrations of carbon monoxide, total particulate matter (including PM_{10} and $PM_{2.5}$), and sulphur dioxide have all declined in Nova Scotia since 1990 and remain within accepted guidelines. Nitrogen dioxide concentrations have not declined substantially since 1990 but remain within accepted guidelines. However, ground-level ozone concentrations remain among the highest in the country—largely due to transboundary pollution—and regularly exceed “maximum acceptable concentrations.”
Economic costs	Health and environmental damages due to Nova Scotia’s air pollutant emissions in 2005 are valued at more than a half billion dollars, or $560 for each Nova Scotian. Sulphur oxide emissions—primarily from Nova Scotia Power’s coal-fired power plants—accounted for more than 40% of all air pollution costs. As emissions continue to decline, estimated air pollution costs in 2015 are projected to be 25% less than in 2000 and 40% less than in 1990.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
16. Water Quality	
Releases of water pollutants by industry, agriculture, and municipalities	The main sources of water pollution can be attributed to the release of industrial effluent, discharge from municipal sewers, and run-off from agricultural fields. The 2004 pollutant release to surface waters in Nova Scotia increased by over 300% when compared to releases in 1995. However, changes in inventory methodologies and the pollutants included in the inventory are likely largely responsible for this large increase. In the same time period, on-site pollutant releases to land decreased by over 400% from 435 tonnes in 1995 to 30 tonnes in 2004. Currently, 25% of Nova Scotia's sewage (approximately 375,000 cubic metres per day of wastewater) is handled through 125 municipal wastewater treatment facilities. Onsite septic systems treat 45%, and raw sewage discharges make up the remaining 30% of sewage management in the province. The intensification of agricultural practices—in particular, the growing use of fertilizers and pesticides and the increased specialization and concentration of crop and livestock production—has had an increasing impact on water quality in Nova Scotia. The main agricultural water pollutants that are released include nitrates, phosphorus, and pesticides.
Municipal water supply compliance to Canadian drinking water quality guidelines	All drinking water quality indicators point towards a marked improvement in drinking water quality in Nova Scotia in the past decade.
Quality of rivers, lakes, and wetlands	**Acidification of lakes:** Significant decreases in sulphate deposition have been measured in Nova Scotian lakes in the past decade. However, the recovery of alkalinity and pH has not occurred to the extent necessary to reduce acid deposition below critical loads (harmful levels) and to ensure the recovery of aquatic and terrestrial ecosystems. **Loss of wetlands:** A comprehensive inventory of Nova Scotia's wetlands, which provide many important ecological services, has been completed. As of 2007, there are estimated to be approximately 377,000 hectares of wetlands in Nova Scotia, an estimated loss of 17% of freshwater wetlands and 62% of saltwater wetlands from the original area of wetlands in Nova Scotia. **Recreational fishing:** Catches of Atlantic Salmon and Brook Trout that are impacted by acid rain have continued to decline steadily.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
Economic costs	An estimated total of $3.45 billion per year ($2006) in damage, restoration, and health costs is associated with wetland loss and water pollution in Nova Scotia. By far the largest cost component is the value of services once provided by wetlands that have been lost.
17. Energy	
Total energy demand, by sector and fuel type	Nova Scotia's total energy demand grew by 25% from 1991–2005 and then fell by 11% between 2005 and 2006. Transportation accounts for the highest share of energy demand—34%, up from 26% in 1978.
Per capita energy demand, Canada and provinces	Nova Scotia's per capita energy demand increased by 22% from 1991 to 2005 and then fell by 11% between 2005 and 2006. Among the provinces, Nova Scotia had the second lowest per capita energy demand in the country—21% below the national average.
Total primary energy production	Primary energy production in Nova Scotia increased sharply from 1999–2001, due to Sable Island natural gas production, but has declined by 29% since then. The province is again a net importer of energy—with the vast majority of its energy needs dependent on foreign oil and coal.
Per capita primary energy production, Canada and provinces	Per capita primary energy production in Nova Scotia increased sharply from 1999–200,1 due to Sable Island natural gas production, but has declined by 28% since then. In 2006, Nova Scotia ranked fifth among the provinces in primary energy production—62% below the national average.
Proportion of electricity generated from renewable sources	In 2006, 80.4% of Nova Scotia's electricity was from coal—the highest share since 1993. Renewables accounted for just 8.8%—relatively unchanged since 1993 and mostly from older, small-scale hydro projects. In 2006, wind energy production had not yet significantly changed the mix.
Primary sources of coal for electricity generation	Coal—accounting for over 80% of Nova Scotia's electricity fuel mix—is almost entirely imported from foreign countries, where coal production has produced some serious social and environmental problems.
Economic costs	Damage costs attributable to air pollutant and GHG emissions from Nova Scotia's stationary energy sources (power plants and refineries) in 2005 are estimated at more than $380 million, or $400 per Nova Scotian.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
DOMAIN: HUMAN IMPACT ON THE ENVIRONMENT	
18. Energy Use	
Please see the previous component, "Energy," which falls into both the Natural Capital and the Human Impact domains.	
19. Solid Waste	
Solid waste disposed per capita	Since 2001, Nova Scotians have been producing and disposing more garbage per capita. Since 2006, there has been a slight reversal of this upward trend.
Diversion rate	In 2006/2007, the Nova Scotia waste diversion rate (36%) was well below the 50% peak achieved in 1999/2000 but remained highest among the provinces.
Residential recycling and composting rates	Residential recycling and composting rates in Nova Scotia have increased since 2001, and Nova Scotia continues to boast the highest rates among those provinces reporting.
Hazardous and toxic wastes	Due to lack of a tracking system, and therefore the absence of any raw data, it is not possible to evaluate progress on the disposal of household hazardous waste.
Stewardship agreements with producers	There has been one new stewardship agreement (for electronic waste) put in place since the 2004 *GPI Solid Waste Resource Accounts*. Progress continues to be made in this area.
20. Ecological Footprint	
Ecological Footprint for Canada	According to the 2008 Edition of the Canadian National Footprint Accounts, Canada's 2005 Ecological Footprint was 7.07 gha—8% smaller than the 7.6 gha for 2003, but 2.6 times larger the world average per capita Footprint of 2.69 gha. In 2005, according to the Canadian National Footprint Accounts, the total global supply of productive area or biocapacity was 2.06 global hectares per capita. This means that, if everyone in the world lived and consumed like Canadians do, we would need 3.43 planets to support that lifestyle. **Note:** Nova Scotia data are presently unavailable, but Chapter 20 notes that reliance on coal for electricity likely expands the provincial Footprint.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
21. Greenhouse Gas Emissions	
Total greenhouse gas emissions, 1990–2006	Nova Scotia's GHG emissions decreased by nearly 10% from 2005–2006. However, this decrease is largely the result of indirect changes in energy supply and demand, suggesting that radical changes are still needed in order to meet GHG reduction targets.
Per capita greenhouse gas emissions, 1990–2006	Nova Scotia's per capita GHG emissions decreased by nearly 10% from 2005–2006. The province's rate of 21 tonnes of CO_2 equivalent GHGs per capita was the fourth highest in Canada in 2006 and, according to the UNFCC, puts Nova Scotians among the largest emitters of GHGs in the world.
Total greenhouse gas emissions by sector, 2006	Electricity production accounts for over 31% of Nova Scotia's total GHG emissions, highlighting the need to shift away from coal-fired power plants. Transportation accounts for 29% of total GHG emissions, with light trucks (SUVs and minivans) accounting for over 31% of GHG emissions from road transport.
Nova Scotia performance relative to various greenhouse gas emissions reduction targets, 1990–2006	Nova Scotia would have to reduce its 2006 GHG emissions by 9% in two to four years to achieve the Kyoto reduction targets; by 13% by 2020 to meet the provincial Environmental Goals and Sustainable Prosperity Act reduction targets; and by 27% by 2020 and 81% by 2050 to meet the Suzuki Foundation targets.
Economic costs	Nova Scotia's 2006 GHG emissions could cost the global economy more than $725 million in predicted climate change damage costs, according to the lowest (most conservative) estimates available. Therefore, it is clear that Nova Scotia's GHG emissions, while only a tiny fraction of the world's emissions, will have a significant adverse impact on the world. The 2006 GHG emissions released from Nova Scotia's electricity generation stations alone are predicted to cause a minimum of $227 million in climate change damages to the global economy. Per capita GHG emissions in Nova Scotia were 21 tonnes in 2006, which translates into global damage costs of at least $777 for each Nova Scotian. A comparison of control costs and damage costs indicates that investments in greenhouse gas reduction are highly cost-effective, and that attainment of the province's legislated Environmental Goals and Sustainable Prosperity Act reduction targets will save more than $800 million net when control costs are subtracted from predicted damage costs.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
22. Transportation	
Total road passenger movement	Total road passenger movement in Nova Scotia has increased by 19% since 1990. The use of light trucks (including SUVs and minivans) increased by 65% between 1990 and 2006, while passenger movement by bus decreased by nearly 10% in that same time period.
Road passenger movement per capita, in Nova Scotia and Canada	Per capita road passenger movement in Nova Scotia has increased by 16% since 1990. Nova Scotia's per capita rate was third highest in Canada in 2006. Per capita road travel using light trucks (including SUVs and minivans) increased by 61% between 1990 and 2006, while per capita passenger movement by bus decreased by nearly 12% in that same time period.
Total transportation energy use	Total transportation energy use in Nova Scotia declined by nearly 9% between 2005 and 2006. Energy use by off-road vehicles has increased by 170% since 1990.
Per capita transportation energy use	Per capita transportation energy use declined by just over 8% between 2005 and 2006. Nova Scotia's per capita transportation energy use of 82.8 GJ was sixth highest in the country and nearly 9% above the national average.
Total greenhouse gas emissions from transportation	Greenhouse gas emissions from Nova Scotia's transport sector declined by nearly 10% between 2005 and 2006 but were still 14% higher than 1990 levels. Road transportation accounted for 68% of transport-related GHG emissions in the province in 2006. The share of transport-related GHG emissions from light trucks (including SUVs and minivans) increased by nine percentage points between 1990 and 2006.
Per capita greenhouse gas emissions from transportation, Nova Scotia and Canada	Per capita GHG emissions from transportation were down 9% in 2006 but were still nearly 11% higher than in 1990. In 2006, Nova Scotia had the third lowest per capita GHG emissions from transportation in the country.
Number of fatalities and injuries from road accidents	The total number of injuries and fatalities from road transportation declined by 11% and 52%, respectively, between 1990 and 2005. In 2005, traffic injuries per 100,000 residents in Nova Scotia were 20% below the national average, and traffic fatalities per 100,000 residents were 15% below the national average.
Commute modal split	In Nova Scotia, 84% of commuters use a car to get to work—73% as drivers and another 11% as passengers. Another 6% use public transit, and 9% walk or bicycle to work.
Commuting distance	Just over half (55%) of all commutes in Nova Scotia are under ten km, 23% are 10–20 km, and 22% are more than 20 km.
Government spending on public transit as a percentage of total spending on road transportation	In Nova Scotia, 8% of total government spending on road transportation is on public transit—up from 4.5% since 1990 but still about 50% below the national average.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
Economic costs	The full cost of private automobile use in Nova Scotia is estimated at more than $7.2 billion a year ($2007) when a full range of economic, social, and environmental costs is considered. About one-third of these costs are "external"— borne by society rather than by car users.

ACKNOWLEDGEMENTS

GPI Atlantic gratefully acknowledges funding towards this study and towards the completion of the Nova Scotia Genuine Progress Index provided by the Province of Nova Scotia, the Alerce Trust, Susan and Bill van Iterson, and GPI Atlantic members and donors.

In addition, GPI Atlantic gratefully acknowledges funding assistance from the Canada Foundation for Innovation and the Atlantic Canada Opportunities Agency for the development and construction of the integrated Nova Scotia Genuine Progress Index database. Without that database, it would not be possible to transfer the GPI data to the Nova Scotia Community Counts, nor to update the results easily as new data become available, nor to allow replication for other jurisdictions.

Completion of the research and development phase of the Nova Scotia Genuine Progress Index, signified by this report, was a huge team effort that could not have been accomplished without the dedication and outstanding work of many dozens of experts, researchers, writers, board members, friends, and supporters. Our stalwart researchers have put in long hours way past the call of duty in their dedicated effort to produce the highest quality work.

Particular thanks are due to Vanessa Hayward, as well as Saskia Tait and Patrick Ellis, for copy-editing and formatting this volume, to Karen Hayward for ongoing research and organizational support in countless ways, to the many experts who reviewed various parts of this report, to the original researchers and authors of the roughly one hundred GPI reports produced over more than a decade whose original work has been updated here, to our creative web designers who have made our materials available to the general public, and to all the agencies and individuals who provided funding for different parts of the GPI over many years to reach this stage. All should rightly be named here, since this report is the fruition of all their hard work, innovation, dedication, and support over more than a decade.

As well, many individuals and volunteers have made remarkable contributions to maintaining and strengthening GPI Atlantic as an organization—such as John Leon, Sara Winchell, and Steve Peters who expertly created and maintained a first-rate accounting system that enabled GPI Atlantic to survive financially, and like Gilles Deveau who gave so many volunteer hours of expert legal time to complete documentation, attain charitable status, and ensure our legal house was in order. And there have been strong supporters of this work in provincial and federal government departments, and in agencies like Statistics Canada, including individuals like Hans Messinger, former Director of Industry Measures at Statistics Canada, whose hands-on support of the Nova Scotia GPI work from its inception to the present has never flagged, and who contributed hugely to accessing key data over many years.

There have been journalists and columnists whose role in communicating the GPI work to the larger public, and whose consummate skill in synthesizing complex information in digestible form while maintaining the integrity of the research and results, have been crucial in bringing the GPI from the fringe to the mainstream. And there have been quiet and humble friends at every level who have received no recognition, and yet whose unflagging contributions have provided the infrastructure and support without which the GPI could not exist—folk like Mike and Jean Crowell of our local UPS store, who always went over and above the call of duty to be amazingly and cheerfully available over more than a decade to print up, collate, bind, and despatch reports often at the very last minute and at just a moment's notice.

It is simply not possible to name all the splendid, dedicated, and skilled individuals and organizations who have contributed in so many generous and accomplished ways to the Nova Scotia Genuine Progress Index over twelve years. The authors of this summary report wish they could all be named and their actions described here in the detail they deserve—but this would literally take countless pages, and we would still undoubtedly miss some key people. You all know who you are. Please just accept the most profound thanks of the authors of this report: we have built on your work and on your support, and we could not have reached this point without you. The Nova Scotia Genuine Progress Index *is* the collaborative work of all of you.

EXECUTIVE SUMMARY

A NEW COMPASS: The Completion of the Genuine Progress Index and the Future of Nova Scotia

For more than a decade, GPI Atlantic's focus and mandate have been to ask what *genuine progress* in society looks like, and to attempt to assess whether we are achieving it. This 2008 Genuine Progress Index (GPI) report is the culmination of nearly 12 years of research and developmental work to create new measures of progress for Nova Scotia that account for a wide range of social, economic, and environmental realities. These measures, which are now ready for use and application, are intended to provide the province with a practical and comprehensive tool to measure its progress towards genuinely sustainable prosperity.

What is presented here is a summary of key headline indicators in 20 social, economic, and environmental areas—divided into 5 domains and updated with the latest available data at time of writing. They are accompanied by a set of economic evaluations assessing the value of many key social and natural assets not currently valued in our conventional balance sheets, and examining a much broader range of real benefits and costs than are captured in our conventional economic accounts.

Since the Second World War, economic growth statistics based on the Gross Domestic Product (GDP) have been widely used as a proxy for societal wellbeing and prosperity. This was not the intention of those who created the GDP. Simon Kuznets, Nobel Prize winner and principal architect of national income accounting, warned nearly half a century ago: "The welfare of a nation can scarcely be inferred from a measurement of national income[.] Goals for 'more' growth should specify of what and for what."

GDP-based measures can assess only the quantity of market activity—a very different thing from meaningful progress. Activities that degrade our quality of life, like crime, pollution, and environmental degradation, can all make the GDP grow. The more fish we sell, the more trees we cut down, and the more we buy and consume, the more the GDP grows. Working longer hours makes the economy grow, while consequent losses of free time and voluntary work remain invisible in our conventional accounts because they entail no market transactions. Indeed higher rates of stress are actually "good" for the economy if they induce more drug sales and physician visits. So long as money is being spent—regardless of what it is being spent on—the economy will grow.

And so, the GDP can grow even if poverty increases, even if habitat destruction increases, even if we fish to the point of a stock collapse, and if we remove trees unsustainably, or mine the earth's non-renewable resources to the point where they are exhausted. What's more, the faster we deplete our natural resources and the more fossil fuels we burn, the faster the GDP grows.

Because we assign no value to our natural world, we actually count its depreciation as economic gain.

One observer has described the use of the GDP to measure progress as "brain-dead accounting," because it omits so much of our reality and thus sends highly misleading signals to policy makers. Another compares the use of GDP to measure progress with a pilot trying to fly a plane using a single gauge on the control panel—altitude, for example. For the plane to take off, land, and fly properly, and for the passengers to reach their destination safely, however, we expect the pilot to master, read, and understand a far more complex and variegated set of measures and gauges that together give the pilot the information he needs to pilot the plane. Policy makers similarly require a more comprehensive set of gauges and measures to assess how a nation or province is doing, and to pilot the ship of state towards the goals and aspirations of its people.

To that end, the GPI treats human, social, and natural capital as integral components of our national and provincial wealth, just like the produced, material, and financial capital that is regularly tracked in our standard economic accounts. Not only does the GPI therefore explicitly value human, social, and natural capital, but it also recognizes that they are subject to depreciation, just like produced capital, and thus equally require re-investment to maintain and enhance their value.

If a river is polluted, if population health declines, if crime rates increase and voluntary work declines, these can be regarded, from an accounting perspective, as a depreciation of natural, human, and social capital respectively. Conversely, environmental restoration, health promotion, and a strengthening of social networks and supports can be seen, again from an accounting perspective, as investments in those capitals.

Thus, the GPI makes some crucial distinctions that are absent in GDP-based measures: the GPI gives explicit value, for example, to the economic contributions of unpaid household and volunteer work that are ignored in market-based measures. It counts crime, pollution, greenhouse gas emissions, natural resource depletion, and sickness as costs, not gains, to the economy. And it assigns explicit value to the health and education of the population, to their free time, and to the natural wealth inherent in forests, fish stocks, water resources, and soils. It counts a smaller ecological footprint as a sign of progress. And it values equity as a contribution to social cohesion—therefore counting not only how much income is generated (as in the GDP), but how that income is shared.

The trends in more than 100 indicators of social, environmental, and economic wellbeing presented in this report and summarized here in the accompanying Table of Summary Results, demonstrate very clearly that the GDP's omission of these key measures of environmental sustainability, quality of life, health, equity, financial security, educational attainment, community strength, and leisure make it an unsuitable, misleading, and possibly even dangerous statistic when it is mistakenly misused as a measure of progress. The current economic crisis shows just how misleading the GDP can be, in that much of the growth in GDP in the U.S. since 2001 was simply the result of people excessively borrowing money against their homes to make consumer purchases.[1]

On the whole, trends in the 20 key areas examined in this study indicate progress in some key economic, social, and environmental indicators, but also point to growing inequities and a significant decline in the ability of ecosystems to perform a wide range of interconnected ecological, social, and economic functions that provide vital services to human society. A key conclusion from the evidence examined is that more growth of the same kind we have witnessed will create a significant downward trend in the Genuine Progress Index over time.

A few illustrative results and conclusions are presented below as examples of a few of the significant trends highlighted in this report, though the following illustrations are by no means intended as a comprehensive summary of the wide range of results presented in the full report or even in the accompanying Summary Table of Results. As well, please refer to the accompanying paper, which outlines the differences between indicators and accounts as measurement tools, the basic principles of full-cost accounting used in the GPI, the policy utility of the new measures, and their particular applicability to the current global economic crisis. In addition, PowerPoint presentations accompany that parallel paper and this report. In that larger context, the following sample results—culled from this larger report—illustrate a few key themes, trends, and economic valuations that may be of particular interest to policy makers.

Greenhouse gas emissions

Among all the domains and indicators of the Genuine Progress Index, and of all the evidence examined in 12 years of GPI research, what emerges as perhaps the most critical area in which action is urgently required is the reduction of greenhouse gas (GHG) emissions. The Intergovernmental Panel on Climate Change (IPCC) notes that eleven of the last twelve years rank among the warmest since 1850, and the warming trend in the last half century (between 1956 and 2005) has been nearly twice that of the century-long trend between 1906 and 2005. Global average sea level has risen at a rate of 1.8 mm per year since 1961, and 3.1 mm per year since 1993. Annual average Arctic sea ice has shrunk by 2.7% per decade since 1978, and mountain glaciers and snow cover have declined in both hemispheres.

Predicted impacts of climate change in Nova Scotia include an increase in extreme weather events, particularly hurricanes, floods and droughts, as well as adverse impacts on the province's fisheries and agricultural industries. Other serious impacts predicted for Nova Scotia include flooding in low-lying areas, coastal erosion, saltwater infiltration of groundwater, and falling lake and groundwater levels.[2] At the global level, according to the best scientific evidence available, climate change poses the greatest known threat to long-term human wellbeing, prosperity, and indeed survival on the planet.

Nova Scotia's GHG emissions decreased by nearly 10% between 2005 and 2006. However, this decrease is largely the result of indirect changes in energy supply and demand in the province (like the strike-induced closure of the Port Hawkesbury pulp and paper mill and the final decommissioning of the Cohasset Offshore Oil Project), which means that radical changes are still needed in order to meet GHG reduction targets. The good news is that the GPI analysis contained in this report demonstrates clearly the cost-effectiveness of greenhouse gas reduction measures. Thus, this report contains an analysis of the costs and benefits of reducing Nova

Scotia's GHG emissions to reach the province's Environmental Goals and Sustainable Prosperity Act target of a 10% reduction in GHG emissions below 1990 levels by 2020. If the necessary control costs are subtracted from the benefits in avoided climate change damages and cleaner air, the net cumulative gain to society is likely to exceed $846 million a year. Achieving the more ambitious David Suzuki Foundation target of a 25% reduction of GHG emissions below 1990 levels by 2020 would produce a net cumulative benefit of more than $1.8 billion a year. The analysis found that every $1 invested in reducing GHG emissions between 2008 and 2020 will save at least $29 in avoided climate change damages.

Even using the most conservative possible cost assumptions—comparing the most minimal predicted climate change damage costs with the most pessimistic (high-end) costs of reducing emissions—the economic benefits of reducing emissions were still found to exceed the actual costs of reducing emissions. What this means, in essence, is that greenhouse gas emission reductions are cost effective at any price when compared to potential climate change damage costs—using any range of estimates in the accepted, peer-reviewed literature.

This GPI conclusion is strongly supported by the most thorough and comprehensive analysis of the economics of climate change ever undertaken. Lord Nicholas Stern, former Chief Economist of the World Bank, found that a stabilisation of atmospheric greenhouse gas concentrations could cost 1% of global GDP, while inaction in a "business as usual" scenario would cost between 5% and 20% of global GDP, depending on the climate change models employed. According to Stern, "The benefits of strong, early action on climate change outweigh the costs"; and "The costs of stabilising the climate are significant but manageable; delay would be dangerous and much more costly."

Social trends: income, equity, work (paid and unpaid), and crime

One area that has seen improvement in Nova Scotia over the last decade is income distribution. Income and its distribution are widely acknowledged as core and basic indicators of wellbeing. Abundant evidence links poverty with physical deprivation, illness, crime, poor educational attainment, low productivity, stress, and other detriments to wellbeing. Income inequality also affects societal wellbeing and cohesiveness more broadly, while extreme inequities can undermine political stability and social cohesion. Any reduction in poverty and inequality therefore signify genuine progress.

Disposable income data in Nova Scotia indicate that the income gap has narrowed somewhat since 1998 after widening in the 1990s, and that rates of poverty and low income have declined in the last decade. For the country as a whole, however, the gap between rich and poor Canadians has widened substantially since 1981, and the regional income gap (between the richest and poorest provinces) has also widened. Analysis of the hourly female-to-male wage ratio indicates that the gender wage gap narrowed in Canada between 2001 and 2008. Because women have traditionally been subject to a wide range of inequities, and because inequity has been documented to affect health adversely, the narrowing of the gender wage gap in recent years therefore has considerable potential to improve women's health.

In terms of wealth and the ability of households to weather a financial crisis, however, GPI Atlantic found that Canada's wealth gap has widened greatly since 1999. The richest 20% of Canadians have increased their wealth by 43% while the poorest 20% have fallen deeper into debt—so deep in fact that they could not get out of debt even if they sold off everything they owned. The evidence overwhelmingly points to declining financial security for millions of Canadians even during the recent prolonged economic boom period.

In terms of student debt, Nova Scotia has the second highest level of university student debt in the country. Nationally, student loan debt is disproportionately concentrated in the poorest 40% of Canadian households, who hold fully 70% (or $14 billion worth) of all student debt in the country. The poorest 20% of Canadian households are by far the largest holders of student debt, collectively owing $9.4 billion or 47% of outstanding Canadian student loans in 2005.[3]

The GPI analysis of debt and financial security, released in September, 2008, sheds some light on the origins of the present economic crisis. The current crisis, which has sent shock waves around the globe, actually began in 2006–2007 with high default rates on U.S. sub-prime mortgages. Those mortgages were the result of increasingly risky lending and borrowing practices in preceding years. In addition, individual (consumer) and corporate debt had reached record highs. The increase in default and foreclosure activity in the U.S.—up nearly 80% between 2006 and 2007—eventually triggered the collapse of the market for asset-backed securities, which in turn triggered the financial crisis.

The salient point here, from the GPI perspective, is that in September of this year, just prior to the market collapse, GPI Atlantic had reported that the very Canadians who were most at risk of default were going deeper into debt—the situation which, in the U.S., led directly to the sub-prime defaults. And it found that 80% of Canadians saw their debts grow at a significantly faster pace than their incomes in the last decade, compromising the ability of many households to service their debts adequately. In sum, the debt-fuelled growth patterns of the past decade contained some of the key seeds of the crisis now being experienced.

The GPI analysis also contains some broader societal warning signals. In the last three decades, crime rates have fluctuated with the business cycle, and have increased in tandem with the increases in unemployment that have accompanied recessions. Conversely, the last few years have seen the lowest levels of unemployment in more than three decades, and have seen a steady parallel decline in crime. From the 1950s through the 1990s, the average unemployment rate in Canada steadily increased from an average of 4.2% in the 1950s to an average of 9.5% in the 1990s. Peak unemployment years in Canada were 1983 and 1993 when 11.9% and 11.4% of Canadians, respectively, were out of work. Since 2001, the official unemployment rate in Canada has decreased from 7.2% to 6%, and crime rates have fallen steadily since their peak at the height of the early 1990s recession. The present economic downturn—and the massive layoffs likely to ensue—are likely to see a concomitant rise in crime rates unless timely preventive measures are undertaken to cushion the impact of unemployment.

A GPI economic analysis of these trends found that the recent decline in the unemployment rate produced a significant savings to society and the economy. Thus, the output loss and fiscal costs associated with the official unemployment rate in 2006 of 7.9% were $3.6 billion or $3,941 per Nova Scotian, compared to $4.4 billion ($4,846 per capita) in 2001 when the unemployment rate was 1.8 percentage points higher.[4] The potential economic burden of illness in Nova Scotia attributable to the 2006 official unemployment rate of 7.9% is estimated to be $162.2 million—down from $202 million in 2001 when the jobless rate was 1.8 percentage points higher.

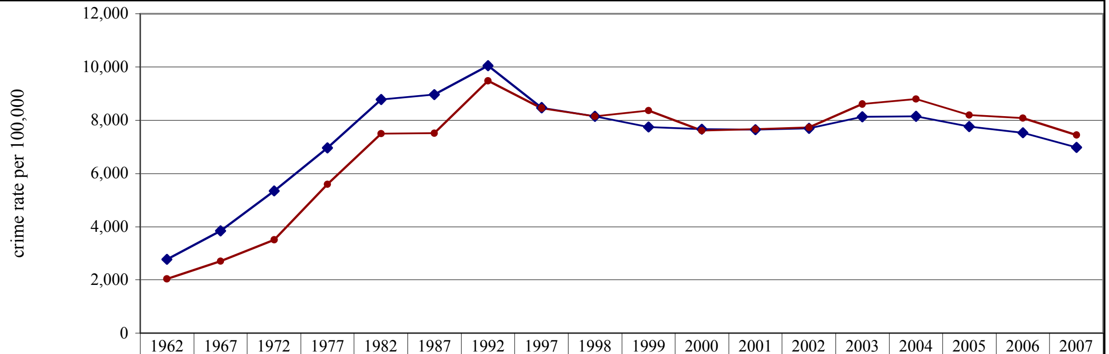
The present economic crisis means that, as unemployment rates begin to rise, there is likely to be a gradual but significant increase not only in output losses and fiscal and illness costs, but also in property offences. According to one study referenced in this report: "Unemployment is an important determinant of the social conditions in which crime becomes more prevalent."[5] According to data reported by GPI Atlantic in 2004, 57% of Nova Scotia adults committed to sentenced custody in 2001–02 were unemployed at the time of sentencing—nearly six times the unemployment rate in the general population at the time. Similarly, in 2001–02, nearly 63% of young offenders in Nova Scotia were unemployed.[6]

Figure 1 below illustrates how crime rates both in Canada and in Nova Scotia (indeed, in almost all provinces) peaked during the recessions of the early 1980s and early 1990s, easing off as employment rates rose. In 1983–85, as Canada pulled out of recession, crime rates (and unemployment rates) declined in Nova Scotia and nationwide. In the 1990s crime rates (and unemployment rates) peaked during the recession, reaching the highest levels ever recorded.

Since 1997 there has been a decline in the official crime rate in both Canada (by 18%) and Nova Scotia (by 12%), while the chances of being of victim of crime declined from one in eleven in 1997 to one in 13 in 2007. However, the overall crime rate in Nova Scotia now exceeds the national average and remains considerably higher than 30–40 years ago.

GPI Atlantic found that crime cost Nova Scotia more than $700 million in 2007—amounting to a saving of $8 million dollars over the 1997 costs of crime. However, crime rates both in Nova Scotia and nationwide remain considerably higher than they were in the 1960s. If increases in the official crime rate are discounted by one-third to account for higher reporting rates in some areas in 2007 than in 1962, and if crime costs are roughly proportional to crime rates, then Nova Scotians could have saved $851.2 million in 2007 if crime rates were still at 1962 levels, according to a comprehensive estimate of crime costs.

Figure 1. Crime rate, total incidents per 100,000 population, Canada and Nova Scotia, 1962–2007



	1962	1967	1972	1977	1982	1987	1992	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Canada	2,771	3,850	5,355	6,971	8,773	8,957	10,040	8,475	8,161	7,752	7,667	7,655	7,706	8,142	8,160	7,769	7,543	6,984
NS	2,036	2,701	3,509	5,602	7,498	7,525	9,475	8,461	8,163	8,380	7,624	7,670	7,738	8,611	8,791	8,206	8,081	7,456

Source: Statistics Canada. Uniform Crime Reporting Survey. CANSIM Table 252-0013. Minister of Industry. Ottawa.

Just as the average overall unemployment rate has been higher in each decade, never quite returning to pre-recession levels, so robbery rates have also increased steadily each decade as well. As Canadian unemployment rates rose from an average of 4% in the late 1960s to 6.7% in the 1970s to 9.3% in the 1980s to an average of 10% between 1992 and 1997, robbery rates rose correspondingly from 34 per 100,000 in the 1960s to 68, 93, and 106 per 100,000 in each of the succeeding decades. The Nova Scotia progression follows a similar trend, as do most other provinces (Table 1 below).[7]

Table 1. Robbery rates and unemployment rates, Canada and Nova Scotia, 1962–1997 (average rates by decade)

	CANADA		NOVA SCOTIA	
	Robbery Rate (per 100,000)	**Unemployment Rate**	**Robbery Rate (per 100,000)**	**Unemployment Rate**
1962-69	33.6	4.0%*	16.0	4.9%*
1970-79	68.1	6.7%	32.8	8.1%
1980-89	93.3	9.3%	38.3	11.8%
1992-97	105.7	10.0%	41.6	12.5%

Sources: Statistics Canada, *ESTAT* and *CANSIM* databases.

Note: Unemployment rates are averaged for the years 1966–69, the earliest available on Statistics Canada's *ESTAT* and *CANSIM* databases.

Therefore, it is entirely reasonable to predict that the current economic downturn will lead to an increase in the crime rate, possibly exceeding the levels of the early 1990s, as the recession deepens and generates more layoffs. With this understanding and foreknowledge, social safety net features can be put in place now to prevent despair and marginalization among those who will be affected by the job losses. Given the enormous social costs associated with both joblessness and an increased crime rate, it is prudent to take early action both to avoid job losses and to create new work opportunities. This can be done by implementing a variety of strategies including a reduced work week that can help to redistribute work hours, and job creation programs in areas that are ultimately beneficial to society, including land conservation, forest restoration, renewable energy projects, retrofitting existing buildings, sustainable transportation, local food production, arts and music, education and health.

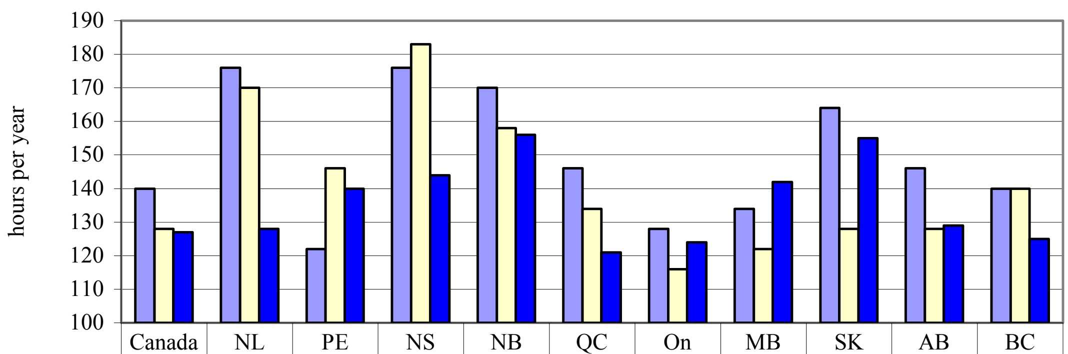
Several GPI reports have noted that poverty and inequality are often precursors to social unrest, and are among the most reliable predictors of poor health. Socioeconomic status has been linked to cardiovascular diseases, arthritis and musculoskeletal disorders, and diabetes mellitus. This knowledge, along with documented associations between unemployment and illness, can again predict that the impending economic downturn will have disease consequences that in turn will adversely impact health-care costs. An understanding of these costs highlights the cost-effectiveness of policy measures like shorter work weeks designed to avoid layoffs, and of investments in social measures designed to lessen the impact of the economic downturn on the most vulnerable.

This discussion illustrates the way that the GPI components, when connected and integrated, may give considerable predictive power to the GPI and thereby suggest policy options that are not currently on the agenda based on a narrower conventional analysis. This is quite simply because trends in one area have implications for other areas.

Another example of the GPI's predictive power is in its analysis over the years of the value of volunteer work to society. A society's commitment to voluntary work is a measure of the strength of its network of community-based organizations that together constitute what is often called "civil society." Analysts have observed that civil society, in turn, reflects societal health, stability, and harmony, and is thus a key indicator of social and community wellbeing and of a healthy democracy. It is the arena in which we participate most fully as citizens, freely choosing our interests and associations, and expressing our deepest aspirations to help others. Analysts have also observed that a weak civil society is more subject to social unrest, alienation, and disintegration. It is frequently associated with higher rates of crime, drug abuse and other dysfunctional activities, which eventually produce much greater social and economic costs.

In 1998, GPI Atlantic predicted a decline in volunteer work because it found that the groups with the highest rates of volunteerism (women and highly educated people generally) were the most time-stressed—and that these stresses were increasing as both groups worked longer paid work hours. The GPI report predicted that women and highly skilled employees would not be able to keep up their volunteer efforts as their paid work hours increased, and that volunteerism would be squeezed out by increased time pressures. The most recent data indicate that volunteer hours have indeed declined nationwide (see Figure 2 below), thus affirming the earlier prediction. The new data also show that fewer volunteers are now putting in longer hours in order to maintain services, providing an early warning signal of potential future burnout among volunteers struggling to maintain the same level of services with fewer human resources

Figure 2. Civic and voluntary work, average hours per year, total population, 15 years and older, Canada and provinces, 1992, 1998, and 2005



	Canada	NL	PE	NS	NB	QC	On	MB	SK	AB	BC
1992	140	176	122	176	170	146	128	134	164	146	140
1998	128	170	146	183	158	134	116	122	128	128	140
2005	127	128	140	144	156	121	124	142	155	129	125

Source: Statistics Canada. 1992, 1998, 2005 General Social Surveys.

If we integrate the findings of the Unpaid Housework and Childcare component of the GPI and of the GPI Free Time component, we can predict a further decline in civic and voluntary work if total work hours continue to increase and if leisure time continues to shrink away, as has happened in the past decade. Between 1992 and 2005, total work hours (paid and unpaid) per week for both men and women in dual-earner families increased. In addition, between 1998 and 2005, there was an increase in severe time stress among Nova Scotians from 16.2% to 18.3% of the population.

Women continue to do the lion's share of unpaid work even as they have sharply increased their paid work hours, so it is not surprising to find that the proportion of Nova Scotian women suffering from severe time stress jumped from 17.4% in 1998 to 22.7% in 2005. Nova Scotian women are nearly 70% more likely to be severely time stressed than Nova Scotian men. The GPI analysis of time use survey results also found that free time in Nova Scotia has declined by an average of half an hour a day or 186 hours a year since 1998. The biggest losers of free time were single working mothers, who saw their free time shrink by 2.7 hours a day or nearly 19 hours a week.

When all of these trends are viewed together—and if they continue—it is possible to predict a further future loss in the voluntary sector, which will further impact those Canadians who benefit most from voluntary activity, namely the elderly, disabled, sick, homeless, abused women and children, disadvantaged youth, and other vulnerable groups. The decline in volunteerism also adversely affects arts and culture, after-school activities, environmental groups, churches, and other sectors that rely heavily on voluntary activity. A consequent weakening of civil society and community networks may, in turn, lead to social unrest, alienation and disintegration, higher rates of crime, drug abuse, and other dysfunctional activities, which eventually generate significant social and economic costs. Paradoxically, the current economic downturn may be the best hope for a revival of volunteerism if it results in a generalized reduction of work hours rather than in layoffs.

The GPI economic analysis found that the actual services provided by volunteers in 2005 can be valued at roughly $1.8 billion ($2007). Even if we ignore the social costs associated with a weak "civil society," the decline in volunteerism in Nova Scotia between 1998 and 2005 cost the province $370 million in lost voluntary services in 2005, and will cost a similar amount every year that the shortfall persists.

Trends in population health

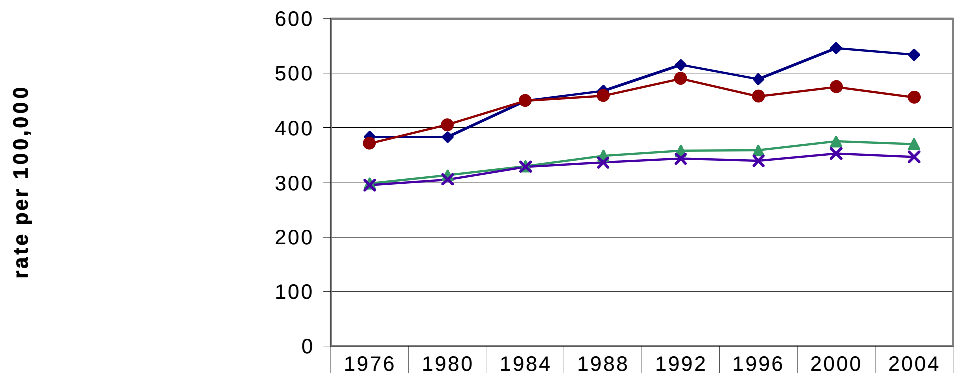
New health care technologies and early detection and screening programs have resulted in some observable health improvements, particularly in reduced mortality rates in some key areas. Thus, mortality rates for acute myocardial infarction, cerebrovascular diseases (particularly stroke), and colorectal cancer, for example, declined significantly in both Canada and Nova Scotia between 1979 and 2004. By contrast, mortality due to lung cancer increased in that time period due to increases in lung cancer mortality among women, whose rates of smoking declined more recently than for men.

Despite reduced mortality and improved screening in several categories, the GPI population health analysis found disturbing trends in some key areas. In the last 12 years, for example, the percentage of men rating their health as excellent or very good has declined in both Canada and Nova Scotia—a significant finding, since self-rated health is highly correlated with actual physical health outcomes. Canadian women saw a smaller decline in self-rated excellent or very good health, while Nova Scotian women saw an improvement from 1994/95 to 1998/99 and a decline thereafter. As these results are based on age-standardized data, demographic trends cannot account for the overall decline in self-rated health. Further investigation is particularly required to assess trends in self-rated health among Canadian and Nova Scotian youth.

As well, there was no improvement in asthma rates among Nova Scotians or Canadians between 1994–95 and 2007. In 2007, Nova Scotia had the highest prevalence of asthma in the country, and female asthma rates in Nova Scotia now stand at record levels—nearly twice as high as in 1994/95. Asthma prevalence is highest among children, with childhood asthma on the rise nationwide since 1994.

The prevalence of diabetes and high blood pressure increased in both Nova Scotia and Canada between 1994–95 and 2007, and cancer incidence increased by 39% for Nova Scotian men and by 24% for Nova Scotian women between 1976 and 2004 (Figure 3 below). Nova Scotia has the second highest cancer rate in the country—12.4% higher than the Canadian average—and the third highest rates of diabetes and high blood pressure.

Figure 3. Cancer incidence, age-standardized rate per 100,000 population, by gender, Canada and Nova Scotia, 1976–2004



	1976	1980	1984	1988	1992	1996	2000	2004
Nova Scotia (men)	384.3	383.2	449.8	467.7	515.6	489.3	546	534.2
Canada (men)	371.9	406.1	450	458.4	490	457.8	475.4	456.2
Nova Scotia (women)	299.1	313.1	330.4	349	357.7	358.5	374.8	370.4
Canada (women)	294.9	305.5	329.5	336	343.8	339.6	353.6	347.2

Source: Statistics Canada, Canadian Cancer Registry (CCR) Database, the National Cancer Incidence Reporting System and Demography Division (population estimates). CANSIM Table 103-0204.

Between 1994–95 and 2007, rates of adult obesity increased in Canada from 12.7% to 16%, and in Nova Scotia from 16.7% to 20.1%. Nova Scotia has consistently had higher rates of obesity than the national average. Rates of physical inactivity declined both nationally and provincially between 1994–95 and 2003, but have seen no further improvements since then. Fully half of Nova Scotians are still classified as physically inactive, heightening the risks of hypertension, type 2 diabetes, heart disease, colon cancer, and a range of other ills.

On the positive side, rates of smoking continue to decline both nationally and provincially, which in turn will reduce the incidence of lung cancer, heart disease, respiratory disorders, and other chronic diseases well into the future. Most impressively, rates of smoking among Nova Scotian youth (aged 15-24) declined from one in three in 1999 (33%) to one in five in 2005 (20%)—the sharpest decline in the country and a testimony to the effectiveness of the province's comprehensive tobacco control strategy, which included sharp increases in tobacco taxes, smoke-free places legislation, tobacco display restrictions, and school-based prevention programs. The example illustrates how indicator trends can be used to assess the effectiveness or otherwise of existing programs and policies.

The population health chapter in this summary GPI report updates GPI Atlantic's earlier cost estimates for chronic disease, tobacco, obesity, and physical inactivity to 2007 dollars using the Consumer Price Index, and outlines definitional changes and significant improvements in the epidemiological evidence, data sources, and costing methodologies that have become available since GPI Atlantic's original cost of illness studies in 1999–2002. A major year-long GPI Atlantic cost of obesity research project currently under way, and due for release in 2009, uses the wide range of newly available evidence to improve the quality and accuracy of cost estimates in this field, and may therefore become a suitable basis for future updates of GPI Atlantic's earlier health cost estimates for Nova Scotia.

Natural capital

At the same time that we have seen some progress in key areas, particularly in the economic and social realm (in reduced rates of poverty, unemployment, income inequality, crime, mortality, and smoking, for example), the GPI results in this report reveal some significant adverse impacts on the natural world, as well as serious problems in some of Nova Scotia's resource-dependent sectors.

By tracking the state of natural resource stocks, the GPI capital accounting system provides early warnings of potential asset depletion and degradation that may be countered by timely remedial action. In fact the natural capital results in this report indicate that real overall progress may require a shift to *preventing* resource loss rather than attempting to fix the problem after losses and damage have occurred.

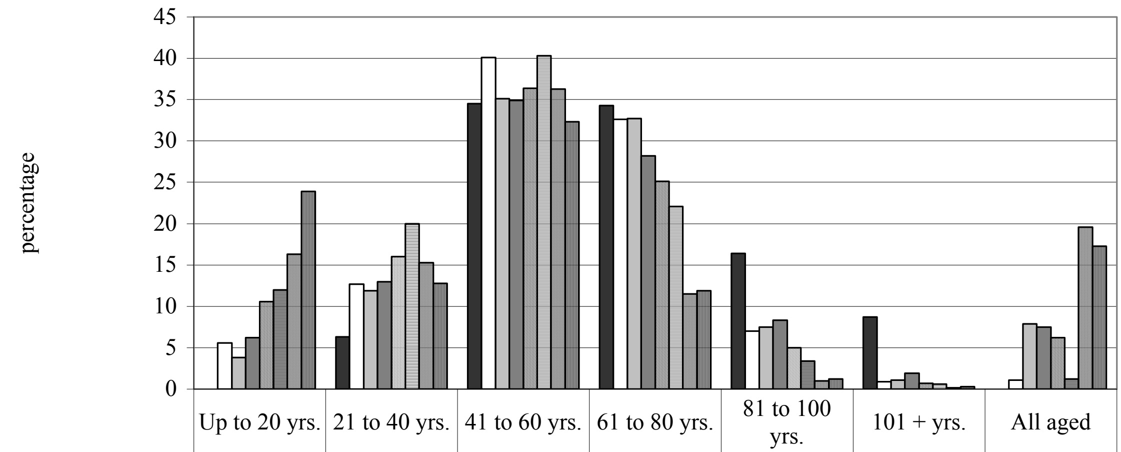
In the province's forests, for example, Nova Scotia has less clearcutting than it had a decade ago, more sustainable selection harvesting, and more land under protection. But the changes are too small to alter the already degraded state of the province's forests, which is the legacy of generations of over-harvesting, high-grading, clearcutting, and other unsustainable practices.

Thus, one area of very slight improvement is selection harvesting, which grew marginally from 0.9% of all provincial logging in 2000 to 1.5% in 2005–06, while clearcutting declined from 97% to 94% of all harvesting in the same period. As well, the percentage of Nova Scotia's land under protection increased from 8.1% in 2001 to 8.5% in 2007, and is set to increase to 9% with the imminent addition of three new pieces.

But these slight improvements are a far cry from what is needed to repair the enormous damage caused by the massive increase in logging and clearcutting in the last 25 years. Since the early 1980s, timber harvest volumes have increased by nearly 60%—from 3.3 million cubic metres annually to 5.2 million in 2006, after peaking at nearly 7 million cubic metres in 2004. As a result, the average age of Nova Scotia's forests has never been younger. In the 1970s, only 4% of the province's forests were under 20 years of age, compared to 16% in the 1990s and 24% today. While the percentage of forests over 80 years old has declined by 94% in the last half century, the proportion of very young forests up to age 20 increased by a remarkable 327%.

Older forests (aged more than 80 years) declined from 25% of Nova Scotia's forests 50 years ago to just 1.5% in the latest forest inventory. True old-growth forest, which dominated the province's forests prior to European colonization, has virtually disappeared from Nova Scotia. Only 0.3% of Nova Scotia's forests are now more than 100 years old, down from 9% fifty years ago (Figure 5 below). Not surprisingly, there has also been a marked concomitant decline in forest-dependent species of flora and fauna.

Figure 5. Forest area by age class, percentage of total forest area, Nova Scotia, 1958–2003



	Up to 20 yrs.	21 to 40 yrs.	41 to 60 yrs.	61 to 80 yrs.	81 to 100 yrs.	101 + yrs.	All aged
1958		6.3	34.5	34.3	16.4	8.7	
1965-71	5.6	12.7	40.1	32.6	7	0.9	1.1
1970-78	3.8	11.9	35.1	32.7	7.5	1.1	7.9
1975-82	6.2	13	34.9	28.2	8.3	1.9	7.5
1976-85	10.6	16	36.4	25.1	5	0.7	6.2
1979-89	12	20	40.3	22.1	3.4	0.6	1.2
1999 update	16.3	15.3	36.3	11.5	1.0	0.2	19.6
1997-2003	23.9	12.8	32.3	11.9	1.2	0.3	17.3

Sources: The Forest Resources of Nova Scotia (1958); Nova Scotia Forest Inventory Provincial Summary 1965-1971, 1970-1978, 1975-1982, 1976-1985, 1979-1989; DNR GIS 1995 Inventory Data (September 1999 update); DNR GIS Unpublished Inventory Data (1997-2003).

The current reliance on pulp and paper as a market for wood, the severely degraded state of provincial forests, and a lack of training have produced a decline in the rate of value-added forest product per cubic metre of wood harvested in Nova Scotia. In value-added production, Nova Scotia has the second-lowest ranking among the provinces—$107 per cubic metre harvested, compared to the Canadian average of $183, and $425 in Manitoba, which has a policy of promoting value-added business operations in forestry. In 2007, only 13% of all wood exports from Nova Scotia were characterized as value-added, compared to 28% in New Brunswick, 57% in Ontario, and 75% in Manitoba. The Canadian average was 29%.

The minimal progress in this area, and the lack of substantial positive change to date, undermine the Government's new commitment to "sustainable prosperity" and its stated intention to "demonstrate international leadership by having one of the cleanest and most sustainable environments in the world by the year 2020" (Environmental Goals and Sustainable Prosperity Act, 2007). The latest GPI forest statistics indicate that the "recuperative measures" which were actually needed half a century ago, according to the Government's own reporting at the time, are even more urgently required today if Nova Scotia is to meet its goal to have "one of the [. . .] most sustainable environments in the world."

The troublesome results in all dimensions of the province's natural capital, and the continued reliance on GDP-based measures that count the depletion of this capital as if it were economic gain, bring to mind the following serious warning:

> The short-lived empire of Ur exhibits the same behaviour as we saw on Easter Island: sticking to entrenched beliefs and practices, robbing the future to pay the present, spending the last reserves of natural capital on a reckless binge of excessive wealth and glory.[8]

If there is one area where we have already witnessed the failure of GDP-based measures both to signify progress and to send early warning signals, it is the fishery. Traditionally, we have assessed the economic performance of Nova Scotia's fishery by adding up all the revenue obtained from catching and selling fish. This practice misses a critical point, in that it does not account either for the value of fish remaining in the ocean, or for damage to the natural system which maintains the fishery. The fish in the sea, the quality of the water, the ocean bottom habitat, and all the other elements of the marine environment constitute "natural capital." This is what keeps the fishery functioning, and it needs to be recognized as having real value.

In the late 1980s, Nova Scotia's fishery for cod and other groundfish seemed to be booming. The media reported record catches, high exports, and strong contributions from a thriving fishery industry to the province's Gross Domestic Product (GDP). A few years later, many fisheries were collapsing and the fabric of many coastal communities began to unravel. Our conventional economic measuring sticks—such as landings, exports, and GDP—gave no warning whatever of the impending disaster. Catches were high, and the decline of the groundfish stocks remained hidden from public view because our accounting system assigned no value to natural capital. In fact, fishery GDP reached its highest recorded levels on the very eve of the groundfish stock collapse. A narrow set of economic measures failed to incorporate all that we value in the fishery and on which a healthy fishery totally depends—notably healthy fish stocks within a healthy ecosystem, supporting strong fishing communities and a sustainable fishing economy.

Fifteen years after the collapse of the groundfishery, the trends in some indicators of the health of fish stocks and the marine environment, coupled with renewed increases in the fishery GDP based on a shift to shellfish harvesting, are again sounding a warning. Using groundfish in the Eastern Scotian Shelf region as an indicator of fish abundance, we see that this measure has decreased substantially since the 1980s. The cod biomass shows no sign of recovery, while the haddock and pollock stocks show only limited recovery. The value of the groundfish stocks in the Eastern Scotian Shelf region has decreased markedly since the late 1980s, signifying a substantial depreciation of natural capital. Despite modest increases in the value of the haddock and pollock stocks, the value of all groundfish stocks in the region remains low compared to the historically high levels of the mid to late 1980s.

Lobster landings, meanwhile, have increased nearly five fold since the 1970s, leading to a perception that lobster stocks are healthy. But increased levels of fishing effort on lobster may have contributed considerably to the increased catches since 2001. As we should have learned from the sad example of the cod fishery, catch levels are no guarantee of healthy stocks. Most recently, in 2007, lobster landings in Nova Scotia suddenly dropped to 70% of the 2006 record level, returning to the lower levels of the 1990s. It is too early to determine the cause of this sharp decrease—and in particular what it says about the sustainability of the high catch levels of the previous few years. The concern, of course, is that lobster stocks could be in potentially serious trouble—possibly for the first time in recorded history.

Also alarming is the steady decline in the mean trophic level of the species landed in Nova Scotia's fisheries since the mid-1980s. Species at the top of the marine food web have already been depleted—notably the large predatory fish such as cod and tuna—and lower trophic level species are now the primary target and source of revenue in Nova Scotia's fisheries.

The situation for key marine species at risk has also worsened. The two species groups examined in this GPI report—marine mammals, and sharks and rays—have experienced substantial population declines in Atlantic Canadian waters. While the mortality rate and birth rate of the North Atlantic right whale population have both increased since the previous GPI Fisheries and Marine Environment report (2001), the increased birth rate is insufficient to counter the rate of population decline, and the population is now in even greater jeopardy than at the time of the original GPI Fisheries report.

In its failure to assess the value of natural capital in particular—perhaps more so than in any other area—GDP-based measures continue to paint a dangerously deceptive picture. As our natural capital declines, the GDP increases, because it counts only what we extract from our natural resource base, not what we leave behind. Yet, GDP itself will eventually take a hit when the capital base on which it rests is so depleted as to be unable to fuel further production— like a factory owner who sells off his machinery and celebrates the extra cash in his pocket, but is unable to produce more goods with his machinery gone.

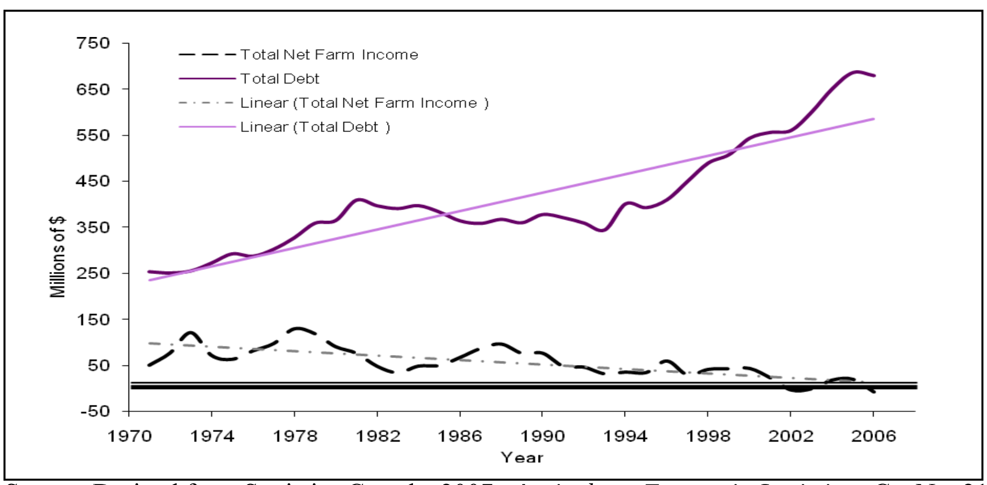
Thus, between 1992 and 1995, immediately following the groundfish collapse, the Nova Scotia fishery GDP decreased by almost half. After 1995, however, the Nova Scotia fishery GDP increased again as fishing effort switched to lucrative shellfish harvesting, and by 2006 it had grown to nearly 80% of the 1992 level. But these GDP dollar values again give no indication of biomass levels or of the health of stocks, so we are unable to assess, for example, whether the five-fold increase in lobster fishing is sustainable. In the fishery, the lessons of history are not very far in the past. Though the recent, sudden 30% decline in lobster landings does not constitute a trend and may be attributable to particular marine conditions in 2007, the precautionary principle indicates that remedial action in the form of conservation efforts be considered sooner rather than later in order to avoid another crisis like the one experienced 15 years ago.

Trends in agriculture

Reliance on GDP-based measures in agriculture has also masked very significant and disturbing changes taking place on Nova Scotia farms. Gross farm cash receipts rose by an average of 6.7% in Nova Scotia from 1971-2006. However, this GDP-based measure sends highly misleading signals to policy makers, businesses, and the general public, since it takes no account of the cost of farming or of product prices in relation to farm input prices, and therefore does not reveal the *net* income, expense, and debt levels that actually determine farm viability in practice.

Net farm income has dropped an average of 91% in Nova Scotia since 1971, and in 2007 reached the lowest levels ever recorded in the province. Nova Scotia farms have recorded negative net farm income in four of the last six years (see Figure 6 below). In 2006, the expense-to-income ratio for Nova Scotia farms reached 100%, far exceeding the 80% threshold estimated as needed for a healthy farm sector. Total farm debt increased by 146% in Nova Scotia between 1971 and 2006 (Figure 6). It is not mathematically possible to calculate a ratio of debt to net income for Nova Scotia when the latter is zero or less. The farm solvency ratio (liabilities in relation to assets) in Nova Scotia increased by 106% between 1971 and 2006, with results indicating that farm indebtedness is now so deep that many farmers could not pay off their debt even if they sold everything they owned (land, buildings, and machinery). In sum, every key indicator of farm economic viability in the province (and in the Maritimes as a whole) is trending sharply and seriously downward.

Figure 6. Total net farm income and total debt, NS farms, 1971–2006 (millions of $2007), with trendlines



Source: Derived from Statistics Canada. 2007. *Agriculture Economic Statistics.* Cat No. 21-010-XIE; 21-014-XIE (latest update May 2007).

In an era of uncertain global food supply lines and impending peak oil conditions, the GPI Soils and Agriculture Accounts point to an urgent need to move toward secure, viable, and reliable local food sources. And yet, at the same time that the demand for local food is growing, the 2008

GPI results reported in this volume indicate clearly that—except in supply managed sectors like dairy and poultry—farming is no longer economically viable in Nova Scotia, and is now in a state of serious crisis. Indeed, it is not an exaggeration to say that farming is in danger of demise as an economic, social, and cultural institution in this province and in the Maritimes as a whole. Since farms make a highly significant contribution to employment and income in rural areas, as also demonstrated in the GPI analysis, the potential demise of farms, in turn, will have serious economic and social consequences for rural communities.

In 2001, GPI Atlantic reported in *Farm Viability and Economic Capacity in Nova Scotia*—based on the most recent data available at the time—that all key indicators of farm viability were in serious decline. Among other results, the 2001 GPI report noted that net farm income had declined by 46% since 1971. At the time that this original GPI farm viability report was published, the data did not yet show net farm income in negative territory, though the trends were certainly headed in that direction. Thus, while the *absolute* figures at the time still showed marginal economic viability for Nova Scotia farms (on average), the *relative* trends pointed towards a developing crisis.

Unfortunately, these troubling trends first noted in the 2001 GPI report, and updated both in a separate 2008 GPI farm economic viability report and again here in this 2008 summary GPI report, have continued unabated, as have the underlying causes of these trends. A key purpose of the Genuine Progress Index is to provide an early warning system pointing to such potentially troubling trends, so that corrective measures can be undertaken in a timely way and before the trends produce a real (and potentially irreversible) crisis. Unfortunately, the adverse trends reported in the 2001 GPI farm viability report did not spur sufficient public, government, industry, and corporate action to reverse those trends and enhance the economic viability of farming in Nova Scotia. Instead, those adverse trends have been allowed to continue to the point where recovery is no longer an option for many farmers, who are now being forced either to abandon farming or to sell off portions of their farms.

Because indicators of farming viability have been in decline for so long (at least a quarter of a century), progress towards a thriving and healthy agricultural sector and agricultural communities will require more than just “sustaining” what we have at this point in time. A long-term perspective therefore requires both a retrospective analysis that ensures current levels are not blindly taken as the “base” or “threshold” for progress, and also a forward-looking analysis that attempts to assess current actions in light of their long-term impact on future generations. Thus, producers in agricultural communities who conserve and enhance soil quality, water resources, and the many other components of natural and social capital in agriculture, can be seen as making a significant long-term social contribution to rural communities, to the common good of society as a whole (given its dependence on agricultural communities for its food security, health, and wellbeing), to future generations, and to “genuine progress” in agriculture.

This approach raises the policy issue of potential payments to farmers for provision of “ecological goods and services” and for protection of prime agricultural land from development. To that end, the GPI Land Capacity report recommended that the best and most threatened working farm land be removed from the speculative or real estate market by purchase of development rights. Buying development rights—or purchase of Working Land Conservation Easements—would guarantee the land's continued use for farming, while compensating farmers for potential losses incurred by being unable to sell it for other uses. GPI Atlantic calculated the average provincial value of such conservation easements at $1,339 per hectare, based on the difference between the real estate value of fertile land and its productive value (the ability of the land to generate net income for farmers). Such new and creative solutions could potentially restore farm economic viability in the province.

If the true costs of agriculture and food production were included in our current measures of progress, we would find that locally and sustainably grown food in Nova Scotia would be much cheaper than imported, chemically grown food. This point may become painfully clear as fuel and transportation prices increase with the advent of peak oil, and as global food shortages, higher food prices, and food safety concerns potentially threaten the affordability of imported food and the reliability of long-distance food supply lines. In that situation, new Maritime farmers will increasingly be needed to fill the growing demand for locally-produced food. Thus, the GPI analysis also points to the issue of renewal as vital to the long-term health of agriculture in this region, and ultimately to the sustainability of the region itself in so far as this depends on a reliable local food supply.

Water

Nova Scotia has experienced a marked improvement in drinking water quality over the past decade and there has been a significant decrease in sulphate deposition in Nova Scotian lakes—both signs of genuine progress. However, the recovery of alkalinity and pH has not occurred to the extent necessary to reduce acid deposition below critical loads (harmful levels), and to ensure the recovery of aquatic and terrestrial ecosystems and of recreational fishing catches of Atlantic salmon and brook trout that are impacted by acid rain. In fact, these fish populations have continued to decline steadily. Since 1985, for example, the number of brook trout caught in the province has declined by 50% from 2.6 million to 1.3 million.

Overall, the results for all health-related drinking water quality indicators together point to genuine and significant progress in municipal drinking water safety and quality over the last 15–20 years in Nova Scotia, and a very high rate of compliance with all facets of health criteria described in the Guidelines for Canadian Drinking Water Quality (GCDWQ)—chemicals, coliform bacteria, and trihalomethanes (THMs):

- Only 1% of the provincial population served by a municipal drinking water system in 2001 (the most recent full audit of municipal drinking water supplies in Nova Scotia) was served by a supply that exceeded the maximum acceptable concentration of at least one chemical water pollutant as specified in the GCDWQ—compared to 24% in 1986 and 16% in 1996.
- In 2004–07, at least 98% of Nova Scotians served by municipal drinking water supplies were served by supplies that met the GCDWQ health-based criteria for bacteriological quality at all times in each of those years—up from 96% in 2003.

- There has been a marked decrease in the percentage of Nova Scotians served by municipal water supplies that do not meet the GCDWQ health standard for THMs—from more than 40% in 1995 to less than 4% today.

There has also been a marked improvement in compliance with the GCDWQ aesthetic objectives over time—from nearly 80% of Nova Scotians served by non-compliant municipal water supplies in 1986 to 66% in 1996 to 42% in 2001.

A comprehensive inventory of Nova Scotia's wetlands, which provide many important ecological, economic, and social services, estimates that in 2007 there were approximately 378,000 hectares of wetlands remaining in Nova Scotia—an estimated loss of 17% of freshwater wetlands and 62% of saltwater wetlands from the original wetland area of Nova Scotia. GPI Atlantic estimates the damage, restoration, and health costs associated with wetland loss and water pollution in Nova Scotia, plus the cost of water-related defensive expenditures and water intake costs, to be $3.71 billion/year ($2006), of which 91.6% are attributable to the wetland losses.

Air quality

With a few notable exceptions, Nova Scotia has generally seen improvements in ambient air quality, and reductions in pollutant emissions:

Emissions: With the exception of nitrogen oxide emissions, which increased by more than 20% between 2000 and 2005 to reach their highest level since the 1980s, other Criteria Air Contaminant (CAC) emissions have either decreased or remained stable. By international standards, however, Nova Scotia's per capita pollutant emissions are still very high—due primarily to continued reliance on coal-fired electricity generation and private automobile use.

Ambient air quality: Atmospheric concentrations of carbon monoxide, total particulate matter (including PM_{10} and $PM_{2.5}$), and sulphur dioxide, have all declined in Nova Scotia since 1990 and remain within accepted guidelines. Nitrogen dioxide concentrations have not declined substantially since 1990 but remain within accepted guidelines. However, ground-level ozone concentrations in Nova Scotia remain among the highest in the country—largely due to transboundary pollution—and regularly exceed "maximum acceptable concentrations."

The GPI accounts and economic valuations show that improvements (i.e., reductions) in Nova Scotia's air pollution emissions in 2005 translate into savings in terms of reduced health and environmental damages. Those damages, however, are still valued at more than a half a billion dollars annually, or $560 for each Nova Scotian. Sulphur oxide emissions—primarily from Nova Scotia Power's coal-fired power plants—accounted for more than 40% of all air pollution costs in 2005. As emissions continue to decline, according to new targets and guidelines established in the 2007 Environmental Goals and Sustainable Prosperity Act, estimated costs attributable to Nova Scotia's air pollutant emissions in 2015 are projected to be 25% less than in 2000 and 40% less than in 1990.

Energy

In 2005, a comprehensive GPI Atlantic examination of energy use in Nova Scotia, using thirty separate indicators, concluded that energy sustainability would require reductions in the province's high present levels of energy consumption, coupled with immediate investments both in improved efficiency and in renewable energy sources to reduce the present reliance on imported fossil fuels and coal-fired electricity generation.

This present update reports that Nova Scotia's total energy demand grew by 25% from 1991 to 2005 and then fell by 11% between 2005 and 2006—due in large part to the indirect changes in energy supply and demand noted above (like the Port Hawkesbury mill closure and Cohasset Offshore Oil Project decommissioning). Energy demand on a per capita basis also increased in Nova Scotia by 22% from 1991 to 2005 and then fell by 11% between 2005 and 2006. Transportation accounts for the highest share of energy demand (34%) in the province—up from 26% in 1978. Among the provinces, Nova Scotia had the second lowest per capita energy demand in the country—21% below the national average.

The province continues to be a net importer of energy—with the vast majority of its energy needs dependent on foreign oil and coal. In 2006, 80.4% of Nova Scotia's electricity came from coal—the highest share since 1993. Renewable energy accounted for just 8.8% of electricity generation—relatively unchanged since 1993, and mostly from older, small-scale hydro projects. In 2006, wind energy production had not yet significantly changed the mix.

Nova Scotia's continued reliance on imported coal to generate electricity raises a number of concerns in relation to the long-term economic viability of the energy sector, energy security, social and environmental issues in the coal-supplying countries, environmental and health impacts at home, and other issues. GPI Atlantic has noted the growing insecurity of global fossil fuel supply lines coupled with the advent of peak oil, which is estimated to occur not later than 2010, just 14 months from now. At that time, global demand for oil will exceed likely exceed global supply, indicating an urgent need for action supporting greater conservation, efficiency, and investments in renewable energy sources in the interest of enhanced energy security and self-sufficiency.

Human impact on the environment

To assess progress towards sustainability comprehensively, it is necessary to examine both the *supply* side and the *demand* side of the sustainability equation. Six of the 20 GPI components—forests, fisheries, soils and agriculture, water resources, air quality, and energy—explore the value of key elements of our natural capital from the supply side by assessing the health of our natural resources. Four of the 20 GPI components—Ecological Footprint, greenhouse gas emissions, transportation, and solid waste management—assess Nova Scotians' demand or impact on the environment. The former are of the nature of stock accounts, while the latter constitute flow accounts.

Needless to say, the two sides of the equation are intimately linked, with flows like timber, fish, and crop harvesting, air pollutant emissions, energy use, and fossil fuel combustion directly affecting resource health. For this reason, the GPI natural capital accounts include considerable information on these flows. For example, the GPI Air Quality report is divided into two distinct parts—ambient air quality (partially assessing the health of the atmospheric resource) and air pollutant emissions (a human impact on the atmosphere.) And the GPI Energy Accounts place at least as much emphasis on energy use—the flow side of the equation—as on energy supplies (coal, oil, natural gas, and renewable energy sources).

Despite the clear relationship between these two dimensions of sustainability, it is essential to keep the supply and demand sides of the equation at least conceptually distinct—both for methodological reasons so that stocks and flows are not confused, and also for policy reasons so that responsibility for sustainability is not distorted. Natural capital accounts that assess the health of the resource by implication place responsibility for sustainability on the shoulders of "suppliers" like farmers, loggers, fishermen, and power companies who are expected to harvest and use resources sustainably and responsibly. Taken literally, this lets 98% of the populace off the hook, so to speak, by failing to assign full responsibility to consumers for the environmental impacts of their consumption patterns—the demand side of the equation. For this reason, the GPI attempts to make these demands explicit through four distinct components, as noted above, while also incorporating flow analysis into the natural capital (resource) accounts themselves.

The best and most widely used measurement tool for assessing sustainability comprehensively from the demand or consumption side is the Ecological Footprint. One of the great powers of this tool is that it naturally joins the ecological and social dimensions of sustainability by assessing differential demands on the environment according to income and other socio-economic characteristics. Thus, 30% of the world's population currently consumes 70% of its resources, with global "overshoot'"—the degree to which current resource consumption and waste production exceed the "carrying capacity" of the planet—entirely due to excess consumption and waste generation by a minority. For example, Footprint analysis shows that if everyone in the world consumed and generated wastes at Canadian levels, we would need four planets earth to provide the necessary resources and absorb the wastes.

Major methodological challenges and data limitations, as explained in the Footprint chapter of this report, did not allow an updated assessment of Nova Scotia's Ecological Footprint for this 2008 Genuine Progress Index summary. For that reason, this volume reports on Canada's Ecological Footprint, which is well documented in the Global Footprint Network's National Footprint Accounts. To the degree possible, we then attempt to assess how the size of this national Footprint might vary in Nova Scotia as a result of particular provincial conditions and circumstances like the current heavy reliance on coal-fired electricity generation, but this cannot yet be done systematically to assess actual provincial Footprint size. It is hoped that future updates of the Nova Scotia GPI will be able to calculate the provincial Footprint directly in methodologically sound and rigorous ways that are not yet possible due to data limitations. Ground-breaking work currently being undertaken by the City of Calgary, Alberta, in close collaboration with the Global Footprint Network, holds great promise for the assessment of Footprint size at the sub-national level in Canada.

A second "demand" side or consumption-based indicator of sustainability is the emission of greenhouse gases. From a policy perspective, we have assessed this particular GPI component as requiring more urgent and immediate policy attention than any other single indicator, and we have therefore placed the summary of Nova Scotia greenhouse gas emission results at the very beginning of this executive summary in the hope that this will help give this vital GPI component the attention it requires. Here, to conclude this executive summary, we therefore present summary results for the remaining two consumption or demand side GPI components—transportation and solid waste management.

Transportation

Total road passenger movement in Nova Scotia, as measured in passenger-kilometres travelled, has increased by 19% overall since 1990. With only a 2.8% increase in population between 1990 and 2006, it is apparent that Nova Scotians are driving considerably more than they did in the early 1990s. Per capita road passenger movement in Nova Scotia (20,100 km) is the third highest in Canada—nearly 26% higher than the national average of 16,000 passenger-kilometres per person, and 53% higher than in Manitoba and B.C. (13,100).

The use of fuel-inefficient light trucks (including SUVs and minivans) increased by 65% between 1990 and 2006, while passenger movement by bus decreased by nearly 10% in that same time period. Small car use increased between 1990 and 1995 but has declined by 10% since 1995. In 2006, light trucks (including SUVs and minivans) accounted for nearly 32% of all passenger movement—up from 23% in 1990. These trends and the increase in overall driving reflect movement away from sustainability in transportation.

Greenhouse gas emissions from Nova Scotia's transport sector declined by nearly 10% between 2005 and 2006—due largely to the closure of Stora-Enso's Port Hawkesbury pulp and paper mill and the decommissioning of the Cohasset Offshore Oil Project that year. However, transport-related GHG emissions in 2006 remained 14% higher than 1990 levels. The share of transport-related GHG emissions from light trucks (including SUVs and minivans) has increased sharply—from 14% of all transport-related emissions in 1990 to 23% in 2006—now exceeding emissions from cars (22%).

Per capita transport-related GHG emissions in Nova Scotia are much less than in oil-producing Alberta and Saskatchewan, but remain 5% above the national average and 39% higher than in Quebec. Given the unsustainable trend towards fuel-inefficient vehicles in the province, and the fact that transport-related GHG emissions remain 14% above 1990 levels, significant shifts to active forms of transportation and use of public transit will likely be required for the province to meet its own legislated target of reducing its overall GHG emissions to levels at least 10% below 1990 emissions by 2020.

The total number of injuries and fatalities from road transportation in Nova Scotia declined by 11% and 52% respectively between 1990 and 2005—denoting a significant improvement in road transport safety. In 2005, Nova Scotia had the second fewest traffic fatalities and injuries per 100,000 residents in the country—15% and 20% respectively below the national average.

In 2006, nearly 84% of commuters in Nova Scotia travelled to work by automobile. Of these, 87% were drivers and 13% were passengers, indicating that the vast majority of Nova Scotians drive alone to work, while only a small minority carpool. Fewer than 9% of Nova Scotians got to work using active modes of transportation in 2006—8.2% by walking and 0.7% by bicycling, and only 5.9% of commuters used public transit. These breakdowns have hardly changed since 1996, indicating inadequate movement over the decade towards a more sustainable transportation system. Nova Scotia also had the second highest rate in the country of commuters travelling 20 km or more to work each day—22.3% versus the national average of 19.4%

Government spending on public transit in Nova Scotia increased from 4.5% of total spending on road transportation in 1990-91 to 8% in 2005–06. While the increase is encouraging, the 8% proportion remains the 5th lowest rate of public transit spending in Canada—nearly 50% below the national average of 15.7%—and remains insufficient to denote sustainability for this indicator.

The four top household direct expenditures—taxes (21%), shelter (20%), transport (13%), and food (10%)—accounted for 64% of total household spending in Canada in 2007. Canadian households spent an average of $9,400 on transportation in 2007, up 1.7% from 2006—with a 6.9% increase in spending on gasoline offset by a 6.3% decline in average spending for automobile purchases.

As a proportion of total household budgets, transportation rose from 13% in 1997 to 16% in 2002, and then fell back to 13% in 2007. The increase in transportation spending between 1997 and 2002 was so large as to reduce the proportion of household disposable income available for *discretionary* (i.e., non-essential) spending. This denoted a decline in transportation affordability during that period, and therefore of the economic sustainability of the transport system, with affordability returning to 1997 levels by 2007.

The full cost of road passenger transportation in Nova Scotia is estimated at $7.2 billion ($2007) a year, or $8,541 per capita. Of these costs, about 60% are indirect and remain invisible in the conventional economic accounts. These are either non-market costs, like travel time (including congestion costs) and climate change and air pollution damages, or are costs paid indirectly through taxes, rent, and mortgage payments (such as road facility expenditures, taxpayer funded medical costs associated with automobile crashes, and residential off-street parking).

The high proportion of external and indirect driving costs indicates that automobile travel is presently significantly under-priced. To the degree that these costs are overlooked in conventional economic analysis, policy and planning decisions are skewed to favour automobile transportation improvements. That in turn results in economically excessive automobile travel, excessive automobile-dependency, and reduced transportation options. The more that the external and fixed costs of driving are internalized and made variable to account for vehicle type and kilometres travelled, the more distortions will be rectified and removed, and the more users will pay the full costs of the transport modes they choose. That in turn will naturally encourage development of a wider range of more sustainable transportation options.

The GPI transport study presents a wide range of tested and proven policy and planning reforms—some of which are summarized in table form in the transport chapter of this report—which can help move the province towards greater transportation sustainability. These are called "Win-Win Transportation Solutions" because each intervention achieves multiple benefits across a wide range of economic, social, and environmental dimensions. They are cost-effective and technically feasible market reforms that help solve transportation problems by increasing consumer options and removing market distortions that encourage inefficient travel behaviour. Although their individual impacts may appear modest, their combined benefits can be substantial in enhancing genuine sustainability.

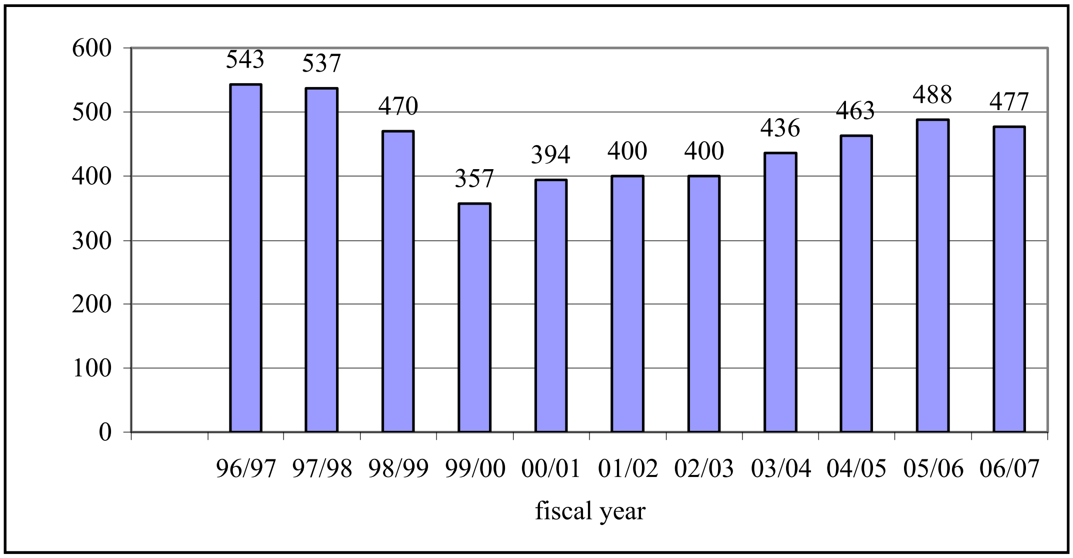
Mixed news about waste management

One area where Nova Scotia has made significant improvements is in the area of solid waste management. In fact, the province has become a leader both nationally and internationally in waste diversion. In 2000, for a six-month period, Nova Scotians succeeded in throwing away just half as much waste as they did in 1989—thus becoming the first and only province in Canada to achieve the target of 50% diversion from landfills by 2000 set by the Canadian Council of Ministers of the Environment (CCME) in 1989. Indeed Nova Scotia was the first province or state in all North America to divert half its waste from landfills—a significant achievement.[9]

Since 2001, however, Nova Scotians have been generating and disposing more garbage per capita—and doing so at a faster rate than they are diverting it. Thus, Nova Scotia's diversion rate has fallen from 50% in 2000 to just 36% today—sliding disappointingly backwards from its earlier achievement. Between 1996-1997 and 1999-2000, waste disposal per capita in Nova Scotia decreased by a remarkable 34%—from 543 kg to 357 kg per person, by far the sharpest decline in the country—but it then began to creep steadily back upwards. The upward trend in waste disposal reversed somewhat in the 2006–2007 fiscal year when the per capita annual disposal rate dropped marginally from 488 kg in 2005–2006 to 477 kg in 2006–2007 (Figure 4 below). The most recent data indicate that this reversal of the upward trend in waste disposal may be continuing.

Economic growth and increased consumption during the boom period of recent years are the key factors contributing to greater waste generation. In fact, the evidence points to a nearly 35% growth in per capita spending on goods and services in Nova Scotia between 1996 and 2006. The current economic downturn may well be the greatest impetus for a return to the lower disposal rates of eight years ago.

Figure 4. Per capita solid waste disposal (kg per capita per year), Nova Scotia, 1996/97–2006/07



Source: Kenney, Bob. Solid Waste-Resource Analyst. Nova Scotia Department of Environment. Personal communication, September 2, 2008.

Human capital

Because knowledge is required to improve wellbeing and sustainability in all the GPI components discussed above, an educated populace is the vital connective tissue linking all the components of the GPI. Abundant evidence indicates that education has a significant effect on quality of life in terms of its direct impact on income, population health, environmental behaviour, civic engagement, and other dimensions of wellbeing. Indeed, the ultimate evidence of whether or not Canadians and Nova Scotians are learning what they need to know to create a healthy, wise, and sustainable society should be found in desirable social outcomes such as peace, equity, environmental stewardship, good health, cultural diversity, and social tolerance.

This approach to educational objectives and indicators is considerably broader than that found in conventional education indicator systems—which focus too narrowly on *outputs* of the formal education system that may be unrelated to desired learning and societal *outcomes*. Traditional measures of educational attainment also generally ignore informal and nonformal learning processes that may have a greater impact on learning outcomes than schooling, and they frequently send contradictory messages. Alberta, for example, has one of the lowest graduation rates but highest standardized test scores in the country, indicating that graduation rates may be a better indicator of labour market conditions than of educational attainment while test scores may reflect the proportion of students remaining in school rather than a more educated populace. For these reasons and others that are explained in detail in GPI Atlantic's 2008 educated populace report, GPI Atlantic has not relied on the inadequate conventional indicators of educational attainment, but has instead adopted measures of adult 'literacy' in the broadest sense.

The effective transmission and use of knowledge for societal benefit requires both basic literacy and multiple additional literacies in relevant areas such as ecology, civics, art, science, health, multiculturalism, and Indigenous knowledge. Thus, an educated populace would have a reasonable understanding about important issues that affect daily life, which in turn requires practical skills like the ability to understand the meaning of statistics, the ability to analyze the media's presentation of information, and the ability to make informed political decisions as a voter. Based on an extensive three-volume background study and literature review, GPI Atlantic recommends a series of new indicators of educational attainment that reflect such societal knowledge in key areas.

Among other results, the GPI study found that despite higher rates of postsecondary graduation, there was no real improvement in the literacy profiles of Canadians between 1989 and 2003. As well, the political knowledge of Canadians is in general decline. This decline is particularly marked among younger people, who tend to have considerably less political knowledge today than younger people did a generation ago. These results and others point to a lack of alignment between conventional, formal education indicators and societal knowledge outcomes.

Conclusion

This report, updating and summarizing all 20 GPI components and all key indicators developed over the last 12 years, represents the completion of the research and development phase of the Nova Scotia Genuine Progress Index. The body of accumulated knowledge gives the Province of Nova Scotia more detailed, varied, and integrated information about itself and its progress in a wide range of social, economic, and environmental dimensions than is currently available to any other jurisdiction in North America.

In particular, what is measured here is entirely in line with the provincial government's own 2006 Opportunities for Sustainable Prosperity development strategy, which is based on valuing natural, social, and human capital alongside conventional measures of built and financial capital. And the GPI measures are also directly relevant to the province's 2007 Environmental Goals and Sustainable Prosperity Act (EGSPA), which also undertakes to value Nova Scotia's natural wealth and to create one of the most sustainable environments in the world by the year 2020. Together, these tools can provide the foundation for an enviable future for Nova Scotia reflecting the highest shared aspirations of its people.

Most importantly, the new GPI measures are now ready to be used and applied in practice. All that is required is the courage, determination, and political will to do so. Key to this practical application is the understanding that measurement and policy are intimately and naturally connected in several ways:

- Good evidence is essential for informed decision-making. Without such measures, policy making would be blind, and have no understanding where the greatest needs are, and which population groups need to be targeted with which programs. As noted above, the new measures can also send early warning signals to policy makers if key indicators begin to trend downward, and they thus allow and encourage timely remedial action.

- The new GPI measures spanning a wide range of social, economic, and environmental dimensions enable policy makers and the general public to be aware of the practical trade-offs involved in each decision. If we make progress in one area, is it at the expense of another, or can we advance all aspects of progress harmoniously?

- The indicators can help set specific goals and targets and mobilize the population behind a common vision. This is not theoretical or conceptual but very practical. For example, if we know what the crime rate, smoking rate, poverty rate, or greenhouse gas emission rate is, we can set the goal of cutting those rates by a certain percentage and by a certain year, and measure our progress in getting there. Just as the EGSPA sets specific pollutant reduction targets, the GPI measures as a whole can help formulate a clear vision and establish mutually agreed goals for the province in all 20 components.

- The new measures can help evaluate which programs are working and which are not, according to whether or not they are achieving the agreed goals and targets established through the indicators. Ineffective programs can be scrapped and better ones put in their place.

- The accounting dimension of the GPI can help ensure true sustainable prosperity and even make the province's market economy more efficient by fully valuing the province's economic, social, human, cultural, and natural wealth, and by accounting properly for the social and environmental benefits and costs of economic activity.

- The GPI indicators enable Nova Scotians to hold their government accountable. At election time, for example, the people can assess the degree to which their elected representatives made progress towards the agreed goals and targets established through the indicators, and they can cast their votes accordingly. They can also assess their own personal commitment and that of their local community in making progress towards those goals.

- The new measures can ensure that—whichever political party gains power—all elected representatives are held to a set of common principles and consensus goals, and they will all be judged by the same standard. In other words, the GPI measures reflect consensus values that transcend partisan affiliations. The role of politics is to debate the best strategies designed to achieve those agreed goals.

In these and other ways, the new measures have direct policy utility and relevance. They are ready to use, they can help make Nova Scotia one of the best places in the world to live and work, and they can set an example of genuinely sustainable development to other jurisdictions worldwide.

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1. Civic and Voluntary Work

For the original GPI Atlantic reports on civic and voluntary work, please see the following:

Economic Value of Civic and Voluntary Work (1998)
http://gpiatlantic.org/pdf/volunteer/volunteer.pdf

2003 Update http://gpiatlantic.org/pdf/volunteer/volunteerupdate03.pdf
2000 Update http://gpiatlantic.org/pdf/volunteer/volunteerupdate00.pdf
1999 Update http://gpiatlantic.org/pdf/volunteer/volunteerupdate99.pdf

Headline Indicators

1. Trends in formal volunteer hours per capita
2. Hours per volunteer and volunteer burnout
3. Composition and distribution of voluntary work
4. Trends in formal plus informal voluntary work in Statistics Canada's General Social Surveys
5. Economic value of voluntary work

A widespread, independent, and active network of community and voluntary organizations is widely regarded as the hallmark of "civil society," and their active strength as a critical indicator of healthy democracy. This "social economy" is the arena in which we participate most fully as citizens, freely choosing our interests and associations, and expressing our deepest aspirations to help others. The strength of a society's commitment to voluntary work is, for many social scientists, a touchstone of social health, stability, and harmony, and thus a key indicator of social and community wellbeing.[1]

Analysts have observed that a weak civil society, by contrast, is more subject to social unrest, alienation, and disintegration. It is frequently associated with higher rates of crime, drug abuse, and other dysfunctional activities, which eventually produce much greater social and economic costs than wise investment in the community and voluntary associations that strengthen the fabric of civil society.[2]

Jeremy Rifkin describes civil society as "the millions of people in every country who give of themselves to contribute to the common weal. It's the ancient economics of gift-giving . . . . Each person giving of themselves to the community maximizes their own self-interest." Rifkin recommends that schools not only train students for the market economy, but also encourage youth to "go out into their community, as part of their educational experience, and work in a non-profit neighbourhood organization of their choice, to learn social capital." He predicts that in the twenty-first century, workers will spend just 25 hours a week in the market economy and the rest with family and volunteering in community.[3]

In his latest book, *Blessed Unrest: How the Largest Movement in the World Came into Being and Why No One Saw It Coming*, Paul Hawken describes an emerging global civil society consisting of between one and two million volunteer-based non-profit organizations dedicated to protecting the environment and promoting social justice. This apparently haphazardly organized movement, he says, is "the most complex coalition of organizations the world has ever seen," the largest and fastest growing movement in history, and the world's most powerful moral and social force. He argues that the movement is genuinely representative of citizens' needs, concerns, and aspirations, and is in fact born from the failure of national organizations like governments to represent those needs and interests effectively.[4]

But volunteers also engage in countless more prosaic activities that nevertheless contribute enormously to community health and wellbeing. Volunteers coach and staff after-school sports activities, bake cookies for church socials, fundraise for the Cancer Society and Heart and Stroke Foundation, man soup kitchens, provide counselling for youth in need, teach literacy, fight fires and engage in search and rescue operations, serve on non-profit boards, and provide the lifeblood for countless culture and arts programs.

Though motivated by generosity and care, civic and voluntary work also have a direct economic value. If it were suddenly withdrawn, either our standard of living and quality of life would deteriorate markedly, or else government and the private sector would have to provide the lost services for pay. Particularly in an era of government fiscal restraint, we depend even more directly on the work of volunteers.[5]

In addition, research has found that social networks may play as important a role in protecting health, buffering against disease, and aiding recovery from illness as behavioural and lifestyle choices such as quitting smoking, losing weight, and exercising.[6,7]

According to Health Canada, social support networks, which extend from close family and friends to the broader community, are a major determinant of health, and are "reflected in the institutions, organizations and informal giving practices that people create to share resources and build attachments with others."[8] For this reason, Health Canada uses volunteerism as a key indicator of a "supportive social environment" that can improve health.[9] In addition, the Treasury Board, which publishes yearly reports evaluating national trends in quality of life, includes volunteering as one of its five key indicators of "the strength and safety of Canadian communities."[10]

"Formal" voluntary activity describes unpaid work undertaken for charitable, non-profit, and community organizations. "Informal" voluntary work is assistance given directly to individuals, not through any organization, such as shopping, cleaning and doing yard work for a disabled, sick, or elderly neighbour. According to Statistics Canada, "voluntary work" is always performed outside one's own home, while unpaid household work refers to work done within one's own home. So washing dishes for a sick neighbour is classified by Statistics Canada as informal voluntary work, washing dishes at a church soup kitchen is classified as formal voluntary work, and washing one's own dishes at home is classified as unpaid household work.

Whether voluntary work is formal or informal, it is widely accepted as making a major contribution to wellbeing and even, according to Hawken, to addressing and dealing effectively with the most salient issues facing the planet and its people. Indeed, Statistics Canada's 2004 Canada Survey of Giving, Volunteering and Participating (CSGVP) found that the top reason given by Canadians for volunteering was to make a contribution to the community (92%). The lowest rated motivation was to "improve one's job opportunities" (22%).[11]

A note regarding data sources

Previous GPI Atlantic reports and updates on the Economic Value of Civic and Voluntary Work in Atlantic Canada reported voluntary work trends from Statistics Canada's General Social Surveys, and also analysed data from Statistics Canada's National Surveys of Giving, Volunteering and Participating (NSGVP) from 1997 and 2000. The survey was subsequently reconfigured and renamed the Canada Survey of Giving, Volunteering and Participating (CSGVP). According to Statistics Canada, however, the results from the 2004 CSGVP are not comparable to the 1997 and 2000 results on volunteering rates, due to methodological differences and changes in the 2004 survey coverage, sample size, and questionnaire.

Therefore, in the indicators that follow, we will report the trends up to 2000 using the earlier NSGVP and then report the 2004 data separately, using the CSGVP.

We will also use results from Statistics Canada's time use surveys in the 1992, 1998, and 2005 General Social Surveys (GSS) to assess trends from 1992 to 2005 in formal and informal voluntary work combined. Both sources are necessary, as the NSGVP and CSGVP focus on formal volunteer work, whereas the GSS time use surveys include informal voluntary work.

1.1. Trends in formal and informal voluntary work

Data sources: Statistics Canada, 1987 National Survey of Volunteer Activity; 1997 and 2000 National Surveys of Giving, Volunteering and Participating (NSGVP); 2004 Canada Survey of Giving, Volunteering and Participating (CSGVP); Statistics Canada, 1992, 1998, and 2005 General Social Surveys.

Result: Volunteer hours have declined nationwide. Fewer volunteers are now putting in longer hours in order to maintain services, leading to a danger of burnout. The Maritimes have among the highest rates of volunteering in the country. Voluntary work contributes $1.8 billion in services annually to the Nova Scotia economy.

1.1.1. Trends in formal volunteer hours per capita, 1987–1997–2000

Statistics Canada's 1987 National Survey of Volunteer Activity and its 1997 and 2000 National Surveys of Giving, Volunteering and Participating (NSGVP) assessed volunteer rates in the formal sector for 1987, 1997, and 2000. According to GPI Atlantic's 2003 update of its 1998 *Economic Value of Civic and Voluntary Work*, formal volunteer service hours per capita dropped 10.7% nationwide between 1987 and 2000. These per capita results account for Canada's population increase.[12]

Following earlier declines between 1987 and 1997, the 2000 NSGVP results showed a continuing sharp decline in formal voluntary work throughout Canada since 1997, including in the Atlantic provinces where rates of formal voluntary work were higher than the national average. For example, in Nova Scotia in 2000, 35% of women and 32% of men participated in formal volunteer activities, compared with 28% and 25% in Canada respectively.[13]

In 2000, 12.8% fewer Canadians volunteered than in 1997, and the volunteer participation rate dropped from 31% to 27% of Canadians. There were parallel declines among both men and women: in 2000, 28% of women and 25% of men volunteered in the formal sector, down from 33% and 29% respectively in 1997. Despite a 2.5% growth in population, there were 960,000 fewer Canadian volunteers in 2000 than there were in 1997 and the total number of hours volunteered in Canada declined by 5% in just three years.[14]

Across the country, volunteers are trying to compensate for the dropping numbers of volunteers by putting in longer hours, in an apparent effort to maintain services with fewer hands. Thus, between 1997 and 2000, volunteers increased their annual hours by 8.7% from an average of 149 to 162. One-third of those hours were contributed by just 5% of volunteers, who gave 596 or more hours.[15]

However, as was noted in GPI Atlantic's 2003 voluntary work update, the total volunteer numbers underestimate the impact of this decline in volunteerism on those Canadians who benefit most from voluntary activity, namely the elderly, disabled, sick, homeless, abused women and children, disadvantaged youth, and other vulnerable groups, as well as the arts and culture, after-school sports and other activities, environmental groups, churches, and other sectors that rely heavily on voluntary activity.

Therefore, from the perspective of the beneficiaries of voluntary work, the most accurate measure of progress is volunteer service hours offered per capita, which takes into account changes in population rather just the absolute number of hours of volunteers. According to this measure, volunteer hours per capita declined by 6.3% between 1997 and 2000. In other words, on a per capita basis, Canadians received 6.3% fewer volunteer services in 2000 than they did in 1997.

On the whole, Atlantic Canadians bucked that national trend in 2000, and they did so dramatically. Only four provinces in Canada *increased* their per capita formal volunteer service hours between 1997 and 2000—Newfoundland (by 45%), Prince Edward Island (by 50%), Nova

Scotia (by 18%), and Saskatchewan (by 3%). However, in all these provinces, except Prince Edward Island, the increase was entirely achieved by fewer volunteers putting in longer hours. Only PEI saw a modest increase in the number of volunteers (2,000) between 1997 and 2000; Newfoundland and Labrador had 12,000 fewer volunteers in this time period; Nova Scotia had 30,000 fewer; and New Brunswick had 34,000 fewer. In total, Atlantic Canada had 74,000 fewer volunteers in 2000 than it did in 1997.[16]

In 2003, GPI Atlantic reported that the 1997–2000 trend continued the decline in the formal voluntary service hours received by Canadians that was first observed between 1987 and 1997. In other words, the 6.3% decline between 1997 and 2000 built on the earlier 4.7% decline between 1987 and 1997. Cumulatively, and taking Canada's population increase into account, formal volunteer service hours per capita dropped by 10.7% nationwide between 1987 and 2000.

Every province in the country, with the exception of Newfoundland and Labrador, Prince Edward Island, and Nova Scotia, shared in that 1987–2000 decline in formal volunteer service hours per capita. As noted above, Newfoundland and Labrador and Nova Scotia together lost 42,000 volunteers between 1997 and 2000, and all three provinces shored up their voluntary service hours per capita only by sharply increasing the workload on the remaining volunteers.

If formal volunteer work had continued to be offered through community-based organizations in 2000 at the same rate as in 1987, Canadians would have received the benefits of 126 million more hours of voluntary services than they actually did. The nationwide stagnation of voluntary services has implications for quality of life as well as economic implications. It means the sick, elderly or disabled are no longer receiving the same level of volunteer health support as before. The poor are receiving fewer volunteer social services. Victims of crime and abuse or youth in need are receiving less volunteer counselling or support. Children are receiving fewer volunteer-based after school sports and other activities. And health, social service, and church groups are short on volunteer fundraisers. In sum, a decline in volunteer service hours per capita has direct implications for community quality of life in a very wide range of areas.

1.1.2. Hours per volunteer and volunteer burnout

To compensate for this decline, volunteers in all four Atlantic provinces increased their contribution more dramatically, as measured by hours per volunteer, than volunteers in any other province. The remaining Atlantic Canadian volunteers worked 51% more hours in Newfoundland, 46% more hours in Prince Edward Island, 32% more hours in Nova Scotia, and 16% more in New Brunswick.

In 2000—the most recent data available that are comparable to the earlier results—Atlantic Canadian volunteers worked longer hours than volunteers in any other province. Newfoundland volunteers put in the longest hours of any volunteers in Canada, 28% higher than the national average, with New Brunswick volunteers ranking second (17% higher), Nova Scotian volunteers third (15% higher), and Prince Edward Island volunteers fourth (14% higher). Unfortunately, the longer hours of New Brunswick volunteers were not able to compensate for the 16.3% decline in the *number* of volunteers in that province, leading to a net 2.6% loss in volunteer hours per capita, when population change is taken into account.

As a direct result of these very long volunteer hours, Prince Edward Island and Newfoundland and Labrador had the highest formal volunteer service hours per capita in the country in 2000—56% above the national average, followed by Nova Scotia (46% above the Canadian rate), Saskatchewan (42% higher), and New Brunswick (28% higher). (Figure 1-1 below). Thus, Atlantic Canadians in general benefited from a far higher level of formal volunteer services than in the rest of Canada.

However, because these volunteer services rested on an increasingly narrow base, GPI Atlantic reported in 2003 that the trends to date indicated a dangerous situation with a growing burden and responsibility resting on ever fewer shoulders. A smaller number of dedicated volunteers is being spread increasingly thin, and the danger of volunteer burnout is real. Statistics Canada notes:

> Such reliance on a small minority of the population to provide the bulk of volunteer time and charitable donations may be a source of vulnerability for charitable and non-profit organizations and the people they serve. Any decline in number among this small core group of contributors could have dramatic repercussions.[17]

In 2003, GPI Atlantic also reported that with fewer people putting in longer volunteer hours means that these volunteers are at risk for burnout. The data indicate that most volunteers are women, and that volunteerism tends to rise with level of education. However, Statistics Canada's time stress surveys report that Canadian women are 34% more likely to be highly time stressed than men,[18] while Labour Force data show the highly educated spending longer hours on the job.[19] Among those most likely to volunteer, therefore, time pressures appear to be squeezing out voluntary work.

Unfortunately, the lack of comparability between the new Canada Survey on Giving, Volunteering and Participating and the 1997 and 2000 NSGVP on which the above results and trends are based do not allow an assessment of the consequences of the increasing burden on fewer volunteers documented here on future levels of volunteering. But while current comparison within the formal volunteer sector is not possible, Statistics Canada General Social Survey time use surveys, which assess both formal and informal voluntary work, do show precipitous declines in total voluntary hours in Newfoundland and Labrador and Nova Scotia between 1998 and 2005 (Figure 1-5 in Section 1.1.4 below), which may indicate some impact from the trends observed above.

While rates of volunteer burnout are recommended as a key potential indicator of the health of the voluntary sector—especially since they can act as an early warning system signalling the need for corrective action—adequate comparative and time series data do not presently exist to populate such an indicator effectively or to measure it directly. As well, additional work needs to be done to define "burnout" and to assess whether thresholds exist for particular groups. Just as there is a notion of "full-time" work in the market economy, with defined hours, and as Statistics

Canada currently defines long hours as those over 50 a week, it would be interesting to experiment with applying such thresholds to the voluntary sector.

At present we can only speculate that the sharp increases in annual volunteer hours documented above—occurring at the same time as a significant decline in the number of volunteers—may provide a warning signal of potential future burnout among volunteers struggling to maintain the same level of services with fewer human resources. Though we cannot presently measure such burnout directly, therefore, it is possible to use trends in volunteer hours as a potential proxy. As noted, the reported trends in volunteer hours do point, as Statistics Canada has stated, to a potential "vulnerability" in the voluntary sector that "could have dramatic repercussions" for the health and strength of the sector, and for volunteerism and civil society in Canada. For that reason, burnout is included as a key indicator for this component of the GPI, and hours per volunteer are here used to indicate the potential for such burnout.

Figure 1-1. Formal volunteer service, hours per capita, Canada and provinces, 2000

Source: Statistics Canada National Survey of Giving, Volunteering and Participating, 2000.

Note: Volunteer service hours per capita are calculated by dividing total volunteer hours by the population.

1.1.3. Composition and distribution of voluntary work 2004

In 2001, the federal government provided funding for Statistics Canada to establish a permanent survey program on charitable giving, volunteering, and participating, designed to be conducted every three years.[20] The first survey was administered in 2004, and the results were published in 2006 as Statistics Canada's 2004 Canada Survey of Giving, Volunteering and Participating (CSGVP).

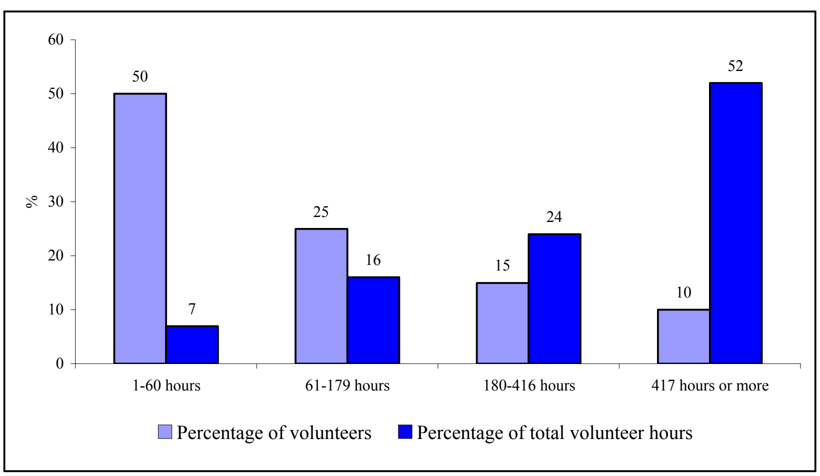
The new survey provides detailed information on the composition of voluntary work, the distribution of voluntary hours, the socio-demographic characteristics of volunteers, the organizations to which volunteers contribute, the motivations of volunteers, and more. Although results are not comparable to previous surveys on volunteer activity, the 2004 CSGVP provides a wealth of data that will act as a baseline and benchmark for future detailed comparisons and updates of formal voluntary work trends and valuations.

According to the CSGVP, formal volunteerism accounted for nearly 2 billion hours of unpaid work in Canada in 2004—the equivalent of 1 million full-time jobs.[21] Forty-five percent of the population aged 15 and older—or 11.8 million Canadians—formally volunteered their time to organizations or charities. When averaged over a year, volunteers contributed 168 hours of their time to non-profit organizations or charities.

In Nova Scotia, according to the CSGVP, 377,000 people formally volunteered their time. When averaged over a year, each Nova Scotia volunteer contributed 195 hours, or 16% above the national average. In 2004, volunteerism accounted for 73.5 million hours of unpaid work in Nova Scotia—or the equivalent of roughly 38,000 full-time jobs.

Although trends in the total number of volunteer hours are significant, it is noteworthy that most of these hours are contributed by a small percentage of the population. In Canada, just 10% of volunteers contributed 417 or more hours a year, providing more than half (52%) of all volunteer hours. Overall, 25% of all volunteers contributed 77% of all volunteer hours (see Figure 1-2 below).

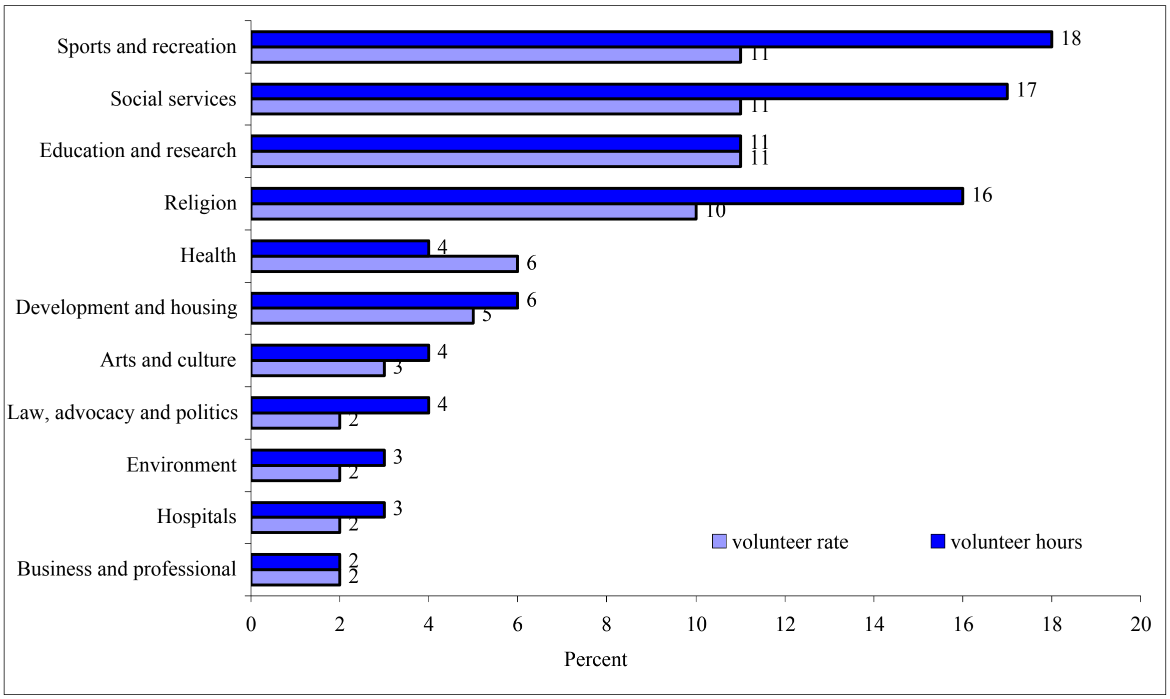
Figure 1-2. Distribution of volunteers and percentage of total volunteer hours contributed, by annual hours volunteered, aged 15 and older, Canada, 2004



Source: Hall, Michael, David Lasby, Glenn Gumulka, and Catherine Tryon. 2006. *Caring Canadians, Involved Canadians: Highlights from the 2004 Canada Survey of Giving, Volunteering and Participating*. Statistics Canada. Minister of Industry. Ottawa. Figure 2.1.

The CSGVP also reported on the types of organizations supported by volunteers in Canada and found that in 2004, most volunteering was directed towards four types of organizations: more than one in ten (11%) of Canadians volunteered time for sports and recreation, social services, and education and research organizations, and one in ten (10%) volunteered for religious organizations. In terms of hours contributed, 18% of all volunteer hours were contributed to sports and recreation; 17% to social services organizations; 16% to religious organizations and 11% to education and research organizations (see Figure 1-3 below).

Figure 1-3. Volunteer rate and percentage of total volunteer hours, by selected organization type, aged 15 and older, Canada, 2004



Source: Hall, Michael, David Lasby, Glenn Gumulka, and Catherine Tryon. 2006. *Caring Canadians, Involved Canadians: Highlights from the 2004 Canada Survey of Giving, Volunteering and Participating*. Statistics Canada. Minister of Industry. Ottawa. Figure 2.2.

The percentage of Canadians who volunteer generally decreases with age. More than half (55%) of all Canadian youth (aged 15 to 24) and 54% of all Nova Scotian youth volunteered in 2004 compared to 32% of Canadian seniors and 35% of Nova Scotian seniors. However, in Nova Scotia, the highest rate of volunteering was found among those aged 35–44 (61%), while the Canadian rate for that age group was, at 51%, significantly lower. Apart from seniors, the second lowest volunteer rate in Nova Scotia was found among those aged 25–34 (42%).

While the volunteer rate in Canada tends to be lower among older than younger age groups, average annual volunteer hours generally increase with age—from 139 hours for Canadian youth to 245 hours for Canadian seniors, and from 177 hours for Nova Scotian youth to 258 hours for Nova Scotian seniors. As a result, total volunteer hours were proportionately similar among youth and seniors, since longer volunteer hours among the latter compensated for lower participation rates. In fact, according to Statistics Canada, most age groups contributed volunteer hours roughly in proportion with their representation in the Canadian population, with the exception of those aged 25–34, who made up 17% of the population in 2004, but contributed only 13% of the total volunteer hours.[22]

In Canada overall, the likelihood of volunteering increased as household income increased, but the hours volunteered generally moved in the opposite direction. Thus, the volunteer rate for individuals with a household income of less than $20,000 a year was 30%, increasing to a rate of 60% among those with an annual household income of $100,000 or more. In contrast, however, the average annual number of hours volunteered among those with household incomes under $20,000 was 177 hours compared to 155 hours for those with household incomes of $100,000 or greater.

In Nova Scotia this pattern was not as apparent. The volunteer rate for individuals with a household income of less than $20,000 was 29%, increasing to a rate of 66% among those with an annual household income of $100,000 or more. At the same time, the average annual number of hours volunteered among those with household incomes under $20,000 was 184 hours compared to 191 hours for those with household incomes of $100,000 or greater. Those with household incomes in the $20,000 to $39,000 range contributed the highest average annual hours at 225 hours a year.[23]

In both Canada and Nova Scotia, volunteering increased with level of education and with the presence of children in the household (see Table 1-1 below).

Table 1-1. Volunteer rate and average annual volunteer hours, by selected characteristics, Canada and Nova Scotia, 2004

	CANADA		NOVA SCOTIA	
	Volunteer Rate (%)	**Average Annual Hours**	**Volunteer Rate (%)**	**Average Annual Hours**
AGE				
15 to 24	55	139	54	177 E
25 to 34	42	137	42	158 E
35 to 44	51	152	61	171
45 to 54	47	177	47	206
55 to 64	42	202	49	230
65 and older	32	245	35	258
GENDER				
Male	44	168	45	199
Female	47	168	51	191
EDUCATION				
Less than high school	37	140	36	143 E
Graduated from high school	42	161	48	190
Some postsecondary	50	166	48	124 E
Postsecondary diploma	47	172	52	200
University degree	59	180	68	245
LABOUR FORCE STATUS				
Employed	50	152	55	175
Unemployed	42	235	F	F
Not in the labour force	43	199	45	240
HOUSEHOLD INCOME				
Less than $20,000	30	177	29	184 E
$20,000 to $39,000	37	175	42	225
$40,000 to $59,000	45	184	51	178
$60,000 to $79,000	48	168	55	174
$80,000 to $99,000	51	151	61	214 E
$100,000 or more	60	155	66	191 E
PRESENCE OF CHILDREN				
No children in household	40	191	42	222
Pre-school aged children only	43	125	42	111 E
Both pre-school and school-aged children	53	141	56	111
School aged children only	59	142	66	179

Source: Hall, Michael, David Lasby, Glenn Gumulka, and Catherine Tryon. 2006. Caring Canadians, Involved Canadians: Highlights from the 2004 Canada Survey of Giving, Volunteering and Participating. Statistics Canada. Minister of Industry. Ottawa. Tables 2.2 and D.7.

Notes: Pre-school aged is defined as 0–5 years of age and school aged is defined as 6–17.
F means that results were too unreliable to be published due to high sampling variability.
E denotes that data should be used with caution because the coefficient of variation is high (16.6% to 33.3%).

As previously noted, total volunteer numbers do not tell us how volunteerism is affecting those Canadians who benefit most from voluntary activity, such as: the elderly, disabled, sick, or homeless; abused women and children and other vulnerable groups; and participants in after-school sports programs, arts and culture, churches, literacy programs and more. Therefore, from the perspective of the beneficiaries of voluntary work, the most accurate measure of progress is the trend in volunteer service hours offered per capita. This measure has the advantage of taking into account changes in population that affect volunteer service needs and levels, which the more commonly reported measure of the absolute number of volunteer hours does not.

Since we cannot compare these 2004 CSGVP data with the earlier NSGVP data, the following calculations are intended to provide a benchmark for future updates of this trend. When total volunteer hours are expressed per person in Canada—as volunteer service hours per capita—62.7 hours per capita were volunteered in 2004. On this basis, Nova Scotia (78.4 hours per capita) ranked second after Saskatchewan (81). Quebec ranked lowest with just 40.9 hours of volunteer service per capita (see Table 1-2 below).

Table 1-2. Formal volunteer rate, volunteer hours, and volunteer hours per capita, aged 15 and older, Canada, provinces, and territories, 2004

	Number of Volunteers (thousands)	Volunteer Rate (%)	Total Annual Volunteer Hours (millions)	Average Annual Hours per Volunteer	Volunteer Hours per Capita
CAN	11,809	45	2,000	168	62.7
NL	187	42	35.1	188	67.9
PE	54	47	8.8	163	64.2
NS	377	48	73.5	195	78.4
NB	273	44	50.6	185	67.3
QC	2,114	34	308.6	146	40.9
ON	5,075	50	819.7	162	66.1
MB	459	50	71.3	155	60.9
SK	428	54	80.6	188	81.0
AB	1,227	48	214.5	175	67.0
BC	1,580	45	314.9	199	75.0
YT, NT and NU	35	50	5.8	162	56.0

Source: Statistics Canada. Canada Survey of Giving, Volunteering and Participating, 2004; Canadian Council on Social Development. Demographics of the Canadian Population: Population. Available from http://www.ccsd.ca/factsheets/demographics. Original population data from CANSIM, Table 051-0001.

Notes: Average annual volunteer hours are calculated for volunteers only; provincial estimates may not add up to Canadian totals due to rounding. Volunteer hours per capita are calculated by dividing the total annual volunteer hours by the total population in each jurisdiction in 2004.

In 2004, the top three reasons for volunteering cited by CSGVP respondents were a) to make a contribution to the community (92%), b) to use one's skills and experiences (77%), and c) being affected by the cause supported by the organization (60%). The least popular motivation for volunteering was to improve job opportunities (22%).[24] The results indicate that altruism, rather than materialism, is the primary motivating factor for volunteers to undertake the voluntary work they do.

The CSGVP also found that those who attended religious services at least on a weekly basis were much more likely to volunteer their time than those who did not (62% vs. 43%), and that those who attended religious services weekly also tended to volunteer more time than those who did not (229 hours vs. 147 hours). Statistics Canada also notes that those who attended religious services weekly volunteered 57% of their voluntary hours to non-religious causes—indicating that more religious Canadians do not simply give their voluntary time to their churches. It is also noteworthy that while these more religious Canadians only comprise 19% of the overall Canadian population, they contributed 35% of all volunteer hours in Canada.[25]

The 2004 survey also found that immigrants were somewhat less likely than native-born Canadians to volunteer (41% vs. 48%), but that those who did volunteer contributed nearly the same number of hours annually (165) as native-born Canadians (168). Immigrants contributed a larger proportion of their volunteer hours to religious organizations (22%) than did native-born Canadians (15%). In addition, the rate and level of volunteer activity does not seem to be directly related to the length of time that immigrants have resided in Canada.[26]

Although focussing on the formal volunteer sector, the CSGVP also provides some more limited data on the informal voluntary sector. Thus, the CSGVP found that 83% of the Canadian population (15 and older) helped others directly, without going through an organization.

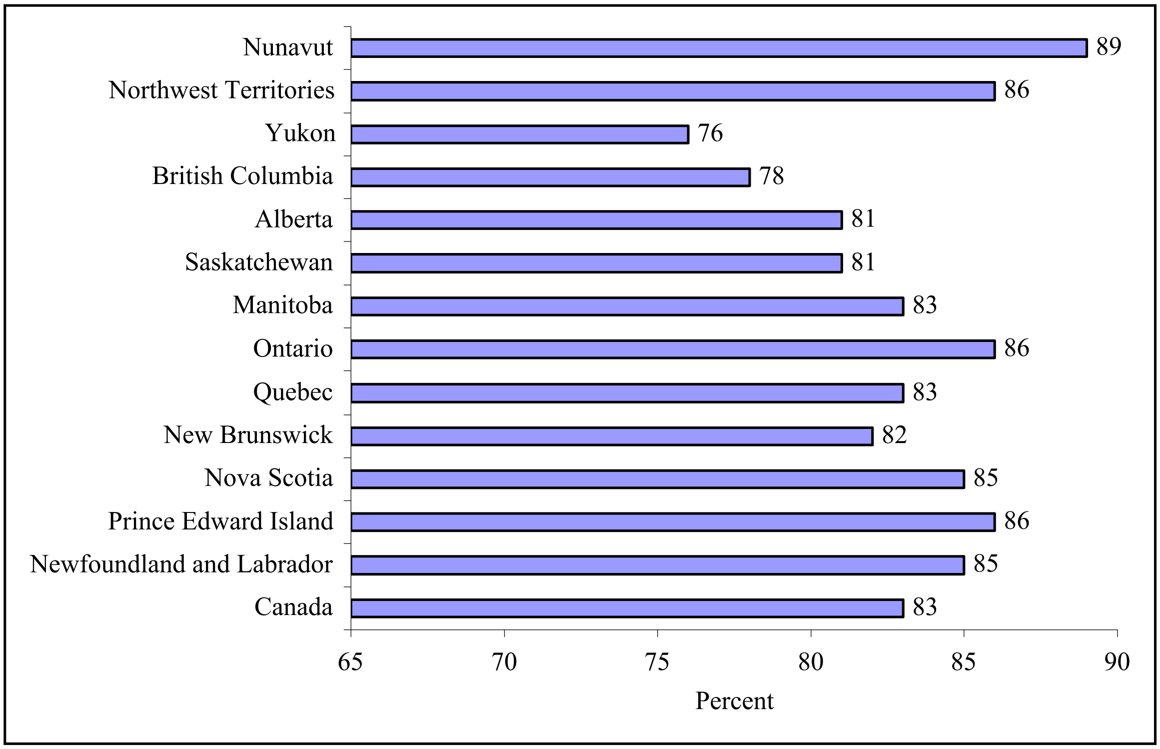
The survey found that among those who volunteered in a direct or informal way, 60% provided help in the home (cooking, cleaning, shovelling, etc.), 50% provided health-related help or personal care (emotional support, visiting the elderly, or unpaid babysitting), 46% helped by shopping or driving someone to their appointments, 28% helped with paperwork tasks (writing letters, doing taxes, banking etc.), and 16% provided unpaid teaching, coaching or tutoring. It should be recalled that Statistics Canada's definition of voluntary work includes the stipulation that it is performed outside one's own home.

In addition, of those who directly helped others, 15% did so on a daily or almost daily basis, 34% did so at least once a week, 30% did so at least once a month, and 21% helped others directly a few times a year.

Canadians aged 15–34 were the most likely to help others directly—with more than 88% of these young adults engaged in some form of informal voluntary work in 2004. Not surprisingly, those over the age of 65—who are more likely to be the recipients of direct help—were least likely to help others directly (66%), followed by those aged 55–64 (81%).

According to the survey, 85% of Nova Scotians helped others directly. The highest rates of informal voluntary work were in Nunavut (89%), the Northwest Territories (86%), Ontario (86%), and Prince Edward Island (86%). The Yukon (76%), British Columbia (78%), Alberta (81%), and Saskatchewanatchewan (81%) had the lowest rates of informal voluntary work (see Figure 1-4).[27]

Figure 1-4. Informal voluntary work—helping others directly (%), aged 15 and older, Canada, provinces, or territories, 2004



Source: Hall, Michael, David Lasby, Glenn Gumulka, and Catherine Tryon. 2006. *Caring Canadians, Involved Canadians: Highlights from the 2004 Canada Survey of Giving, Volunteering and Participating*. Statistics Canada. Minister of Industry. Ottawa. p. 48.

Based on an analysis of both the NSGVP and the General Social Survey time use surveys, GPI Atlantic estimated in 2000 that formal volunteer work represented only 29% of total voluntary work in Nova Scotia, down from one-third in 1992. At the time, GPI Atlantic speculated that the dramatic shift from hospital care to home care likely helped to account for the sharp increase in informal caregiving in the province. However, the apparent 7% decline in formal voluntary work during that time period indicated that at least some community agencies and non-profit groups were likely in trouble—trying to meet more demands with fewer resources.

The 2004 CSGVP did not provide data on the total number of informal volunteer hours offered by Canadians, and it was not therefore possible to determine a breakdown between levels of formal and informal volunteer work based on CSGVP results. The CSGVP only provided details on the frequency and type of informal volunteer work, reporting, as noted above, that 83% of Canadians directly helped others in 2004.

1.1.4. Trends in formal plus informal voluntary work from Statistics Canada's GSS

Statistics Canada's 1992, 1998, and 2005 General Social Surveys (GSS) collected data on the time use of Canadians. According to Statistics Canada's 1992 GSS, Nova Scotians aged 15 and older devoted an average of 3 hours and 23 minutes a week to civic and voluntary work (formal plus informal combined)—the highest rate in the country and well above the Canadian average of 2 hours and 40 minutes a week.[28]

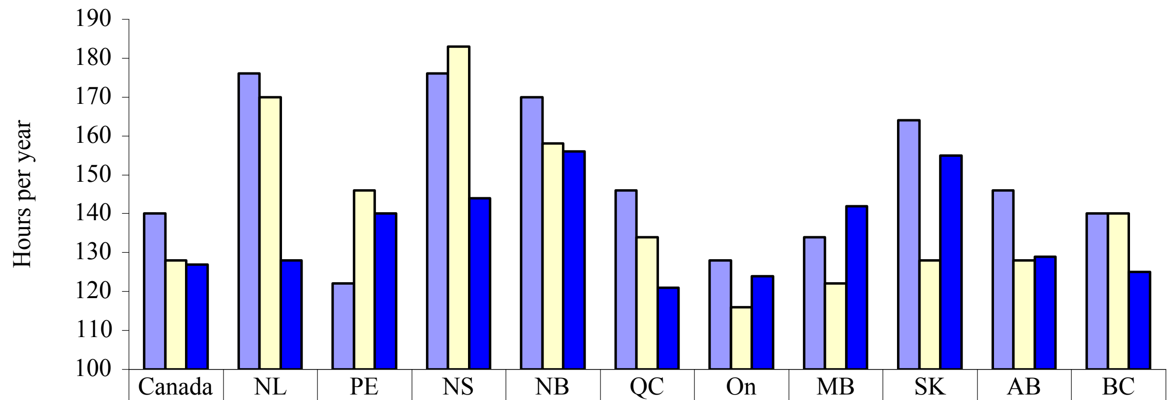
Based on comparisons with results in the initial screening questionnaire of the 1987 National Survey of Volunteer Activity, it can be estimated that about one-third of the civic and voluntary work reported in the 1992 GSS was work with "formal" non-profit organizations, and the remaining two-thirds was "informal" voluntary work.[29]

By 1998, Canadians were spending less overall time volunteering—2 hours and 27 minutes a week volunteering on average (down 8% from 1992)—while Nova Scotians were spending more time—3 hours and 30 minutes a week (up 3% from 1992).[30] Thus, in 1998, the average Nova Scotian put in 43% more voluntary hours (formal plus informal) than the average Canadian, up from 27% more in 1992.

By 2005, however, the gap had narrowed considerably as Canadian rates of civic and voluntary work remained stagnant, while Nova Scotian rates declined dramatically. Thus, Nova Scotians spent an average of 2 hours and 46 minutes/week (144 hours/year) on civic and voluntary work per person (down 21% from 1998, while the average Canadian contribution remained virtually unchanged at 2 hours and 26 minutes/week (127 hours/year). This narrowed the Nova Scotia–Canada gap in voluntary hours to just 14%—down from 43% in 1998.

The province with the highest civic and voluntary hours per person in 2005 was New Brunswick (156 hours/year) followed closely by Saskatchewanatchewan (155 hours/year). Nova Scotia was third with 144 hours/year, followed by Manitoba (142) and Prince Edward Island (140). The provinces with the fewest civic and voluntary hours per person in 2005 were Quebec (121 hours/year), Ontario (124), and British Columbia (125). The most dramatic declines in civic and voluntary work contributions occurred in Newfoundland and Labrador (down 27% between 1992 and 2005) and Nova Scotia (down 21% between 1998 and 2005) (Figure 1-5 below).[31]

Figure 1-5. Civic and voluntary work, average hours per year, aged 15 years and older, Canada and provinces, 1992, 1998, and 2005



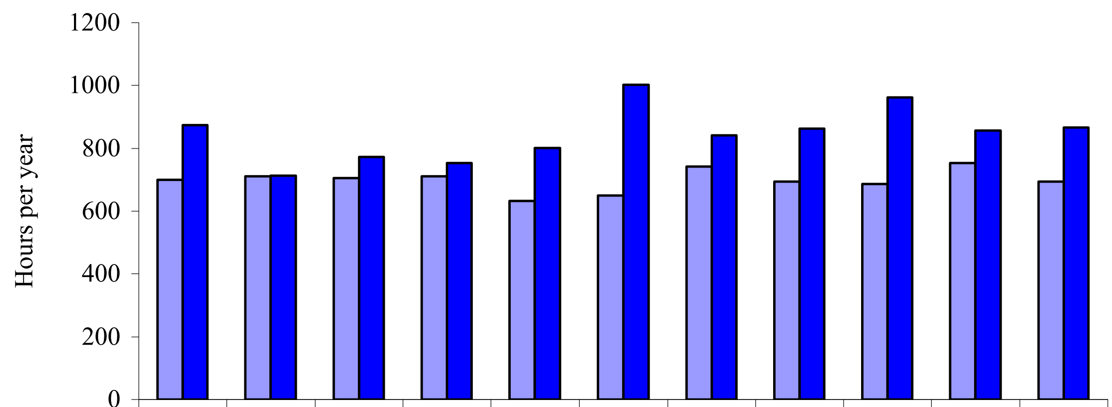
	Canada	NL	PE	NS	NB	QC	On	MB	SK	AB	BC
1992	140	176	122	176	170	146	128	134	164	146	140
1998	128	170	146	183	158	134	116	122	128	128	140
2005	127	128	140	144	156	121	124	142	155	129	125

Source: Statistics Canada. 1992, 1998, 2005 General Social Surveys.

When civic and voluntary work hours per year are calculated for participants (i.e., those actually engaged in civic and voluntary work), Quebec ranked the highest in 2005 with 1,003 hours per year, followed by Saskatchewanatchewan with 962 hours. Nova Scotian volunteers worked an average of 753 hours annually, 14% below the national average of 875 hours per year (Figure 1-6 below).

However, these rankings can by no means be interpreted on a favourable–unfavourable scale. On the contrary, as noted in the discussion of volunteer burnout above, it may be a distinct disadvantage to have fewer volunteers putting in longer hours. That appears to be the case with Quebec, which has the fewest voluntary hours per capita and the highest hours per volunteer (Figures 1-5 above and 1-6 below).

Figure 1-6. Civic and voluntary work, average hours per year, aged 15 years and older, Canada and provinces, 1998 and 2005



	Canada	NL	PE	NS	NB	QC	On	MB	SK	AB	BC
1998	699	712	706	712	633	650	742	694	687	754	694
2005	875	713	773	753	802	1,003	841	862	962	856	867

Source: Statistics Canada. 1992, 1998, 2005 General Social Surveys.

What is notable in recent trends, as indicated in Figure 1-6 above and as reported in previous GPI voluntary work updates, is that volunteer service levels have been partially maintained—in the face of declining rates of volunteerism—through longer unpaid work hours on the part of the remaining volunteers. Previous GPI reports, noting the decline in volunteers, warned that the reliance on fewer volunteers working longer hours to maintain services may only be a short-term fix if it leads to volunteer burnout. Indeed, the most recent results, showing a sharp drop in voluntary hours in Nova Scotia, may confirm those earlier predictions.

The volunteer results demonstrate the potential predictive power of the integrated GPI approach and its utility in providing early warning signals for policy makers. For example, the original 1998 GPI voluntary work report noted the high levels of voluntary work among married women and university graduates while time use and labour force trends showed rising rates of time stress among the former and longer paid work hours among the latter—potentially squeezing out volunteer time. Subsequent data did indeed reveal a decline in volunteer hours, particularly among these groups.

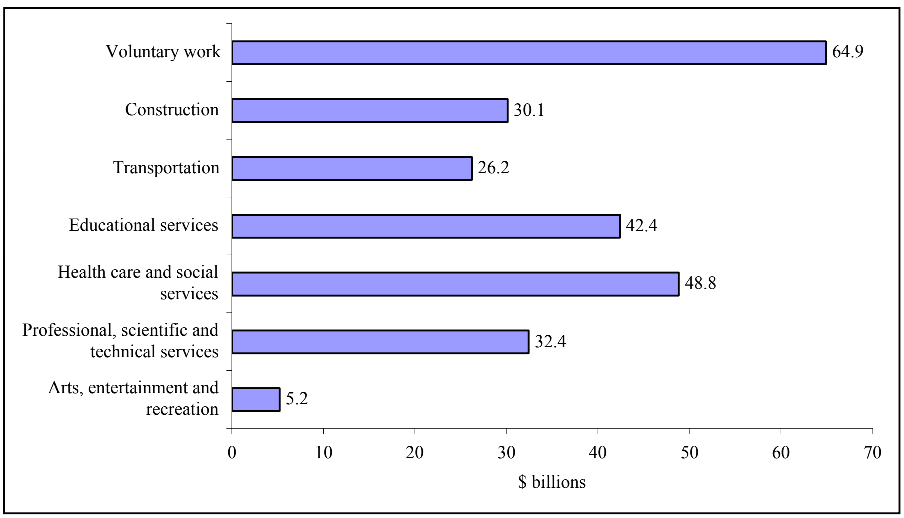
1.2. Economic value of voluntary work

Data sources: Statistics Canada, General Social Survey, 1998, 2005; Statistics Canada. Households' Unpaid Work: Measurement and Valuation. Catalogue no. 13-603E, #3. December, 1995; Census of Population 1991, 1996, 2006

Result: In 2005, Nova Scotian volunteers contributed the equivalent of $1.8 billion to the economy. The decline in volunteerism in Nova Scotia between 1998 and 2005 cost the province $370 million in lost voluntary services in 2005.

Canadian volunteers contribute the equivalent of $64.9 billion ($2007) worth of services annually to the national economy either through voluntary organizations or by informal volunteer work—far more than a wide range of other industries (Figure 1-7 below).[32] In 1998, GPI Atlantic reported the economic value of formal and informal voluntary work to be $65.6 billion ($2007). In Nova Scotia, volunteers contributed the equivalent of $1.8 billion ($2007) worth of services in 2005.[33]

Figure 1-7. Value of voluntary work compared to selected annual industry payrolls ($2007), Canada, 2004



Sources: Statistics Canada. Survey of Employment, Payrolls and Hours. Table 281-0025; *The Daily*. Employment, earnings and hours. November 29, 2004. Available from http://www.statcan.ca/Daily/English/041129/d041129c.htm. Accessed July 2, 2008; Statistics Canada. *Households' Unpaid Work: Measurement and Valuation*, cited in Colman, Ronald. *Economic Value of Civic and Voluntary Work in Atlantic Canada*. 2003 Update. GPI Atlantic. Halifax; Statistics Canada National Survey of Giving, Volunteering and Participating, 2000 cited in Colman, (2003 update).

Notes: Voluntary work in Figure 1-7 above includes both formal and informal voluntary work. Data for voluntary work are for 2005 from the GSS.

According to the CSGVP, formal volunteerism accounted for nearly 2 billion hours of unpaid work in Canada in 2004. This has an estimated economic value of $39.3 billion ($2007).[34] In Nova Scotia, 377,000 people contributed 73.5 million hours of formal volunteer work in 2004, worth an estimated $1.2 billion ($2007).[35]

Just as voluntary work has a definite economic value, so any decline in volunteerism represents an economic loss. Thus, a decline in voluntary work of the magnitude described above can either produce an absolute loss in services, with a corresponding decline in the standard of living and quality of life, or the lost voluntary services can be replaced for pay. "Replacement cost" valuations assess the value of the lost volunteer hours by imputing a market value to the work that volunteers do. Statistics Canada estimated the replacement cost rate for volunteer work to be $19.63 an hour for Canada and $16.28 an hour for Nova Scotia ($2007).

Thus the 10.7% cumulative decline in formal volunteer services per capita documented above (between 1987 and 2000) cost Canada more than $2.3 billion in lost services in 2000 ($2007) compared to the value these volunteer services would have had if they had been maintained at 1987 levels.[36] Because voluntary work is not valued or measured in the conventional economic accounts, this $2.3 billion loss does not show up in the GDP or in any other market statistics.

It should be noted that these estimates of economic losses between 1987 and 2000 based on the NSGVP are not comparable to the valuations of voluntary work from the 2004 CSGVP provided above. Because the most recent 2004 data from the CSGVP altogether are not comparable to the earlier NSGVP data, it is not possible to estimate trends in the economic value of formal voluntary work since 2000.

When both formal and informal voluntary work are combined, as in the GSS data, Nova Scotian volunteers contributed an average of 144 hours per person 15 and older in 2005—the equivalent of $1.8 billion worth of services annually to the economy.[37] This represents a loss of $400 million in voluntary services compared to the combined value of formal and informal voluntary work in 1997—$2.2 billion ($2007)—as estimated in GPI Atlantic's original 1998 report on *The Economic Value of Civic and Voluntary Work in Nova Scotia*.[38]

When the loss is calculated according to the provincial decline in volunteerism indicated in the 1998 and 2005 General Social Surveys, as reported in Figure 1-5 in Section 1.1.4 above, the results are as follows. Nova Scotian volunteers contributed an average of 183 hours per person 15 and older in 1998—amounting to a total of 133.4 million hours, worth $2.17 billion ($2007).[39] This indicates that the decline in volunteerism in Nova Scotia between 1998 and 2005 cost the province $370 million in lost voluntary services in 2005.

In 2005, if volunteers were providing services at the same rate as in 1992, Canadians would have received 173 million additional hours a year of help. To replace this work for pay in the market economy would cost $3.4 billion. Similarly, in Nova Scotia, if volunteers were providing services at the same rate as in 1992, Nova Scotians would be receiving 18.3 million additional hours a year of voluntary services. To replace this work for pay in the market economy would cost nearly $300 million.

The loss is due to the decline in volunteerism denoted in Figure 1-5 above. When that decline is combined with population increases, it is therefore apparent that Canadians and Nova Scotians in 2005 were no longer receiving voluntary services at the rate that they were in 1992. Table 1-3 below and the accompanying footnote explain the methodology and steps by which the dollar value of that loss is derived.

Table 1-3. Value of voluntary work and dollar loss in voluntary services, Canada and Nova Scotia, 1992, 1998, 2005[40]

	1992	1998	2005
CANADA			
1. Average volunteer hours per year*	140 hours	128 hours	127 hours
2. Population 15 and older	21,591,816	22,933,174	26,017,413
3. Value of voluntary work	$59.3 bil.	$57.6 bil.	$64.9 bil.
4. Rate of voluntary work per capita†	110 hrs.	102 hrs.	105 hrs.
5. Hypothetical value of voluntary work in 2005 if offered at 1992 rate			$68.3 bil.
6. Dollar loss in voluntary services compared to 1992			$3.4 bil.
NOVA SCOTIA			
1. Average volunteer hours per year*	176	183	144
2. Population 15 and older	719,956	729,243	767,311
3. Value of voluntary work	$2.1 bil.	$2.2 bil.	$1.8 bil.
4. Rate of voluntary work per capita†	141 hrs.	147 hrs.	121 hrs.
5. Hypothetical value of voluntary work in 2005 if offered at 1992 rate			$2.1 bil.
6. Dollar loss in voluntary services compared to 1992			$300 mil.

Sources: Hours data from GSS, 1992, 1998, 2005. Includes formal and informal voluntary work.
Population data for Canada and Nova Scotiafrom 1991, 1996, and 2006 Census. Available from NS Community Counts: http://www.gov.ns.ca/finance/communitycounts/. Accessed September 25, 2008.

Notes: Hourly replacement cost of formal voluntary work for Canada and Nova Scotia are $19.63 and $16.28 ($2007) respectively.
* Average volunteer hours are per capita for the population aged 15 and older.
† Hours are per capita for the entire population and thus assess the rate at which voluntary services are received by Canadians and Nova Scotians (see footnote below for methodology).

If we continue to exclude voluntary work from Canada's core measures of wellbeing and progress, then declines in volunteer services will not be predicted or noticed, early warning signals will not be sent, and remediation will be unlikely. Rather, such losses will only manifest later in a gradual, subtle, and unexplained deterioration in the health, wellbeing, and quality of life of Canadians. And if we exclude the value of voluntary work from the national economic accounts, then its actual contribution to the economy—and the savings it provides governments that might otherwise have to pay for the services contributed by volunteers—will not be recognized.

2. Unpaid Housework and Childcare

For the original GPI Atlantic report on unpaid housework and childcare, please see the following:

The Economic Value of Unpaid Housework and Child Care in Nova Scotia (1998)
http://gpiatlantic.org/pdf/housework/housework.pdf

Headline Indicators

1. Total workload (paid and unpaid)—men and women
2. Total work hours of full-time dual-earner parents and loan parent mothers
3. Time stress
4. Value of unpaid household work and childcare

2.1. Introduction

Every day, and for no pay, Canadians perform hours of valuable services that contribute directly to wellbeing and economic prosperity. In fact, the work performed in households is more essential to basic survival and quality of life than much of the work done in offices, factories and stores, and is a fundamental precondition for a healthy market sector. If children are not reared with attention and care and if household members are not provided with nutritious sustenance, for example, workplace productivity will decline and social costs will rise. Yet, because these services—from raising children to running a household—are assigned no monetary value, their massive contribution to society does not show up in our standard measures of economic progress.

If we look after our own children, clean our homes, cook our own meals, and weed our gardens, the value of this work does not register in our current GDP-based accounting system, which only counts transactions undertaken for pay. But if we hire someone to perform these exact same tasks, the value is added to the GDP and counts as economic growth. In other words, shifts from the household economy to the market economy are misleadingly counted as economic growth, even though no additional production may be taking place.

Failure to measure and value unpaid housework and childcare renders it invisible in the economic accounts from which policy-makers take their cues and which guide the behaviour of governments, businesses, and individuals. The implications are especially harmful to women, who perform the bulk of unpaid work. For example, unpaid workers are excluded from pension plans, including the Canada Pension Plan, and can have trouble getting credit. In addition, if women take time from careers to raise children, they can lose seniority or opportunity for promotion, and the ability to make workplace pension contributions.

Failure to value women's unpaid work can also produce a subtle "wage discrimination" by devaluing women's work as a whole. Work considered traditional, unpaid female work—cleaning, cooking, childcare—also fetches a low wage in the market economy. And overall, Statistics Canada reports that women still earn less than men on an hourly basis—an average of 87.4 cents for every male dollar, though this gap has begun to narrow in recent years from 81 cents to the dollar in 2001 to 83 cents in 2004, largely because of the strong escalation in women's educational qualifications.[1]

However, in those occupations traditionally performed for "free" in the household, and still dominated by women in the market economy, wages remain extremely low. In 2004, even unionized early childhood educators in Halifax were earning an average of just $10.51 cents an hour for an occupation that arguably requires higher levels of skill, responsibility, and constant alertness than most others. Since unionized childcare workers earn an average of 30% more than non-unionized ones, and only 16% of childcare workers belong to a union, the vast majority of Nova Scotia childcare workers (who are overwhelmingly female) earn even less than this and likely remain at minimum wage levels.[2]

A recent paper by Michael Shannon and Michael Kidd addresses the question of the size of the gender wage gap in the future. Using recent Canadian data, Shannon and Kidd used a statistical model to project future trends in the gender wage gap, based on current trends in educational attainment and labour force participation. They found that, while the wage gap will likely continue to close, a gender wage gap of approximately 22% will still exist in 2031.[3] At least in part, this may be due to the continued devaluation of work traditionally performed by women in the unpaid household economy.

Failure to value unpaid childcare and housework also results in a lack of social supports that especially penalizes lone-parent mothers, who carry the total burden of unpaid household work alone. When they also hold down paid jobs, these single mothers spend three times as high a proportion of their incomes on paid childcare as their married counterparts and frequently suffer extreme levels of time stress and "time poverty" that give them considerably less dedicated time with their own children than their married counterparts.[4] For many of these women, the paid workforce is not a viable route to an adequate income that also leaves them time to raise their children properly and undertake essential household tasks. Yet the lack of adequate social support for the latter unpaid tasks often gives them little choice.

In general, data on unpaid work, combined with information on paid work, are essential to provide a more complete picture of the work activities of all Canadians, and particularly of their efforts to juggle their employment and family responsibilities and to achieve a satisfactory work–life balance. Such balance, in turn, is a vital ingredient in wellbeing and quality of life. According to Statistics Canada:

> This information [on unpaid work] can be used to study that part of the population whose main activity is unpaid household work; to analyze the division of household work between men and women; to better understand the contribution of men and women to the economy; to evaluate the capacity of the unpaid sector to absorb care-giving responsibilities no longer provided by the paid sector; and to analyze how workers balance their job and household responsibilities.[5]

Statistics Canada has also recognized that measuring unpaid work is essential to overcoming gender discrimination through under-valuation of women's economic and social contribution: "Since women do most of the unpaid household and volunteer work, their significant contribution to overall production and economic welfare is grossly understated in the major economic aggregates."[6]

For the reasons outlined above, recognizing unpaid work could also encourage policies that address the persistent wage gap between the sexes; high income and time poverty rates among single mothers and their children; the decreasing time many parents have to spend with their children; and growing time stress from the "struggle to juggle" jobs and household duties.

In sum, measuring and valuing unpaid household work and childcare is not a theoretical accounting exercise but a practical tool to raise the policy profile of vital hidden and neglected issues that directly affect the daily quality of life. Through valuing production in the unpaid household economy, these measures can also help us to better understand the economy as a whole and the important links between the market and non-market sectors, and to invest more effectively in the social and human capital on which our future prosperity depends.

2.2. Total workload (paid and unpaid)—men and women

Data Sources: Statistics Canada, General Social Surveys, 1992, 1998, 2005.

Result: Between 1992 and 2005, total work hours (paid and unpaid) per week for both men and women in dual-earner families have increased. Women continue to do the lion's share of unpaid work.

Measures of unpaid household work here use Statistics Canada's General Social Survey (GSS) definition of unpaid household work as housework, maintaining the house, doing yard work, and caring for children and seniors within the home without getting paid for doing so. For example, it includes time spent preparing meals, washing dishes, mowing the lawn, cleaning the house, shopping, and feeding, diapering, bathing, and reading to children.

The GSS time diaries count only “primary” child-care, which is time devoted to exclusively to one’s children as the primary activity of the moment. It does not count time spent supervising children while engaged in another primary activity like cooking, cleaning, or watching television. It should also be noted that the definition of unpaid “work” here includes only those activities that could potentially be contracted out for pay to a third party. Thus, they would include shopping for groceries, for example, but not having a haircut or going to a medical appointment.

According to 2005 GSS data, the average daily amount of time dual-earner couples spend on paid work and unpaid household work combined increased by 0.5 hours per day between 1992 and 2005 (a result of 0.7 hours more paid work but 0.2 hours less household work averaged over a 7-day week). Together, dual-earner couples were putting in about 3.5 hours more work each week in 2005 than in 1992 or about 180 hours more each year—the equivalent of 4.5 additional weeks of full-time work annually.

This net increase in working couples’ total workload was due to an increase in husbands’ paid work and household work, and an increase in wives’ paid work accompanied by a smaller decrease in their household work (Table 2-1 below). In both 1992 and 2005, each partner in dual-earner families did about 50% of the combined paid work and household work: in 1992, wives did 45% of paid work and 65% of household work and in 2005 they did 46% of paid work and 62% of household work.

Table 2-1. Average time spent on paid work and unpaid household work in dual-earner families, 1992 and 2005

	TIME PER DAY (HOURS)		TIME PER WEEK (HOURS)	
	1992	2005	1992	2005
PAID WORK				
Husband	6.3	6.6	44.1	46.2
Wife	5.2	5.6	36.4	39.2
HOUSEWORK				
Husband	1.3	1.4	9.1	9.8
Wife	2.4	2.2	16.8	15.4
TOTAL WORK				
Both	15.3	15.8	107.1	110.6
Husband	7.7	7.9	53.9	55.3
Wife	7.6	7.8	53.2	54.6

Source: Marshall, Katherine. *Converging Gender Roles: Perspectives*. July, 2006. Volume 7, no. 7. Statistics Canada. Catalogue no. 75-001-XIE. Available from http://www.statcan.ca/english/freepub/75-001-XIE/10706/art-1.pdf. Accessed July 8, 2008, Table 2, p. 12. Time per week calculated by GPI author by multiplying by a factor of 7.

Notes: Figures may not add up to 100 due to rounding. Average time spent is averaged over a seven-day week.

Total work hours increase when school-aged children are factored into the equation. Table 2-2 below shows that when compared to dual earners with no children under 19 at home, having school-aged children at home added an average of 1.2 hours to a family's workday in 2005, pushing it to more than eight hours a day for each parent averaged over a 7-day week, or about 58 hours a week.[7] Table 2-2 also shows that *full-time* employed dual-earner couples each put in at least eight hours of total work a day (or roughly 56 hours a week each).

Table 2-2. Total average time spent on paid work and unpaid household work in full-time employed dual-earner couples, Canada, 2005

	Paid Work (hours/day)		Unpaid Housework (hours/day)		Total Paid and Unpaid Work (hours/day)		Total Hours per Week	
	Husband	Wife	Husband	Wife	Husband	Wife	Husband	Wife
Dual-earners with school-aged children	6.8	5.7	1.5	2.5	8.3	8.2	58.1	57.4
Dual-earners with no children under 19 at home	6.4	5.7	1.2	1.9	7.6	7.6	53.2	53.2
Dual-earners both working full-time	6.6	5.9	1.4	2.1	8.0	8.1	56.0	56.7

Source: Marshall, Katherine. *Converging Gender Roles: Perspectives*. July, 2006. Volume 7, no. 7. Statistics Canada. Catalogue no. 75-001-XIE. Available from http://www.statcan.ca/english/freepub/75-001-XIE/10706/art-1.pdf. Accessed July 8, 2008, Table 3, p. 13.

Although GSS data are publicly available for full-time dual earner couples and for dual-earners with children, as denoted in Table 2-1 above, they are not publicly available for full-time dual-earner parents, and they are not broken down by age. Unfortunately financial constraints did not permit purchase of these additional data from Statistics Canada at this time, though it is quite likely that full-time dual-earner parents, especially in the 25-44 year age group, have even longer total work hours than those reported in Table 2-2 above.

According to Statistics Canada, gender differences in the division of labour are still evident, but are slowly diminishing.[8] For example, the proportion of men doing household work on a daily basis has increased considerably over two decades—from 54% in 1986 to 69% in 2005, while for women it has remained steady at 90%. However, while the proportion of all people doing household work has increased due to increased male participation, the amount of time spent doing it has decreased for those doing such unpaid work by about 12 minutes a day (from an average of 2.7 hours per day in 1986 to 2.5 hours per day in 2005).[9]

By 2005 the employment rate of Canadian women had more than doubled since 1961, but they still did 62% of the household work. This female share of household work had fallen slightly from 65% in 1992, and from 68% in 1986 where it had remained almost unchanged since 1961.[10] In other words, there has been a modest change in the gender division of labour in the household, but it has not matched the increased hours that women put in for pay in the market economy, likely resulting in a significant loss of free time for women since the early 1960s.

Although comparable time use data do not exist back to 1961 to allow a longer term comparison of trends in male and female free time, more recent evidence suggests that these paid and unpaid work trends have likely resulted in a significant absolute loss of free time for both women and men. Statistics Canada time use diaries show that since 1992 alone, Nova Scotians, both male and female, have experienced a loss of free time of more than half an hour a day, 3.6 hours a week, or 186 hours a year—equivalent to more than a month of full-time paid work time.[11]

A 2007 Statistics Canada study found that workers spent an average of 45 minutes less with their families during workdays in 2005 than they did in 1986. Based on a 260-day work year, that amounts to 195 hours less, or the equivalent of about five 40-hour workweeks. The study said the main factor associated with the decline was an appreciable increase in time devoted to paid employment on a typical working day.[12]

Results from the 2001 Census, released in 2003, confirmed the earlier GSS results on the gender division of household labour, and indicated that women were still doing the lion's share of household work and childcare. In the week before the census, 21.4% of Canadian women and just 7.8% of men spent at least 30 hours doing household work. The same pattern exists with childcare. The census found that 16% of women and just 6.9% of men spent 30 or more hours a week diapering, bathing, feeding, reading to, and otherwise taking care of children.[13]

2.3. Total work hours of full-time dual-earner parents and lone-parent mothers

Data sources: Statistics Canada, General Social Survey, 1992, 1998, 2005

Result: The 2005 total work hours data for these two groups are not publicly available; therefore, it is not possible to ascertain a trend at this time. The 1998 Statistics Canada data show that the total weekly paid and unpaid work hours of full-time, employed, dual-earner parents aged 25–44 amounted to 71.4 hours for men and 73.2 hours for women. Total paid and unpaid work hours for full-time working mothers amounted to 74 hours a week and for full-time, employed, single mothers it added up to 75 hours a week. Trend data are available for women aged 25 to 54. Counting both full-time and part-time workers, the average time spent on paid and unpaid work by women aged 25–54 increased from 57.4 hours a week in 1986 to 61.6 hours a week in 2005.

The “struggle to juggle” paid and unpaid work responsibilities and to balance work and family life is typically most difficult for full-time employed dual-earner parents and for working single mothers. Statistics Canada time use data indicate that when civic and voluntary activity are included in unpaid work, the total weekly paid and unpaid work hours of full-time employed dual-earner parents aged 25–44 amounted to 71.4 hours for men and 73.2 hours for women in 1998 (Table 2-3 below). Total paid and unpaid work hours for full-time employed single mothers added up to an astonishing 75 hours a week.[14] When all full-time working mothers are considered, they put in a 74-hour workweek in 1998 when paid and unpaid work were both counted.[15]

These are averages for these demographic groups as a whole, indicating that some full-time working parents are working even longer hours than indicated here, likely producing extreme rates of time stress that in turn may have health consequences.

Unfortunately, more recent data for total paid and unpaid work hours for these two demographic groups were only available for purchase through special Statistics Canada tabulations—a cost that financial constraints did not permit at this time. However, it is likely that the 2005 GSS time use data would demonstrate that these groups continue to be the most time-stretched, working the longest total hours per week.

Table 2-3. Weekly paid and unpaid work hours of full-time dual-earner parents, aged 25 to 44, Canada, 1992 and 1998

	1992		1998	
	Hours work/week	**Total work hours**	**Hours work/week**	**Total work hours**
Paid work, fathers	46.6	68.9	48.6	71.4
Unpaid work, fathers	22.3		22.8	
Paid work, mothers	36.8	70.7	38.8	73.2
Unpaid work, mothers	33.9		34.4	

Source: Statistics Canada. *The Daily*. November 9, 1999. General Social Survey: Time Use. Available from http://www.statcan.ca/Daily/English/991109/d991109a.htm. Accessed July 3, 2008.

Notes: Unpaid work includes household work, childcare, shopping, helping others, volunteering, and civic activities. Paid work hours are for parents who both work full-time, and are therefore higher than the total paid hours when part-time employed parents are included.

According to a Statistics Canada analysis of the 2005 GSS time use data, the increasing number of dual-earner families and a heavier overall workload are making it more difficult for growing numbers of Canadians to balance their jobs with their home life. For example, between 1986 and 2005, the average daily time spent on paid and unpaid work by women aged 25–54 increased steadily from 8.2 hours to 8.8 hours—with all of this increase attributable to paid labour. During this time period, unpaid work dropped only slightly—refuting “the theories that advanced technology and growth in productivity capacity would invariably lead to increased leisure time.”[16]

2.4. Time Stress

Data sources: Statistics Canada, General Social Survey, 1998 and 2005.

Result: Between 1998 and 2005, there was an increase in severe time stress among Nova Scotians—from 16.2% to 18.3% of the population. The proportion of Nova Scotian women suffering from severe time stress jumped from 17.4% in 1998 to 22.7% in 2005. Nova Scotian women are nearly 70% more likely to be severely time stressed than Nova Scotian men.

Time stress generally results from the struggle to juggle domestic and work schedules, and to balance work, family, and life responsibilities. Statistics Canada’s 1992, 1998, and 2005 General Social Surveys (GSS) each assessed responses from almost 11,000 Canadians aged 15 and over to measure the extent of time stress in their daily lives and to determine which individuals were most prone to this kind of stress. Those who agreed with seven out of ten questions about time stress were determined to be severely time stressed.

Statistics Canada defines “time scarcity” as the perception that one does not have enough time. Statistics Canada actually has four broad measures of time scarcity in the GSS—the third of which is generally used to report rates of time crunch or time stress:[17]

1. Feeling rushed every day:
   How often do you feel rushed? Would you say it is . . .
   a) Every day?
   b) A few times a week?
   c) About once a week?
   d) Less than once a month?
   e) Never?

2. Experiencing a lot of stress in past two weeks:
   During the past two weeks, would you say that you experienced a lot of stress, a moderate amount of stress, relatively little stress or no stress at all?

3. Time crunch / stress indicator component questions:
   a) Do you plan to slow down in the coming year?
   b) Do you consider yourself a workaholic?

c) When you need more time, do you tend to cut back on your sleep?
d) At the end of the day, do you often feel that you have not accomplished what you had set out to do?
e) Do you worry that you don't spend enough time with your family or friends?
f) Do you feel that you're constantly under stress trying to accomplish more than you can handle?
g) Do you feel trapped in a daily routine?
h) Do you feel that you just don't have time for fun anymore?
i) Do you often feel under stress when you don't have enough time?
j) Would you like to spend more time alone?

4. In addition, the GSS also asks respondents about the amount of stress in their lives and how much of the stress is due to not having enough time. [18]

As mentioned, Statistics Canada reports rates of time stress or the experience of time crunch based on responses to the 10 questions listed in item 3 above from the GSS. If respondents answer "yes" to 7 out of the 10 questions they are determined to be "severely time stressed" or to experience "severe time crunch." Based on this computation, severe time stress rose sharply across Canada for both men and women between 1992 and 1998—increasing from 12% to 16% for men and from 16% to 21% for women.[19, 20]

Time stress data for 2005 for Canada and the provinces were not publicly available through Statistics Canada. However, Table 2-4 below presents data for 1998 and 2005 for Nova Scotia and "other Canada" (not including Nova Scotia), as derived from the GSS micro-data files by Dr. Andrew Harvey, lead author of the recently released GPI Atlantic report *The Value of Free Time in Nova Scotia*.

The available data from all years indicate that full-time working mothers, in particular, consistently record significantly higher rates than men of life stress in general and time stress in particular, and are the most highly time-stressed demographic group in Canada.

Statistics Canada's analysis of the 1998 time stress results linked levels of time stress directly with excess work hours and lack of free time:

> Severely time-stressed individuals aged 15 and over spent more of their days doing some form of work, either paid or unpaid, than low-stress individuals. Time-stressed men spent 9.7 hours and time-stressed women spent 9.4 hours per day on total work activities. This is 2.8 hours more for both these men and women than those who reported low levels of time-stress. Those who were severely time-stressed also had less free time—2.2 hours less for men and 2.0 hours less for women.[21]

According to the GSS time crunch data, in 1998, 16.2% of Nova Scotians and 18.6% of other Canadians aged 15 and older experienced severe time stress, based on positive responses to seven out of the ten questions listed in item 3 above. But this disparity was reversed in 2005, with Nova Scotian levels of severe time stress rising to 18.3% while they fell to 16.4% in the rest of Canada. The overall Nova Scotian increase was entirely generated by a sharp increase in the levels of time stress among women, with the proportion severely stressed rising from 17.4% to 22.7%. The male rate of severe time stress in Nova Scotia actually fell as did the rates for both males and females in the rest of Canada. Thus, Nova Scotian women are now nearly 70% more likely to be severely time stressed than Nova Scotian men (Table 2-4 below).[22]

Table 2-4. Share of population indicating severe time stress, Nova Scotia and other Canada, 1998 and 2005

	GSS 1998 (%)	GSS 2005 (%)
MALE		
Nova Scotia	14.7	13.4
Other Canada	15.3	13.9
FEMALE		
Nova Scotia	17.4	22.7
Other Canada	19.4	18.6
TOTAL		
Nova Scotia	16.2	18.3
Other Canada	18.6	16.4

Source: Calculations by Dr. Andrew Harvey. St. Mary's University. Derived from Statistics Canada. 1998 and 2005 General Social Surveys. Cited in Harvey, Andrew and Ronald Colman, *The Value of Free Time in Nova Scotia*. GPI Atlantic. Halifax. September, 2008.

Notes: The phrases "high levels of time stress" and "severe time stress" are used interchangeably by Statistics Canada. Any variation between the 1998 numbers for "other Canada" presented in Table 2-4 above and the 1998 time crunch data for Canada presented by Statistics Canada is due to the fact that Statistics Canada includes Nova Scotia in the Canada average, while the "other Canada" data reported in Table 2-4 do not, and are for the rest of Canada minus Nova Scotia.

The sharp increase in time stress among Nova Scotian women in particular may be partly due to the fact that they are working considerably longer paid hours than ever before. According to GSS data, Nova Scotian women, on average, worked seven hours a week longer for pay in 2005 than they did in 1992.[23]

When GSS time crunch data are explored by demographic group, we find that the overall averages conceal significant differences among different demographic groups.[24] Thus, in 1998, 38% of full-time employed mothers aged 25–44 (both single and married) were classified by Statistics Canada as severely time stressed—the most time stressed groups in Canada. As they try to juggle the demands of both paid employment and unpaid household work, these full-time employed mothers put in an average of 74 hours or work a week when paid and unpaid work are combined, as noted above. As indicated below, 26% of full-time employed married fathers aged 25–44 were also severely time stressed. To illustrate variations in time stress levels according to work status, Table 2-5 below indicates rates of severe time stress for select groups of 25–44 year-old Canadians.[25]

Table 2-5. Time stressed population, aged 25 to 44, by gender and role group, Canada, 1998

	MEN (%)	WOMEN (%)
Employed full-time, lone parent	--	38
Employed full-time, married parent	26	38
Employed part-time, married parent	--	22
Not employed or a student, married parent	--	26
Employed full-time, unmarried non-parent	26	20

Source: Statistics Canada. The Daily. General Social Survey, Time Use. November 9, 1999. Available from http://www.statcan.ca/Daily/English/991109/d991109a.htm. Accessed July 4, 2008.

Notes: "--" means the amount is too small to be expressed. Data in Table 2-5 above are based on the "Perceptions of Time" Module of the GSS, which asks respondents to answer ten questions about their outlook towards use of time. Those who answer yes to seven out of ten questions are determined to be "severely time stressed" or to experience "high levels of time stress."

Analysing the different components of the time stress survey for these 25–44 year-olds further, Statistics Canada found that more than half of Canadian men and women aged 25 to 44 felt that they did not have enough time for family or friends, and fewer than half thought their feelings of stress would change in the future. One in three full-time employed married parents aged 25 to 44 were dissatisfied with the balance between their work and family life. Not having enough time for family, including their spouses and children, was the main reason for their dissatisfaction. About half of them reported that their first priority, given more time, would be to spend it with friends and family.[26]

Working single mothers—who put in an average of 75 hours a week of paid and unpaid work when employed full-time—have a particularly daunting challenge, as they shoulder the entire burden of unpaid household work alone, coming home from their paid jobs to face the full demands of childcare, cooking, cleaning, shopping, and laundry largely by themselves. It is noteworthy that the percentage of lone-parent mothers in the paid work force increased sharply between 1971 and 2004 from 35% to nearly 80%. As well, in 1971, only 4.9% of lone mothers worked 40 hours or more per week, compared to 23.2% in 2004. This probability of long hours is almost the same for the average two-parent family (24%).[27,28]

The 2005 GSS also asked respondents about their level of satisfaction with their work–life balance, and it found that women's satisfaction was more adversely affected than men's by longer work days and the presence of children. Thus, only 52% of mothers (compared to 71% of fathers) in couples that worked long hours felt satisfied with their work–life balance—the lowest rate of any socio-demographic group.[29] Not surprisingly, those dual-earner couples that put in the longest work days combining paid work with unpaid household work and childcare generally felt more time stressed and were less satisfied with their work–life balance than those working shorter hours.

According to Statistics Canada and the Canadian Association of Administrators of Labour Legislation, high levels of time stress, the increasing length of paid work days among both men and women, and a growing recognition of the costs associated with work–life imbalance, have combined to make "work–life balance" one of the top ten issues in collective bargaining.[30]

When 2005 GSS time use data were compared to similar data in other OECD countries, a Statistics Canada study found that Canadian teenagers worked longer hours than teenagers in any other country—an average of 7.1 hours of combined paid and unpaid work averaged over a 7-day week. This 50-hour week was virtually the same as that of adult Canadians aged 20–64 doing the same activities. In 2005, teenagers aged 15–19 living at home with their parents did an average of 9.2 hours of school work, homework, paid work, and housework on school days and 3.5 hours on weekends. [31]

This high workload resulted in stress for many of these teens, with 39% reporting they felt under constant pressure to accomplish more than they could handle, and nearly 64% saying they cut back on sleep to get things done. Only 45% of teenagers with high stress reported being very happy and / or very satisfied with life, compared with 72% of those with little or no stress.[32]

2.5. Value of unpaid household work and childcare

Data sources: Statistics Canada, General Social Survey, 2005; Nova Scotia Department of Finance, Statistical Review, 2007.

Result: Unpaid household work and childcare contributed $10.4 billion to the Nova Scotia economy in 2005.

In 2005, Nova Scotians contributed 977 million hours a year in unpaid household work and childcare, or 1,241 hours per person over the age of 15. This is the equivalent of 509,000 full-time jobs.[33] If this unpaid work had to be replaced for pay in the market economy, at the average rate of $10.87 an hour paid to domestic help in the province and $8.96 an hour for childcare, it would be worth $10.4 billion a year to the provincial economy, or 36% of GDP in 2005.[34, 35]

If unpaid household work were included in financial estimates of production by industry, the three largest sectors of the Nova Scotian economy would be household food services (cooking and washing dishes), house cleaning and laundry, and servicing household production through shopping for goods and services. In fact, the value of unpaid housework dwarfs its market equivalents. For instance, at a replacement cost value of $1.9 billion, unpaid household meal preparation and cleanup in Nova Scotia is worth three times the contribution of the entire accommodation and food services sector in the province's market economy.[36]

As noted in the introduction to this chapter, work performed in households is more essential to basic survival and quality of life than much of the work done in offices, factories and stores, and is a fundamental precondition for a healthy market sector. Yet, this huge unpaid contribution registers nowhere in our standard economic accounts. When we pay for childcare and housecleaning, and when we eat out, this adds to the GDP, but when we cook our own meals, clean our own house, and look after our own children it has no value in our economic accounts or in our conventional GDP-based measures of progress.

Thus, shifts from the household economy to the market economy inaccurately register as growth, even though no additional production may be taking place. Statistics Canada has estimated that such shifts from unpaid to paid work overstate GDP growth by up to 0.8 percentage points a year.[37] Acknowledging the existence of the household economy in the standard economic accounts, and tracking the value of unpaid work as part of actual productive activity, can help to correct this error and assess GDP growth rates more accurately.

Indeed, it is noteworthy that Nobel prize winner Simon Kuznets, principal architect of national income accounting, who helped the US Department of Commerce standardize the measurement of Gross National Product, insisted that the department measure the value of unpaid housework as an important component of production, and include its value in GNP. The department's refusal to do so was instrumental in Kuznets breaking from the department.[38]

3. Leisure Time

For the original GPI Atlantic report on leisure time, please see the following:

The Value of Free Time in Nova Scotia (2008)
http://gpiatlantic.org/pdf/timeuse/freetime.pdf

Headline Indicators

1. Number of hours per day per capita of free time in Nova Scotia and Canada
2. Economic value of free time
3. Composition of free time, by age and other socio-demographic characteristics

3.1. Introduction

Free time is one of the most basic conditions of wellbeing and quality of life. Without it, citizens have no time to relax with family and children, to appreciate nature, to pursue hobbies and interests, to reflect and read, to engage in the physical activity that is so essential to good health, and simply to enjoy life. Even more fundamentally, free time is the only time we have to do what we want, not what we have to do, and it thus constitutes a key condition for freedom. Nearly 2,500 years ago, Aristotle, in the *Politics*, described leisure as a prerequisite for democracy and citizenship, as it allowed time for contemplation and debate of vital state issues.

Social scientists and psychologists have further recognized that leisure also has significant value in buffering life's stressful events and assisting individuals in coping with stress (Iso-Alsola and Park, 1996; Iwasaki and Schneider, 2003). Taking care of basic needs (like washing, sleeping, cooking, eating, shopping, and cleaning), taking care of family and others, working for pay, and education all make demands on time and require attention and effort—frequently not at one's time of choice. Many such tasks are relentlessly repetitive, frequently tax individuals' mental and physical resources, and often generate stress in the struggle to juggle diverse tasks and demands.

A study published by the *American Journal of Health Promotion* found stress to be the costliest of all avoidable health risk factors (Goetzel 2001), and Statistics Canada found long work hours to be correlated with higher rates of smoking, physical inactivity, unhealthy weight gain, and depression (Shields 1999). Conversely, leisure has been found to ameliorate the stresses of work and daily life, and to have positive value and benefit for both physical and mental health (Coleman, 1993; Mannell, 1999). And it is widely accepted that when free time gets squeezed out, the quality of life suffers.

Because of its widely acknowledged contribution to wellbeing, free time is explicitly valued in the Genuine Progress Index (GPI) as a key condition of wellbeing, and therefore constitutes one of the 20 core components of the GPI. In the accounting language of the GPI, leisure time is regarded as a human capital stock that can potentially be valued in both its quantity and quality, and that is also subject to depreciation if it is squeezed out by excessive work and other required tasks. While conventional analyses describe human capital only in terms of skills that enhance workplace productivity, the GPI considers the full 24-hour use of time—including paid work, unpaid household work, voluntary work, personal tasks, study, and free time, and the balance between these activities—as a contribution to human wellbeing.

And yet free time counts for nothing in the Gross Domestic Product (GDP), which measures economic growth and which is conventionally used to assess progress and how “well off” society is. Indeed, because the GDP only counts market transactions undertaken for pay, longer work hours (and by implication less free time and more stress) make the economy grow and are therefore interpreted as a contribution to progress and wellbeing. But while Statistics Canada produces the GDP statistics monthly, it provides insight into leisure time and other uses of time only once every six or seven years in its General Social Survey (GSS) Time Use studies—conducted to date in 1992, 1998, and 2005.

In sharp contrast to economic theories that see growth as limitless, a person’s time—like the world’s natural capital—is limited, and the quality of life both in this and future generations depends on *how* that limited time is spent and how skilfully those finite natural resources are used. Each person has a finite life span and only 24 hours in a day to allocate to activities both required and chosen. At the simplest level, analysts have categorized all activities that command that limited time into four types: necessary, committed, contracted, and free time (leisure):

1. Necessary time includes activities needed for personal maintenance such as eating, sleep, and other personal care.
2. Committed time (or unpaid production) is motivated by moral obligation, and includes activities done for maintenance of the household and family, caring activities, and the provision of volunteer services.
3. Contracted time (paid production) is motivated by an explicit or implicit contractual obligation, and includes time allocated to paid work and related activity in the marketplace, plus time devoted to acquiring education.
4. Free time ostensibly encompasses socializing, sports, engagement with media (reading, TV, movies, computer games, etc.), and other active and passive leisure activities.

An activity is classified into one of these four activity types based both on the context in which it occurs and on assumptions about its motivation. From an economic perspective, contracted and committed time refer respectively to paid and unpaid production, as noted above, while the necessary time required for personal survival and maintenance is the condition on which all productive activity depends. From that perspective, free time has been defined very broadly as simply encompassing all those activities not assignable to the other three categories.

However, free time activities have also been more explicitly defined as typically providing the individual with direct personal benefit in the doing; and as activities that one cannot normally do for someone else nor have someone else do for oneself. In the literature on the subject, the factors that have been shown to best differentiate leisure from non-leisure activities are enjoyment, pleasure, freedom of choice, relaxation, intrinsic motivation, lack of evaluation, and the absence of obligations and pressures.

Unfortunately, information on such subjective criteria is not typically available in the time diary data produced by Statistics Canada's General Social Surveys and other time use survey data. In the absence of appropriate subjective data, free time is defined by and limited to activities carried on outside normal personal, family, community, and paid work activities and serves as a surrogate for "leisure." For that reason, "free time" and "leisure" are here used interchangeably, although both leisure and free time should more properly be characterized by the subjective factors listed above.

3.2. Trends in free time

Data sources: Statistics Canada, 1992, 1998, and 2005 General Social Surveys.

Result: Free time in Nova Scotia has declined by an average of half an hour a day or 186 hours a year since 1998 as Nova Scotians work longer hours. The biggest losers of free time were single working mothers, who saw their free time shrink by 2.7 hours a day or nearly 19 hours a week.

Nova Scotians spend an average of five hours and 40 minutes a day on free time (leisure) activities—about half an hour less than in the 1990s. Since 1998, Nova Scotians have increased their paid work time by nearly four hours a week, or 204 hours a year, and cut their free time by 186 hours a year. In other words, Nova Scotians are putting in the equivalent of more than a month's extra paid work time a year at the expense of their free time—mostly because women are working much longer hours for pay. In 1992, Nova Scotians had nearly half an hour more daily leisure time than did other Canadians, but by 2005 this gap had narrowed to just 12 minutes a day.[1]

In contrast to the rest of Canada, where men have about 27 minutes more daily leisure time than women, leisure time is virtually identical for men and women in Nova Scotia. This reflects major changes in the gender division of labour in Nova Scotia—both in the paid work force and in the household. Thus, the most marked difference in overall time use during this period was that women worked an average of an hour a day more for pay in 2005 than in 1992, while men's market work decreased slightly. At the same time, women did an average of 46 minutes less household work and childcare a day in 2005 than in 1992, while men did 26 minutes more.

Free time allocation is closely tied to a number of demographic and social factors. It is highest for individuals over 65 years, and lowest for persons aged 25 to 44, during which time paid work and family obligations tend to crowd out leisure. Retirees in Nova Scotia have more than eight hours a day of free time, while parents with infants and toddlers under 5 years of age have only 3.4 hours a day of free time. In Nova Scotia, by far the sharpest loss in free time between 1992 and 2005 was for single mothers, who saw their free time shrink by 2.7 hours a day or nearly 19 hours a week.

The decline in free time for single mothers is linked to cuts in social service payments in the 1990s following deep cuts in federal transfers to the provinces, which pushed many single mothers into the work force in an effort to make ends meet. Many single mothers have replaced income poverty with "time poverty," which may be defined as less than the minimum necessary to accomplish basic household tasks. Harvey and Mukhopadhyay (2007) have estimated that more than half of all Canadian single parents, overwhelmingly women, suffer "time poverty," and that 88% of employed single parents with one child, and 98% of those with two children, are time-poor.[2]

Table 3-1 below illustrates the decline in free time, both in Nova Scotia and in the rest of Canada. While these trends are certainly affected by the business cycle and the decline in unemployment in the last decade, there appears to be a concomitant nationwide trend to work more and to settle for less leisure.

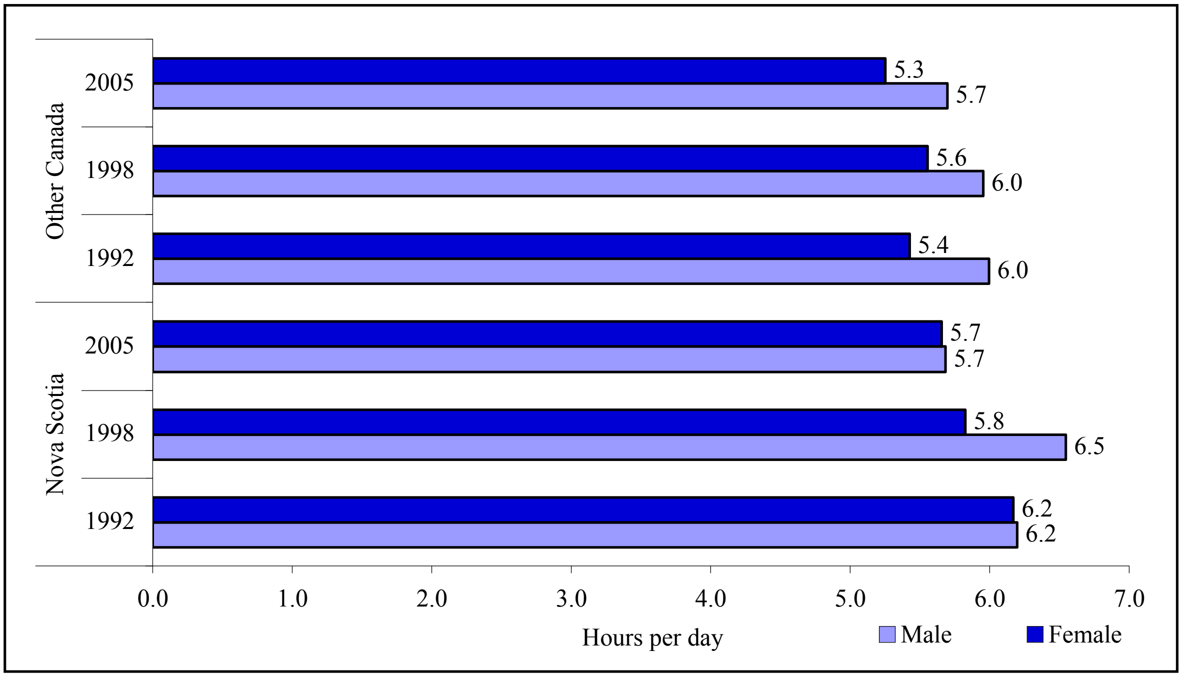
Thus, in 1992 and 1998, Nova Scotians spent an average of 6.18 hours per day on free time (leisure) activities. By 2005, average free time had declined to 5.67 hours per day—a decrease of about half an hour a day for both men and women. In the rest of Canada (Canada less Nova Scotia), free time averaged 5.7 hours a day in 1992, declining to 5.47 hours in 2005, narrowing the difference between Nova Scotia and the rest of Canada from 0.48 hour to 0.2 hour (Table 3-1 and Figure 3-1 below).

Table 3-1. Time allocation, hours per day averaged over seven-day week, by major types and sex, Nova Scotia and other Canada, 1992, 1998, and 2005

	MALE			FEMALE			TOTAL		
	1992	**1998**	**2005**	**1992**	**1998**	**2005**	**1992**	**1998**	**2005**
NOVA SCOTIA									
Necessary	9.88	10.25	10.11	10.50	10.48	10.66	10.20	10.37	10.39
Committed	2.90	2.96	3.34	4.76	4.63	4.13	3.86	3.82	3.75
Contracted	5.01	4.23	4.88	2.57	3.07	3.57	3.76	3.64	4.20
Free time	6.20	6.55	5.68	6.17	5.83	5.66	6.18	6.18	5.67
OTHER CANADA									
Necessary	10.31	10.25	10.47	10.78	10.65	10.81	10.55	10.45	10.64
Committed	2.61	2.73	2.63	4.52	4.41	4.21	3.59	3.59	3.43
Contracted	5.08	5.07	5.21	3.27	3.39	3.74	4.16	4.22	4.46
Free time	6.00	5.96	5.70	5.43	5.56	5.25	5.70	5.75	5.47

Source: Derived from Statistics Canada GSS Time Use Studies Cycles 7, 12, and 19. (0.10 = 6 minutes)

Figure 3-1. Free time, hours per day, Nova Scotia and other Canada, 1992, 1998, and 2005



Source: Derived from Statistics Canada GSS Time Use Studies Cycles 7, 12, and 19.

3.3. Value of free time

Data sources: Statistics Canada, 1992, 1998, 2005 General Social Surveys; Statistics Canada, Households' Unpaid Work: Measurement and Valuation.

Result: Nova Scotians are losing $1.25 billion worth of free time each year compared to what they had ten years ago.

As described by Redefining Progress, which produced the first Genuine Progress Indicator in California in 1995:

> As a nation becomes wealthier, people should have more latitude to choose between work and free time for family or other activities. In recent years, however, the opposite has occurred. The GDP ignores this loss of free time, but the GPI treats leisure as most Americans do—as something of value. When leisure time increases, the GPI goes up; when Americans have less of it, the GPI goes down.[3]

Redefining Progress' most recent 2006 GPI update remarked:

> The GDP creates the illusion that the nation is getting richer, when in fact people are working harder to produce and buy more and to pay interest on mounting personal indebtedness . . . . A more accurate measure of genuine progress and wellbeing would consider the loss of leisure that went along with increased output. Accounting for the nation's wellbeing ought to include the value of leisure time lost or gained.[4]

Since the evidence examined indicates that the loss in free time in Nova Scotia is directly related to increases in women's paid market work, Redefining Progress' description of a trade-off between paid work and leisure time seems also to apply to Nova Scotia. In accord with the Redefining Progress logic, we focus here on the *value* of free time and on the *cost* of its loss.

Redefining Progress estimates the value of lost leisure time in relation to a baseline year in which leisure hours were high—1969 in the case of the United States, on the assumption that this level of leisure time reflects what is possible. On the theory, outlined above, that there is a real choice and trade-off between paid work and leisure, Redefining Progress also puts an economic value on leisure time equivalent to the average real wage rate for the 1950–2004 period—$13.36 in year 2000 constant dollars. It then multiplies that dollar figure by the gap between the 1969 and 2004 leisure hours in the US to conclude that lost leisure time cost Americans the equivalent of $401.02 billion in value.

GPI Atlantic has modified the Redefining Progress methodology in a number of ways to estimate the value of free time and the cost of its loss for Nova Scotians:

1. Based on evidence primarily from Europe, we value leisure time at half the rate of the average hourly wage rather than at the full wage rate. Experiments and studies have found that workers are more willing to swap work hours for free time if their pay cut amounts to half their gain in leisure time than if each additional hour of free time cost an hour of pay. For example, in a 1985 Belgian government initiative, a considerable portion of Belgian civil servants traded a 20% reduction in work hours for a 10% cut in pay.[5] Similarly, GPI Atlantic's own random sample survey of 1900 residents of Kings County, Nova Scotia, found that 26% of Kings County workers were willing to take a 5% reduction in pay in exchange for a 10% decrease in working hours, with male and female rates almost identical.[6]

2. We use the most recently available average hourly wage rate in Nova Scotia—$17.54 in July, 2008[7]—as the basis for our economic valuation calculation, and divide that by half, to give a value of $8.77 for each hour of leisure time lost or gained.

3. We calculate the value of lost leisure time in relation first to 1992 and 1998 levels, when Nova Scotians had 6.18 hours of free time per day, compared to 5.67 hours in 2005 (averaged over a 7-day week). This means that the average Nova Scotian 15 and older had 186.15 hours less free time in 2005 than in either 1992 or 1998. At $8.77 an hour, it can be estimated that the average Nova Scotian lost the equivalent in value of $1,632.53 a year in

free time. As there were 764,200 Nova Scotians aged 15 and older in 2007[8], it can be estimated that Nova Scotia as a whole had lost the equivalent of $1.25 billion a year worth of free time in 2005 compared to its value in 1992 or 1998.

4. While it makes less conceptual sense to place a wage-based economic value on every hour of free time (since there is no logical trade-off between total free time and paid work), we can do so here just to make the point that every hour of time does in fact have value, even if it cannot be easily traded for a market equivalent. Thus, Nova Scotians had an average of 5.67 hours of free time per day or 2,069.55 hours a year. At half the average hourly wage, this would be worth $18,150 a year.

5. Since Nova Scotians have 12 minutes more free time daily than other Canadians, this means they have 73 hours more free time per year than they would have if they had the same amount of free time as other Canadians. At a value of $8.77 an hour, this means that the average Nova Scotian currently has $640.20 worth of free time annually more than if he or she had the same amount of free time as other Canadians. Another way of putting this, based on a population 15 and older of 764,200, is that Nova Scotians currently have $489 million worth of free time annually more than if they worked the same hours and had the same amount of free time as other Canadians. Recognizing this free time as a valuable asset is helpful in instituting policies designed to enhance work–life balance and to prevent a further erosion of free time in Nova Scotia to Canadian levels.

6. Another form of comparison and estimation is to assess the value and gain / loss of free time not only temporally as in #3 above, but in relation to best practices elsewhere, since such examples and models illustrate that better work–life balance is practical and possible. In other words, these best practices might be taken as representing a kind of “gold standard” that shows the potential to reduce time stress and, correspondingly, to improve health, wellbeing, and quality of life. It is assumed here that an expansion of free time expands options to engage in activities that are chosen rather than mandated and thus to enhance individual potential and development. If we were to confine our analysis of the value of free time to Nova Scotian and Canadian trends over time, we would likely restrict an examination of policy options to a much narrower range than if we also valued free time in relation to other industrial societies with comparable living standards. The remainder of this concluding section is therefore devoted to this kind of comparative analysis.

   Among 15 European countries for which comparable data are available, Norway has the most daily free time (5 hours and 46 minutes a day compared to 5 hours and 13 minutes in Nova Scotia) and might therefore be taken as a model or “best practice” for comparative valuation purposes. Thus, if Nova Scotians had as much free time as Norwegians, they would each have more than 200 additional hours of free time each year, which, at half the Nova Scotia hourly wage, would be worth about $1,760 a year. Applying this estimate to the 764,200 Nova Scotians 15 and older, this means that Nova Scotia could have a total stock of free time worth $1.35 billion more than at present if Nova Scotians had as much free time as Norwegians do.

The valuations provided here are intended simply to highlight the utility of such economic valuations in drawing attention to the value of an asset that is generally unvalued and that is invisible in the conventional GDP-based measures of progress. So long as free time is not properly valued, insufficient policy attention will be directed to important models and initiatives that have the potential to improve work–life balance.

3.4. Composition of free time

Data sources: Statistics Canada, 1992, 1998, 2005 General Social Surveys.

Result: Watching television comprises 40% of free time use in Nova Scotia. Nova Scotians spend 31% less time reading for pleasure than in 1992 and 35% less time socializing outside their homes.

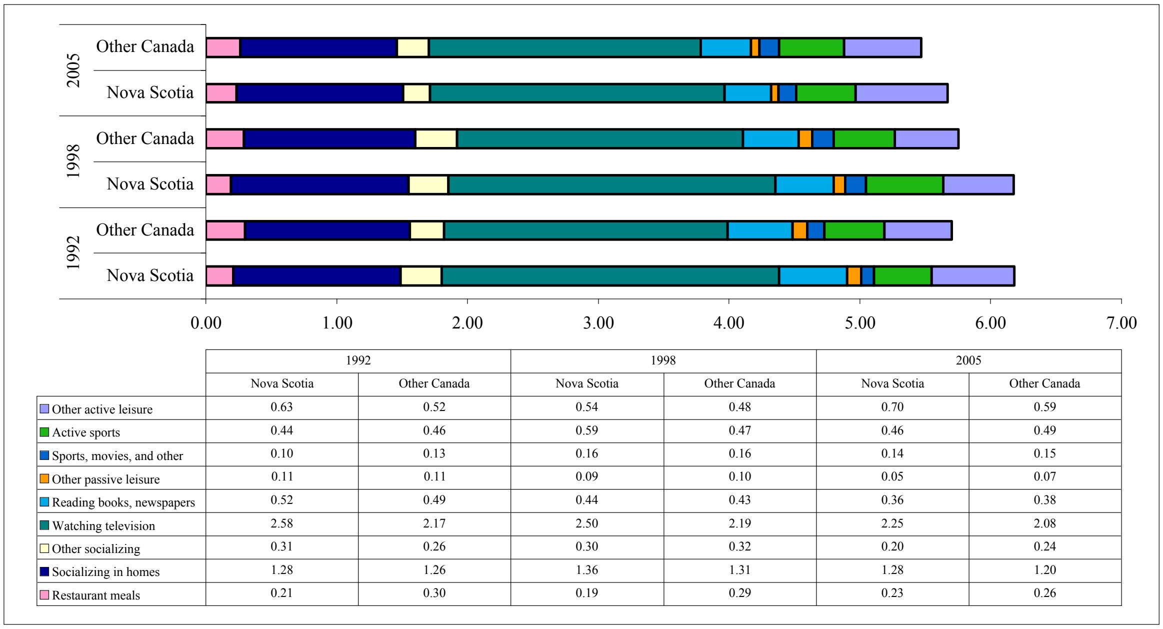
Fully 40% of Nova Scotians' free time is spent watching television. Another 26% is spent socializing. And 20% is spent on sports and other active leisure pursuits. But the average Nova Scotian spends only 22 minutes a day reading—down from 26 minutes a day in 1998, and 31 minutes a day in 1992. And Nova Scotians are spending considerably less time socializing outside their homes than they used to—down from an average of 19 minutes a day in 1992 to just 12 minutes a day in 2005—a decline of more than a third.

Television viewing and socializing in homes dominated the use of free time both in Nova Scotia and in the rest of Canada in 1992, 1998, and 2005 (Figure 3-2 and Table 3-2 below). Nova Scotians spent an average of two and a quarter hours each day watching television in 2005—down from about two and a half hours in the 1990s, and another hour and a quarter socializing in their homes—about the same as in the 1990s. They spent an average of 28 minutes a day engaged in active sports—about the same as in 1992, but down from 35 minutes a day in 1998 (Table 3-2 and Figure 3-2 below).

There were major declines in time spent reading (down by more than 30% from an average of 31 minutes to just 21 minutes a day) and in time spent socializing outside the home (down by more than a third from an average of 19 minutes a day in 1992 to just 12 minutes a day in 2005). All these results are averaged over a seven-day week, so that if a person socialized once a week for an hour and a half, this would be reported here as 13 minutes a day.

Interestingly, Nova Scotian women saw a much more substantial decline between 1992 and 2005 in passive leisure activities (like reading and watching TV) that tend to take place at home than did men. They also saw a substantial increase in time spent on active sports and activities like going to movies, which tend to happen outside the home, while men saw a decline in both of these categories (Table 3-2 below). In sum, it appears that women traded passive leisure activities for more active activities during this period—a pattern that would be consistent with the increase in contracted time (paid work) by women and hence their greater amount of time out of the house.

Figure 3-2. Composition of free time, hours per day, Nova Scotia and other Canada, 1992, 1998, and 2005



Source: Derived from Statistics Canada GSS Time Use Studies Cycles 7, 12 and 19.

Table 3-2. Free time activities, hours per day, Nova Scotia and other Canada, 1992, 1998, and 2005

TYPE OF ACTIVITY	NOVA SCOTIA			OTHER CANADA		
	1992	1998	2005	1992	1998	2005
	(Hours per day)					
Restaurant meals	0.21	0.19	0.23	0.30	0.29	0.26
Socializing in homes	1.28	1.36	1.28	1.26	1.31	1.20
Other socializing	0.31	0.30	0.20	0.26	0.32	0.24
Watching television	2.58	2.50	2.25	2.17	2.19	2.08
Reading books or newspapers	0.52	0.44	0.36	0.49	0.43	0.38
Other passive leisure	0.11	0.09	0.05	0.11	0.10	0.07
Sports, movies, and other	0.10	0.16	0.14	0.13	0.16	0.15
Active sports	0.44	0.59	0.46	0.46	0.47	0.49
Other active leisure	0.63	0.54	0.70	0.52	0.48	0.59
Total	**6.18**	**6.18**	**5.67**	**5.70**	**5.75**	**5.47**

Source: Derived from Statistics Canada GSS Time Use Studies Cycles 7, 12 and 19. (0.10 = 6 minutes)

Patterns of leisure use by gender were similar in the rest of Canada, though other Canadian males spent more time in restaurants, socializing, and engaged in active sports than Nova Scotian males, while Nova Scotian men spent more time watching television. Nova Scotian women spent more time than other Canadian women socializing in their homes and engaged in "other active leisure" (Table 3-3 below).

Table 3-3. Free time activities, hours per day, by sex, Nova Scotia and other Canada, 1992, 1998, and 2005

TYPE OF ACTIVITY	MALE			FEMALE		
	1992	1998	2005	1992	1998	2005
	(Hours per Day)					
NOVA SCOTIA						
Restaurant meals	0.22	0.21	0.21	0.20	0.18	0.25
Socializing in homes	1.10	1.24	1.04	1.44	1.47	1.50
Other socializing	0.46	0.31	0.23	0.18	0.29	0.18
Watching television	2.65	2.71	2.52	2.51	2.29	2.00
Reading books or newspapers	0.44	0.42	0.31	0.59	0.46	0.40
Other passive leisure	0.11	0.11	0.07	0.10	0.07	0.04
Sports, movies, and other	0.13	0.18	0.11	0.07	0.14	0.16
Active sports	0.58	0.81	0.49	0.31	0.38	0.42
Other active leisure	0.49	0.54	0.69	0.76	0.54	0.72
Total	**6.20**	**6.55**	**5.68**	**6.17**	**5.83**	**5.66**
OTHER CANADA						
Restaurant meals	0.32	0.31	0.28	0.29	0.27	0.25
Socializing in homes	1.14	1.21	1.13	1.37	1.40	1.27
Other socializing	0.32	0.33	0.25	0.20	0.31	0.23
Watching television	2.42	2.36	2.22	1.93	2.02	1.94
Reading books or newspapers	0.48	0.39	0.33	0.51	0.46	0.44
Other passive leisure	0.14	0.11	0.07	0.09	0.10	0.06
Sports, movies, and other	0.13	0.16	0.15	0.14	0.16	0.15
Active sports	0.58	0.57	0.59	0.34	0.37	0.40
Other active leisure	0.47	0.50	0.67	0.56	0.46	0.52
Total	**6.00**	**5.96**	**5.70**	**5.43**	**5.56**	**5.25**

Source: Derived from Statistics Canada GSS Time Use Studies Cycles 7, 12, and 19.

3.4.1. Free time use by age and other socio-demographic characteristics

A number of factors influence how people spend their time—including gender, age, stage in the life cycle, marital status, age of children, work status, living arrangement in the household, and education. The type of day (e.g., weekday or weekend) clearly also influences patterns of free time use.

Demographic changes therefore greatly affect time use in general and free time use in particular. For example, between 1992 and 2005, the proportion of Nova Scotians whose main activity was working in a job increased sharply from 45.5% to 51%, while there was a 12-percentage point decline (from 35.6% to 23.7%) in the proportion of Nova Scotians whose main activity was household and childcare responsibilities—both trends reflecting the sharp increase in women's labour force participation.

Not surprisingly, Nova Scotians 65 and older have considerably more free time (7.6 hours a day) than other age groups, while those 25–44 years old (the prime child-rearing years) have the least (4.2 hours a day). In the latter age group, it is noteworthy that free time dropped considerably from 5.45 hours a day in 1992 to just 4.21 hours a day in 2005 (Table 3-4 below), reflecting the sharp increase in the proportion of Nova Scotians with jobs noted above. This means that 25–44 year-old Nova Scotians have an average of 80 minutes less free time per day (amounting to nearly nine and a half hours less per week) than they did in the early 1990s.

While time and resources did not permit a correlation of time use patterns by demographic group with levels of time stress, it is likely that this sharp decline in free time for 25–44 year-old Nova Scotians may be reflected in higher stress levels and adverse impacts on quality of life for this age group. Given the dramatic increase in levels of high time stress among Nova Scotian women (from 17.4% to 22.7% between 1998 and 2005), as reported in the chapter on unpaid household work, it is reasonable to surmise that the sharp increase in employment by women with children—and particularly among single mothers whose social assistance benefits were reduced in the mid-1990s)—may account at least in part for both the decline in free time among 25–44 year-old Nova Scotians and for increases in levels of time stress among Nova Scotian women.

What is most noteworthy in the demographic breakdowns in Table 3-4 below is that free time declined between 1992 and 2005 for every single demographic group without exception in the rest of Canada. In Nova Scotia, the only group to experience an increase in free time during this period was retired individuals, who saw their free time increase from 7.7 hours per day in 1992 to 8.3 hours in 2005 (Table 3-4).

Table 3-4. Time allocation to free time activities, hours per day, by background characteristics, Nova Scotia and other Canada, 1992, 1998, and 2005

CHARACTERISTIC		NOVA SCOTIA			OTHER CANADA		
		1992	1998	2005	1992	1998	2005
		(Hours per Day)					
Sex	**Male**	6.2	6.55	5.68	6	5.96	5.70
	Female	6.17*	5.83	5.66	5.43	5.56	5.25
Age group	**15–24 years**	6.76	6.97	6.22	6.06	6.37	5.97
	25–44 years	5.45*	5.17	4.21	4.77	4.78	4.51
	45–64 years	6.06	6.03	5.95*	5.91	5.67	5.28
	65 + years	7.74	8.17	7.59	7.75	7.92	7.64
Marital status	**Married**	5.66	5.55	5.33	5.31	5.27	5.05
	Other	7.04*	7.12	6.21	6.4	6.52	6.15
Age of youngest child	**Under 5 years**	4.34	4.75	3.39	4.36	4.07	3.74
	5 to 14 years	5.23	4.32	4.24	4.49	4.48	4.05
	15 to 25 years	6.47	6.34	5.3	5.34	5.29	4.96
	No child / other	6.8	6.81	6.33	6.37	6.5	6.16
Work status	**Working at job**	4.95	4.85	4.53	4.74	4.79	4.47
	Student	5.64	6.01	5.08	5.64	6.24	5.5
	Retired	7.7	8.35	8.28	8.06	8.21	7.95
	Other	7.47	6.91	6.7	6.66	6.48	6.32
Household	**Alone**	7.12	7.84	6.92	6.85	6.94	6.67
	Couple only	6.36	6.27	6.11	6.12	6.23	5.97
	Couple with Child <25	5.12	4.74	4.23	4.58	4.44	4.11
	With Parents	7.31	7.01	6.3	6.4	6.71	6.2
	Single Parent with Child <25	6.53	5.18	3.84	5.23	4.66	4.23
	Other	6.65	6.95	6.49	6.28	6.29	5.97
Education	**Less than HS Diploma**	6.52	6.88	6.23	6.51	6.56	6.44
	HS Diploma / Other Certification	6.12	6.15	6.12*	5.51	5.67	5.44
	College degree +	5.87	5.58	5.15	5.23	5.27	5.06
Type of day	**Weekday**	5.49*	5.61*	5.15	5.02	5.13	4.88
	Saturday	7.98	7.9	6.99	7.15	7.31	7.07
	Sunday	7.86	7.27	6.94	7.66	7.32	6.86

Source: Derived from Statistics Canada GSS Time Use Studies Cycles 7, 12, and 19. *Significantly different (0.05 level) from the rest of Canada for corresponding years.

Different demographic groups have different needs and preferences for how they spend their free time. For example, retired Nova Scotians spend nearly three times as much time watching television as students—an average of three hours and 18 minutes a day (or 23 hours a week) watching television, compared to an hour and 12 minutes a day (or 8.4 hours a week) for students.

Young Nova Scotians are generally watching less television than in the 1990s. Thus, Nova Scotian youth aged 15–24 watched nine hours and 20 minutes less television a week in 2005 than in 1992 (11 hours a week vs. 20.4 hours a week). But they are spending six hours a week more socializing in their homes than they used to (15 hours in 2005 vs. 9 hours in 1992). By contrast, Nova Scotian couples with children have only five hours a week to socialize at home—two and a half hours less than in 1992.

Not surprisingly the same pattern holds for socializing outside the home—at parties, gatherings, and other social events. Thus, Nova Scotian youth aged 15–24 spend an average of more than three and a quarter hours a week socializing outside their homes, compared to less than an hour a week for couples with children. On average Nova Scotians aged 25–44 spend only 42 minutes a week socializing outside their homes, while parents of very young children under 5 spend just over half an hour a week socializing outside their homes—more than 80% less time than they spent in 1992.

Youth aged 15–24 also spend ten times as much time going to movies, sports events, and related activities (an average of nearly an hour and a half a week) as parents of very young children under 5 (an average of only eight minutes a week).

And a similar pattern holds for eating out in restaurants—with youth aged 15–24 spending an average of two and a quarter hours a week on restaurant meals, compared to less than half an hour a week for parents of very young children. Interestingly, retired Nova Scotians have sharply increased the time they spend eating out—from half an hour a week in 1992 to nearly an hour and a half in 1998 to just under two hours a week in 2005. Students also more than doubled the time they spend eating out—from less than an hour a week in 1992 to nearly two hours a week in 2005.

Young Nova Scotians, aged 15–24, also spend twice as much time engaged in active sports (nearly four hours a week) as parents with very young children under five (less than two hours a week). Disturbingly, however, Nova Scotian youth are doing about two and a half hours less sports activities each week than they did in 1992—a sharp decline of nearly 40%.

Nova Scotian seniors 65 and older spend 14 times as much time reading for pleasure as youth aged 15–24—nearly an hour a day versus just four minutes a day. In fact, Nova Scotian youth spend 70% less time reading now than they did in 1992. Alarmingly, students spend an average of only six minutes a day or a total of just 43 minutes a week reading for pleasure—a decline of nearly 80% from 28 minutes a day or three hours and 17 minutes a week in 1992. Overall in Nova Scotia, it is noteworthy that the general decline in reading occurred primarily on weekdays and Saturdays rather than Sundays, indicating that increases in paid work likely contributed to squeezing out reading time.

3.4.2. Changing patterns in free time use: 1992 to 2005

During the 1992–2005 period, leisure activities underwent significant changes in Nova Scotia and in the rest of Canada, both in terms of the mix of activities in which individuals engaged and in the demographics of participants. Priorities and preferences changed for different groups in response to demographic and technological shifts, changes in the labour market, and cultural factors.

During this period, for example, the population aged; home computers and Internet access became the norm; women strengthened their labour market position, worked longer hours, and overtook men in many spheres of educational attainment; single mothers entered the labour force in unprecedented numbers as social security payments were reduced in response to cuts in federal transfer payments to the provinces; and unemployment rates dropped drastically as Canada shifted from recession in the early 1990s to a sustained boom period.

All these and other factors had a marked impact on leisure activities and on the use and allocation of free time between 1992 and 2005. This chapter on Nova Scotians' use of free time, however, is primarily descriptive—and confines itself simply to summarizing a few key trends demonstrating how much time was spent by which groups on which activities, and how those patterns changed over time.

This is a necessary first step, but this initial exploration does not yet attempt any explanatory analysis, with the exception of a few occasional passing remarks that may constitute hypotheses for future investigation. We have not here attempted any systematic correlation between changes in free time patterns on the one hand and the kind of economic, social, and cultural changes outlined above. However, it is hoped that this initial discussion will trigger precisely that kind of future research which—since it goes far beyond market economic analysis—has hitherto been sadly neglected and yet goes to the heart of the kind of linkages and connections that the GPI is intended to elucidate.

In this initial descriptive analysis, we conclude here by simply noting a few key trends that are worthy of further exploration and investigation. We have already noted that total leisure time declined by more than half an hour a day or 3.6 hours a week in Nova Scotia between 1992 and 2005, and by 14 minutes a day or more than 1.5 hours a week in the rest of Canada. The reasons for this decline bear careful examination in future studies. As well, some key trends within that overall change are worthy of further exploration, since some components of free time increased while others decreased in time allocation during this period.

For example, while there has been a 13% decline in television viewing in Nova Scotia—from 2.58 hours a day in 1992 to 2.25 hours a day in 2005 (Table 3-3 above), this activity remains by far the largest single component of leisure time use—constituting fully 41.7% of all leisure time in 1992, 40.5% in 1998, and 39.7% in 2005. But young Nova Scotians aged 15–24, for example, saw a much larger 46% decline in television viewing—from nearly three hours a day in 1992 to just over an hour and a half in 2005. The reasons for this and other demographic shifts in particular leisure activities bear further investigation.

Time spent on active sports may have positive health impacts. But there has been no significant increase in this area—which also requires explanation. Thus, Nova Scotians spent 0.46 hour/day on active sports in 2005—up slightly from 0.44 hour/day in 1992, but down by 22% from 0.59 hour/day in 1998. In other words, Nova Scotians, on average, engage in active sports only a miniscule 1.2 minutes a day more than they did in 1992 (equivalent to an increase of just 8.4 minutes a week). And they participate in active sports 7.8 minutes a day *less* than they did in 1998, equivalent to a drop of nearly an hour a week. The overall gain is similarly tiny in the rest of Canada, where engagement in active sports was only 1.8 minutes a day longer in 2005 than it was in 1992 (Table 3-4 above).

When changes in total free time over time are considered by demographic category, further observations and questions arise. For example, it is seen that—among all demographic groups—only retired Nova Scotians had more total free time (leisure) in 2005 than they had in 1992—up by a modest 7.6%. In the rest of Canada, not a single group had more free time in 2005 than in 1992 (Table 3-5 below). In other words, for all subpopulations represented in Table 3-5 below, with the exception of retired Nova Scotians, free time in 2005 stood below 1992 levels.

Most notably, Nova Scotian single parents saw their free time drop by more than 40% between 1992 and 2005—from 6.53 hours per day in 1992 to just 3.8 hours a day in 2005. This is likely related to the dramatic increase in labour force participation by Nova Scotian single mothers in response to major reductions in social service payments in the mid-1990s following the massive cuts in federal transfers to the provinces that began in 1993. The time use evidence examined here indicates that the improved employment prospects and consequent decline in income poverty among Nova Scotian single mothers may have been replaced by sharp increases in "time poverty"—an issue examined in greater depth in GPI Atlantic's household work and women's health reports.[9] Single parents in the rest of Canada suffered a more modest loss, and in 2005 had about 91% of the free time they had in 1992 (Table 3-5 below).

Two other large losers of free time in Nova Scotia in the 1992–2005 period were individuals aged 25 to 44, whose daily free time fell from 5.5 hours in 1992 to 4.2 hours in 2005, and parents whose youngest child was under five years of age, whose daily free time fell from 4.3 hours in 1992 to just 3.4 hours in 2005. Clearly, there is considerable overlap between these groups, which—to some extent—represent the same people. For example, a working single mother aged 25–44 with an infant or toddler would be represented in each of these three categories.

As seen in Table 3-4 above, Nova Scotian single parents and parents of children under five have less free time (3.8 hours/day and 3.4 hours/day respectively) than any other demographic group in the province. It must also be noted that these recorded losses are not insignificant, with single parents losing nearly 19 hours a week of free time, middle aged Nova Scotians aged 25–44 losing nine hours of free time each week, and parents of infants and toddlers losing about six and a half hours a week. Parents of very young children in Nova Scotia now have less than 24 hours a week of free time for all leisure activities combined, including television, socializing, reading, going to a movie, eating out, sports, and more.

While Table 3-3 above and Table 3-5 below indicate that free time levels in Nova Scotia fell by an average of 8.3% between 1992 and 2005 across the various demographic groups, they fell more for some groups than for others. We have already noted that the free time losses for Nova Scotian single parents, those aged 25–44, and parents of very young children were extreme. However, in general it can also be seen that parents with children living at home lost more free time than those without children, middle-aged and younger Nova Scotians lost more free time than older Nova Scotians, and the highly educated lost more free time than those with less education. It is also noteworthy that considerably more free time was lost on weekends than on weekdays—indicating that weekends are no longer the preserve of free time that they once were when the Sabbath was observed.

When absolute hours of free time are considered, as in Figures 3-3 to 3-6 below, what stands out is the substantial amount of free time still available to seniors 65 years and older, those with no children at home, and retired persons. The absolute hours also indicate that there were some very significant changes over time for some demographic groups while there was virtually no change for others. Four demographic groups in Nova Scotia experienced an hour or more decline in daily free time between 1992 and 2005—a drop of 1.24 hours/day for those aged 25 to 44 (Figure 3-3), of 1.17 hours for those with children aged 15 to 25 (Figure 3-4), of just over an hour for Nova Scotians living with their parents (Figure 3-6), and—most drastically—of 2.69 hours daily for single parents (Figure 3-6). By any standard, these are significant declines in free time.

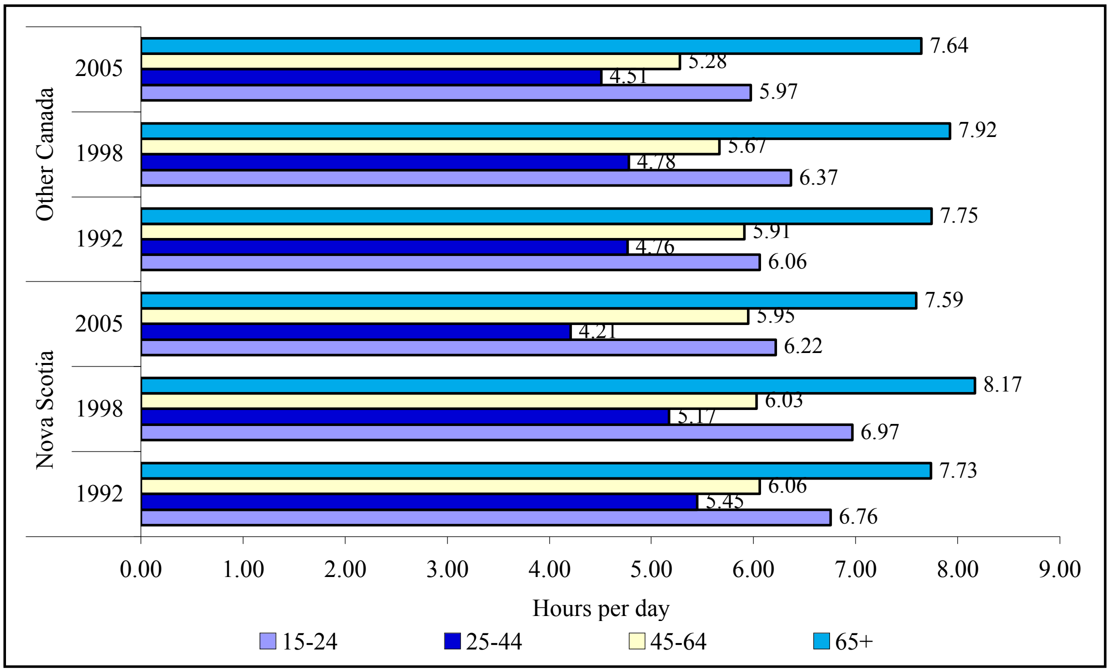
As noted, there is considerable overlap among some groups—for example, between individuals aged 25 to 44 and those with children, and between retirees and those aged 65 and older. As also noted, only one group of Nova Scotians—retirees—increased their free time between 1992 and 2005—by 35 minutes a day or four hours/week, from 54 hours a week to 58 hours a week (8 hours and 17 minutes a day) (Figure 3-5).

If free time does indeed have *value*—a basic premise in the Genuine Progress Index—then these measured losses in free time should be counted as real losses in value, and as declines in one key dimension of human capital. While such values and losses are currently invisible and uncounted in conventional accounting systems and GDP-based measures of progress, a substantial loss in free time not only reflects a direct loss in quality of life but also constitutes a cause of time stress and an indirect threat to health, economic productivity, and human wellbeing. This is especially true when absolute levels of free time sink as low as they now are for single parents and parents of very young children—where they are actually characterized as reflecting "time poverty." Conversely, the increased free time available to retired Nova Scotians may be regarded as an appreciation of a valuable human capital asset, providing the opportunity for greater freedom, options, and choice of leisure activities.

Table 3-5. Free time in 2005 as percent of free time in 1992, Nova Scotia and other Canada

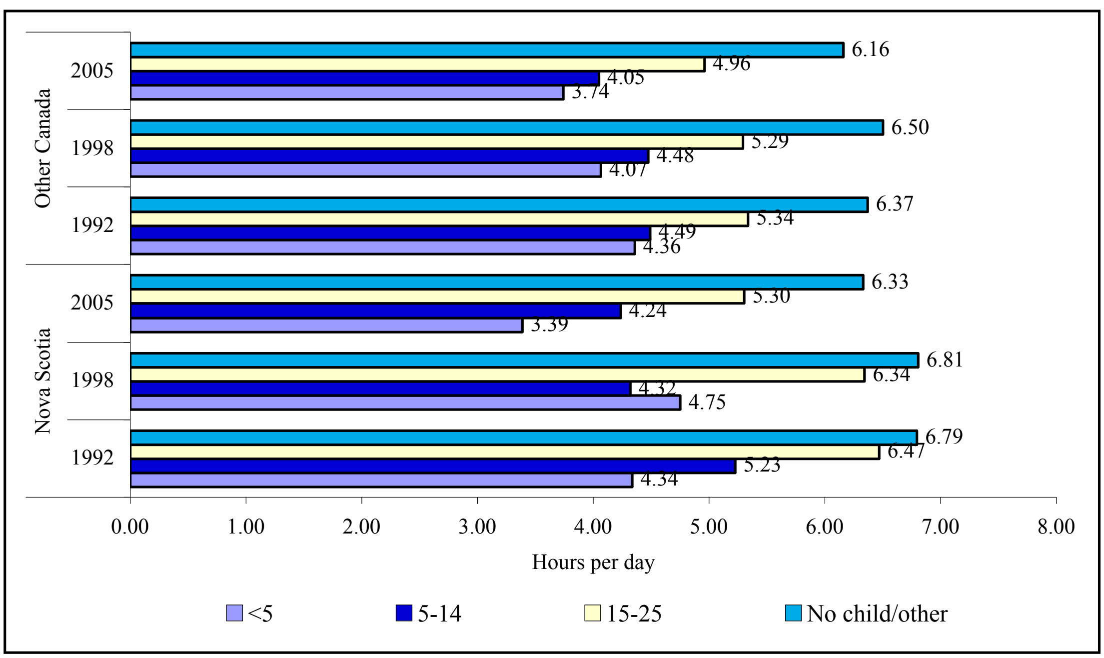
CHARACTERISTIC		NOVA SCOTIA	OTHER CANADA
		%	%
Sex	Male	91.7	95.7
	Female	91.7	94.5
Age group	15–24 years	92.0	93.8
	25–44 years	77.3	94.3
	45–64 years	98.2	93.1
	65 + years	98.1	96.4
Marital status	Married	94.2	95.8
	Other	88.3	94.2
Age of youngest child	Under 5 years	78.1	91.9
	5 to 14 years	81.1	90.4
	15 to 25 years	81.9	93.7
	No child / other	93.2	94.7
Work status	Working at job	91.5	93.3
	Student	90.0	88.2
	Retired	107.6	96.9
	Other	89.7	97.6
Household	Alone	97.2	96.0
	Couple only	96.1	95.9
	Couple with Child <25	82.6	92.5
	With Parents	86.2	92.4
	Single Parent with Child <25	58.8	90.7
	Other	97.6	94.8
Education	Less than HS Diploma	95.6	98.2
	HS Diploma / Other Certification	99.9	95.8
	College degree +	87.8	96.1
Type of day	Weekday	93.9	95.1
	Saturday	87.6	96.6
	Sunday	88.3	93.6

Figure 3-3. Free time, by age, Nova Scotia and other Canada, 1992, 1998, and 2005



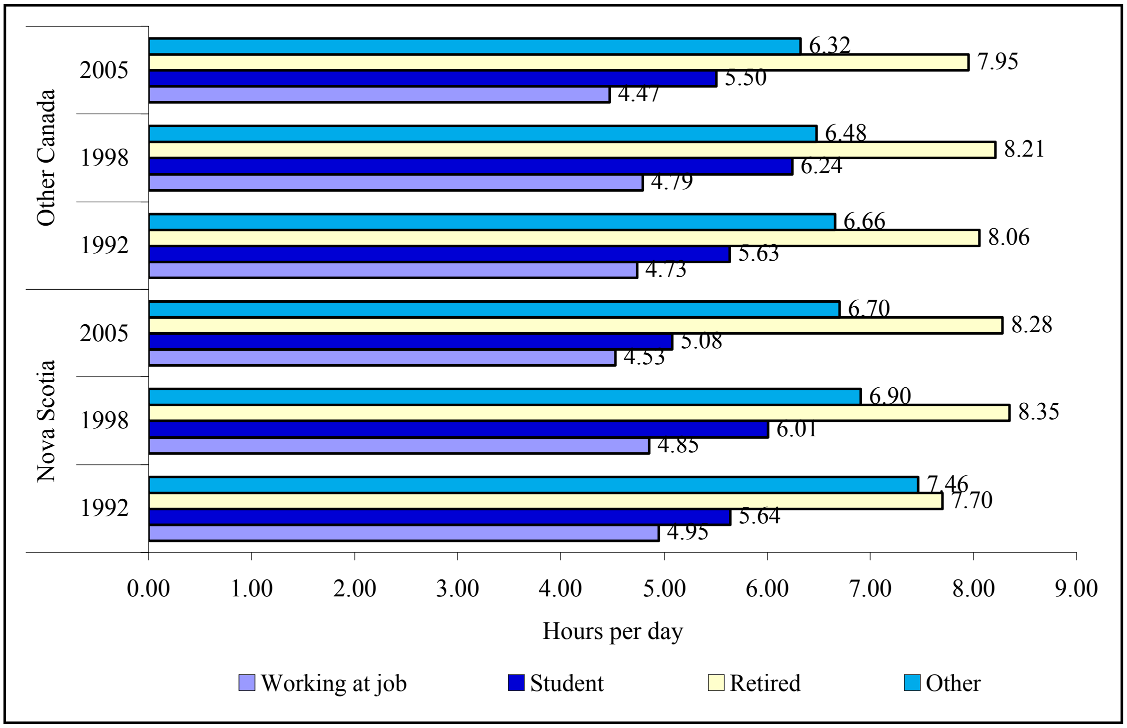
Source: Derived from Statistics Canada GSS Time Use Studies Cycles 7, 12, and 19.

Figure 3-4. Free time, by age of children, Nova Scotia and other Canada, 1992, 1998, and 2005



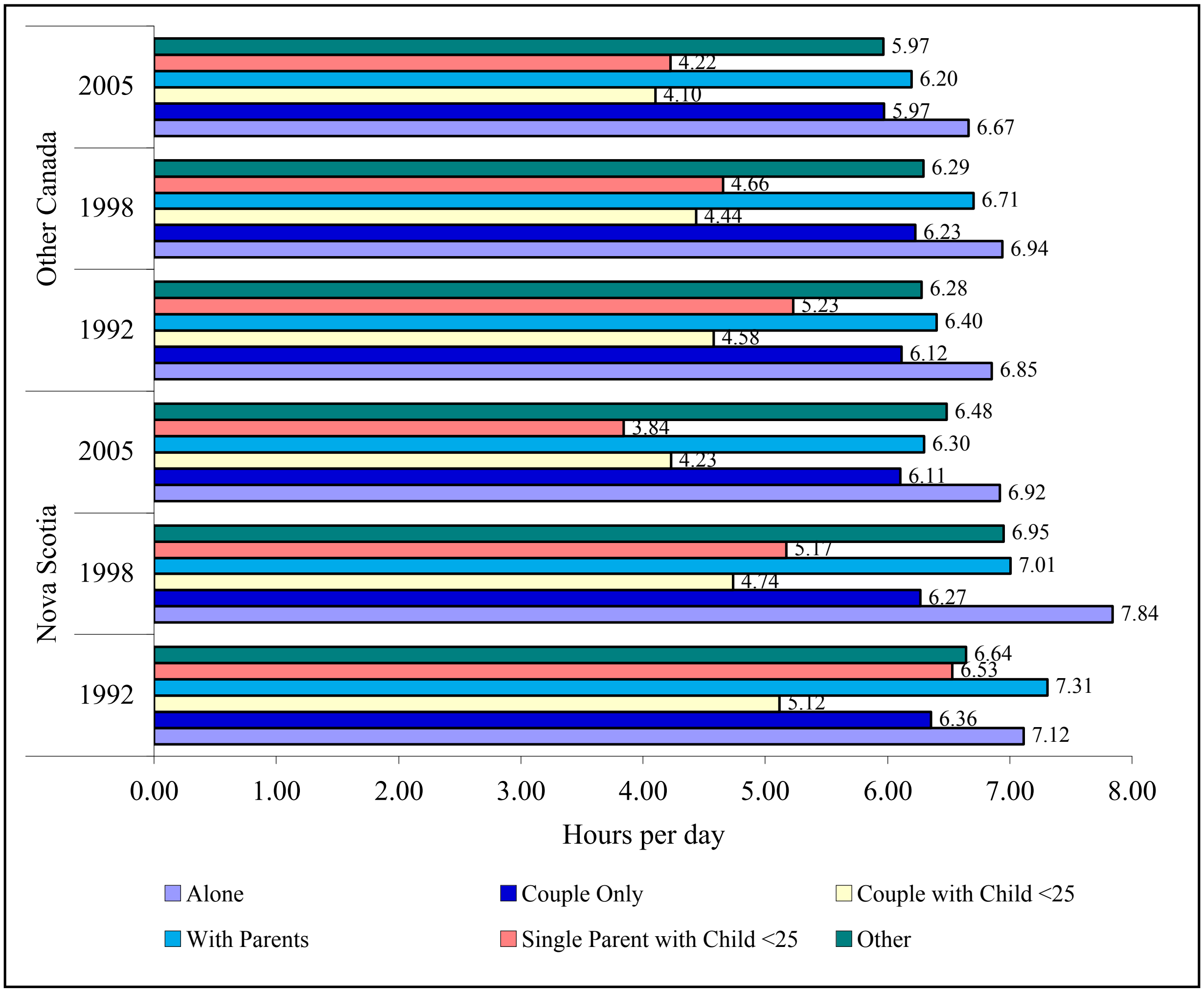
Source: Derived from Statistics Canada GSS Time Use Studies Cycles 7, 12, and 19.

Figure 3-5. Free time, by main activity, Nova Scotia and other Canada, 1992, 1998, and 2005



Source: Derived from Statistics Canada GSS Time Use Studies Cycles 7, 12, and 19.

Figure 3-6. Free time, by household structure, Nova Scotia and other Canada, 1992, 1998, and 2005



Source: Derived from Statistics Canada GSS Time Use Studies Cycles 7, 12, and 19.

One useful way of looking at leisure activities is to characterize them in terms of qualities they represent. One such classification identifies four types among the major activities—social, passive, cognitive, and physical. Each type addresses particular needs and / or uses particular skills.

In both Nova Scotia and the rest of Canada, more free time is allocated to passive leisure activities than to any other type, followed by activities that are primarily social, physical, and cognitive—in that order. Thus, Nova Scotians in 2005 spent an average of two hours and 18 minutes a day engaged in passive leisure activities (like television watching), an hour and 43 minutes a day in social activities, an hour and 10 minutes in physical activities, and half an hour a day in cognitive activities like reading (Table 3-6 below).

Nova Scotians spend about the same amount of time each day as other Canadians on social and cognitive activities, but they allocate somewhat more time than other Canadians to passive and physical leisure—a pattern that holds true in each of the three time use surveys. The decline in total leisure time between 1992 and 2005 is reflected in all leisure types except physical activities where both Nova Scotians (+8%) and other Canadians (+10%) enjoy more physical leisure time than they did in 1992. Social leisure time in both Nova Scotia and the rest of Canada was 5–7 percent lower in 2005 than in 1992.

However, Nova Scotia registered substantially greater declines in passive and cognitive leisure activities than the rest of Canada. Thus, Nova Scotians spent nearly 15% less time on passive leisure activities in 2005 than in 1992 (compared to 5% less time in the rest of Canada), and they spent nearly 20% less time on cognitive activities (compared to about 15% less in the rest of Canada) (Table 3-6).

Table 3-6. Time allocation by leisure qualities, hours per day and 2005 hours as percentage of 1992 hours, Nova Scotia and other Canada, 1992, 1998, and 2005

	NOVA SCOTIA				OTHER CANADA			
	1992	1998	2005	2005/ 1992	1992	1998	2005	2005/ 1992
Social	1.80	1.85	1.71	95.00 %	1.82	1.92	1.70	93.41 %
Passive	2.69	2.60	2.30	85.50 %	2.28	2.29	2.16	94.74 %
Cognitive	0.62	0.60	0.50	80.65 %	0.62	0.59	0.53	85.48 %
Physical	1.07	1.13	1.16	108.4 1%	0.98	0.95	1.08	110.2 0%

Source: Derived from Statistics Canada GSS Time Use Studies Cycles 7, 12 and 19.

3.5. Concluding observations and recommendations

The purpose of all GPI analyses, indicators, and valuations is to improve the evidence base for informed policy making. In this case, the observed decline in free time naturally raises the question whether there are policies that can potentially improve work–life balance and whether there are best practices elsewhere that can act as a model for Canadians and Nova Scotians concerned to reduce time stress, expand free time, and thereby to enhance that work–life balance.

Thus, some European countries have consciously sought to increase free time and quality of life by reducing work hours. The Netherlands, for example, effectively reduced its high unemployment rate of the early 1980s (more than 12%) in large part through efforts in the late 1980s and early 1990s to reduce and redistribute working hours. This was achieved voluntarily, in large part through labour agreements that made part-time work more attractive—carrying equal hourly pay, pro-rated benefits, and equal opportunities for career advancement. By 2001, the Netherlands had the shortest average work hours and the highest rate of part-time work of any industrialized country, and had reduced its unemployment rate to less than 3% of the work force. The shorter work hours not only expanded free time but also improved labour productivity, reduced absenteeism, created new job openings, and expanded opportunities for community and voluntary work.

The Netherlands experience, and a wide range of other examples of shorter work time initiatives and efforts to redistribute work hours and expand free time, are detailed in Chapter 13 of GPI Atlantic's report on *Working Time and the Future of Work in Canada* (April 2004), which can be accessed at http://www.gpiatlantic.org/pdf/workhours/workhours.pdf. As well, Section 7.6 of that report on "Work and Leisure" and other sections of that study provide further analysis of issues involved in work–life balance. Other GPI Atlantic reports of direct relevance to this free time study are *The Economic Value of Unpaid Household Work*, which is available from http://www.gpiatlantic.org/pdf/housework/housework.pdf; *A Practical Model for Voluntary Work-time Reduction*, available from http://www.gpiatlantic.org/pdf/misc/worktime.pdf; and Chapter 4 ("Balancing Paid and Unpaid Work") of GPI Atlantic's 2003 study of *Women's Health in Atlantic Canada*, volume 1, especially Section 4.1, titled "Impacts on Free Time and Personal Time," available from http://www.gpiatlantic.org/pdf/health/womens/womensvol1.pdf.

We conclude with a quote on the distribution of work and leisure from Bertrand Russell:

> Suppose that, at a given moment, a certain number of people are engaged in the manufacture of pins. They make as many pins as the world needs, working (say) eight hours a day. Someone makes an invention by which the same number of men can make twice as many pins as before. But the world does not need twice as many pins: pins are already so cheap that hardly any more will be bought at a lower price. In a sensible world, everybody concerned in the manufacture of pins would take to working four hours instead of eight, and everything else would go on as before.
>
> But in the actual world this would be thought demoralizing. The men still work eight hours, there are too many pins, some employers go bankrupt, and half the men previously concerned in making pins are thrown out of work. There is, in the end, just as much leisure as on the other plan, but half the men are totally idle while half are still overworked. In this way, it is insured that the unavoidable leisure shall cause misery all round instead of being a universal source of happiness. Can anything more insane be imagined?

4. Paid Work Hours

* This chapter falls into both the Time Use Domain and the Living Standards Domain.

For the original GPI Atlantic report on paid work hours, please see the following:

Working Time and the Future of Work in Canada: A Nova Scotia GPI Case Study (2004)
http://gpiatlantic.org/pdf/workhours/workhours.pdf

Headline Indicators

1. Official unemployment rate and supplementary unemployment rate
2. Extent of "hours polarization"
3. Incidence of overtime
4. Incidence of temporary work
5. Rate of involuntary part-time work
6. Increase in real annual income as a proportion of increase in work effort
7. Extent of high chronic and accute stress due to work-related issues

The nature of work has changed dramatically in the last half century, and these changes have had major consequences for the ways in which we configure our lives. While our conventional measures of progress chronicle the widely accepted benefits of these changes, such as higher levels of income and consumption, they have less successfully documented the costs of modern work patterns.

According to conventional GDP-based measures of progress that account only for market transactions, the more hours we work for pay, and the less free time we have, the more the economy grows and the "better off" we are supposed to be. By that standard, stress, for example, is good for the economy, and the drugs used to manage stress contribute to GDP growth. But better and more comprehensive measures of progress that include indicators of population health and work-life balance and that account for the value of voluntary work and free time, would not treat work-related stress and the cost of treating stress-induced illness as contributions to prosperity. Instead, work-related health problems would be counted as costs rather than gains to the economy.

Better measures of progress would similarly recognize that higher levels of income, growth, and output in the industrialized world have not always increased levels of satisfaction, wellbeing, and economic security, and have come with environmental costs.

For example, the 1990s saw an increased polarization of hours and the decline of the standard workweek. Larger numbers of Canadians worked longer hours, while at the same time larger numbers were unable to get the hours they needed to make ends meet. In the economic growth statistics conventionally used to measure progress, long work hours are counted as a contribution to wellbeing because they usually translate into increased output. But there are economic, social, and environmental costs associated both with increased output and with long work hours. Longer work hours may exacerbate stress, produce adverse health outcomes, reduce time with family and friends, and diminish our quality of life, while increased output may place excess demands on our natural resources. At the same time, unemployment and underemployment waste precious resources and also produce substantial social, human, health, and economic costs.

Other major changes in the nature of work, which also have major consequences for quality of life, include the sharp increase in female labour force participation in the last half century, the dramatic influx of single mothers into the work force in the last 15 years, the growing importance of the service industries, and the rise of new categories of "contingent work." These changes have increased time stresses for many dual-earner families and working mothers, and deepened job insecurity for many temporary, contract, casual, and on-call employees.

The full benefits and costs of these and other changes in the nature of work are not fully captured in our current measures of progress, which ignore major aspects of human capital on which the economic system rests, including education, skills, and human health. A sound economic system that properly values work must also value the human, natural, and social capital on which all work is based. Thus, GDP-based measures of progress count any increase in work hours as a contribution to economic growth and prosperity, while ignoring the adverse effects that excess work hours can have on human health and family structure. As noted, the GDP counts medical and drug spending on chronic health problems associated with work stress as a contribution to economic growth instead of as a cost to the economy.

In sum, the economy can grow even as the quality of work—which supposedly "drives" the economy—deteriorates. To overcome some of the shortcomings of conventional labour force indicators, the Genuine Progress Index attempts to go beyond the employment rates conventionally used to assess progress by including additional measures that assess the quality, nature, and type of work and that account for satisfactory work-life balance as a key ingredient in quality of life.

The following key indicators can therefore be used to present a more accurate and comprehensive picture of whether work is improving for Canadians:

- a decline in unemployment.
- a decline in underemployment, signified by a decline in "involuntary" part-time work, or the proportion of people who work part-time only because they cannot find full-time work.
- an increase in job security, characterized by jobs with benefits, security, and decent pay and a corresponding decline in temporary or contingent work, characterized by low pay, insecurity, and lack of benefits.

- a decline in over-work, or the proportion of people working long hours, and a corresponding decline in hours polarization, which contributes to earnings inequality.
- a decline in overtime hours, particularly those that are unpaid.
- a decline in "work effort." When earnings and hours data are combined, it is possible to ascertain whether increased earnings are being purchased by working additional hours—a phenomenon referred to here as work effort. If work effort is increasing, this means that a greater proportion of disposable income is being bought by working longer hours. Conversely, if work effort is declining, income gains are more likely to be funded through improved productivity or redistributive mechanisms.
- a reduction in work stress and an increase in types of work and work arrangements (like job sharing and flexible hours for example) that have the potential to improve work / family / life balance and to contribute to quality of life.

In addition, genuine progress, from a societal rather than purely individualist or household perspective, is made in this area when there is an increase in types of work that contribute to positive human development and quality of life and that are socially and environmentally benign, and a corresponding decline in work that is damaging to communities and to the environment. Further developmental work is required to define and produce appropriate indicators in this area and to develop data sources that will allow such trends to be credibly and reliably measured.

4.1. Unemployment rate

Data sources: Statistics Canada Labour Force Survey (LFS)

Result: There have been decreases in both the official unemployment rate and the supplementary unemployment rate for Canada and Nova Scotia since 2001. Unemployment is at its lowest level in more than 30 years.

Unemployment has been associated with stress, poverty, financial insecurity, poor health outcomes, and a wide range of social problems. For example, abundant evidence indicates that the unemployed suffer higher rates of physical and mental illness than those with jobs. In fact, both unemployment and overwork carry health problems and hidden costs, and one Japanese study found that the underemployed and overworked had equally elevated risks of heart attack.[1] Unemployment is also associated with crime. For example, a Canadian Centre for Justice Statistics survey of inmates in Nova Scotia prisons found that 67% were unemployed at the time of admission to the correctional facility.[2]

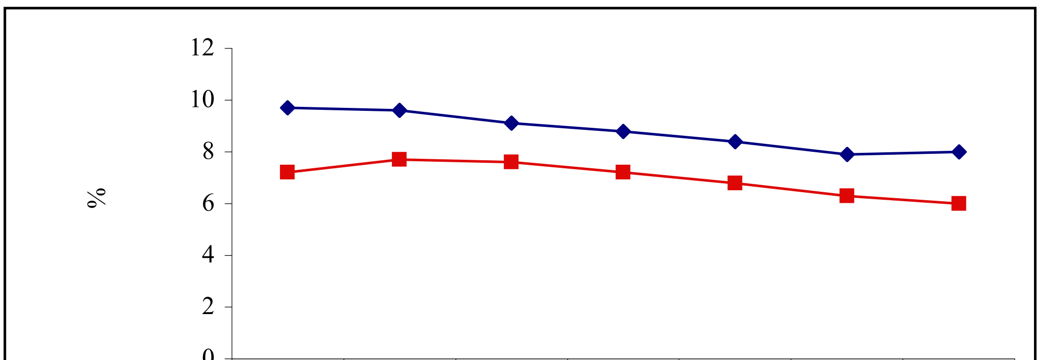
In addition to health and social costs, there are significant economic costs associated with maintaining large numbers of unemployed people through employment insurance and various other social programs intended for those on low incomes. The unemployed also pay less income tax (if any at all), spend less, and represent lost productive potential to society.

Productivity losses and other hidden indirect costs to the economy are substantial.
In the early 1980s, University of Toronto economist Frank Reid estimated that each percentage point increase in Canada's unemployment rate had an overall social cost of $270 million.[3] A 1993 Ontario Medical Association report estimated that unemployment cost the Canadian health care system $1.1 billion that year.[4] GPI Atlantic's 2004 *Work Hours* study conservatively estimated that illness associated with unemployment cost the Nova Scotia economy $202 million in 2001 ($2006). When a wider range of social and economic costs was added, including the value of lost productivity and output, unemployment in Nova Scotia was estimated to cost the provincial and national economies at least $4.4 billion in 2001 ($2006).[5]

Statistics Canada's Labour Force Survey (LFS) counts a person as being unemployed if he or she did not work for even an hour in the reference week and is actively seeking work. From the 1950s through the 1990s, the average unemployment rate in Canada steadily increased from an average of 4.2% in the 1950s to an average of 9.5% in the 1990s.[6] Peak unemployment years in Canada were 1983 and 1993 when 11.9% and 11.4% of Canadians, respectively, were out of work. Since 2001, the official unemployment rate in Canada has decreased from 7.2% to 6%—its lowest level in more than three decades.

Since 1976, the unemployment rate in Nova Scotia has consistently exceeded the national average. The 1980s saw an average jobless rate of 11.8%, and in the 1990s the proportion of unemployed averaged 12%. Since 1996, unemployment rates in the province have declined sharply and in 2007 reached their lowest levels in over 30 years at 8%. Figure 4-1 below plots the official unemployment rates for Canada and Nova Scotia since 2001—the most recent year chronicled in GPI Atlantic's 2004 *Work Hours* report—and Figure 4-2 below documents the longer term unemployment trends from 1976 to 2007.

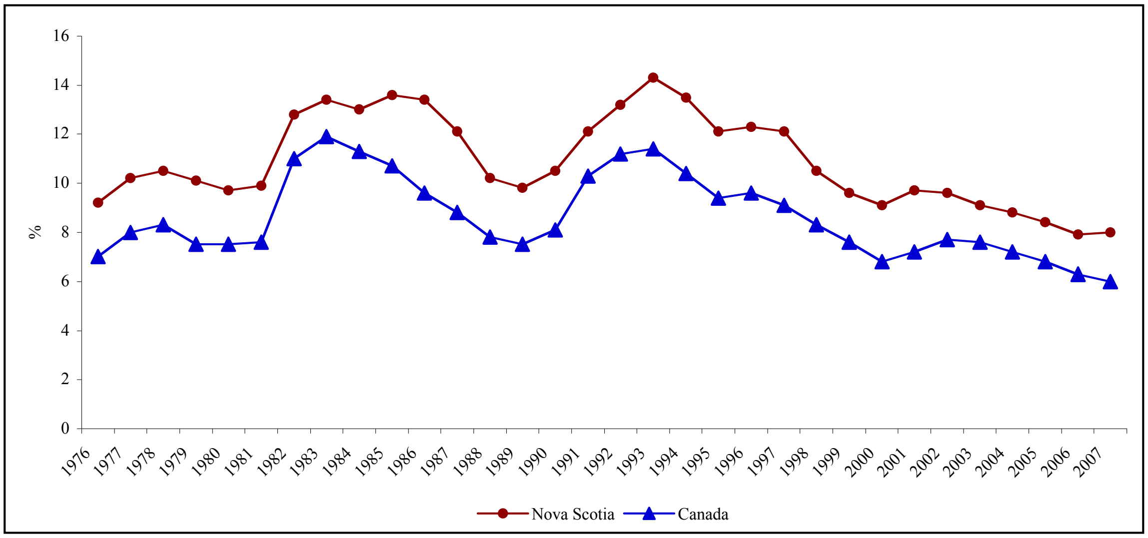
Figure 4-1. Official unemployment rates, Canada and Nova Scotia, 2001–2007



	2001	2002	2003	2004	2005	2006	2007
Nova Scotia	9.7	9.6	9.1	8.8	8.4	7.9	8
Canada	7.2	7.7	7.6	7.2	6.8	6.3	6

Source: Statistics Canada. 2008. Labour Force Historical Review. Minister of Industry. Ottawa.

Figure 4-2. Official unemployment rates, Canada and Nova Scotia, 1976–2007



Data table for Figure 4-2

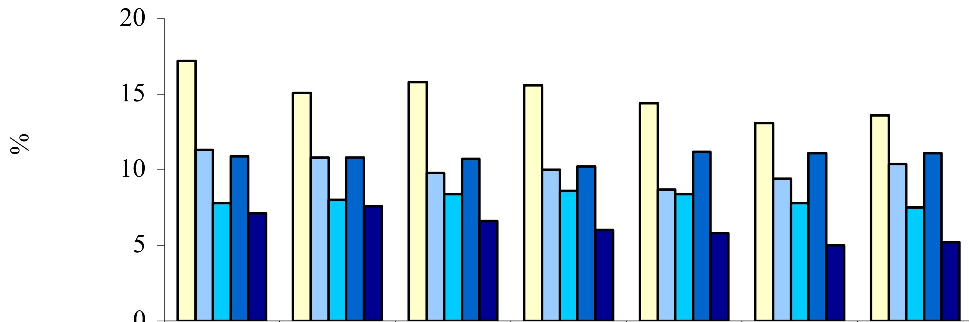
Year	Nova Scotia	Canada	Year	Nova Scotia	Canada
1976	9.2	7.0	1992	13.2	11.2
1977	10.2	8.0	1993	14.3	11.4
1978	10.5	8.3	1994	13.5	10.4
1979	10.1	7.5	1995	12.1	9.4
1980	9.7	7.5	1996	12.3	9.6
1981	9.9	7.6	1997	12.1	9.1
1982	12.8	11.0	1998	10.5	8.3
1983	13.4	11.9	1999	9.6	7.6
1984	13.0	11.3	2000	9.1	6.8
1985	13.6	10.7	2001	9.7	7.2
1986	13.4	9.6	2002	9.6	7.7
1987	12.1	8.8	2003	9.1	7.6
1988	10.2	7.8	2004	8.8	7.2
1989	9.8	7.5	2005	8.4	6.8
1990	10.5	8.1	2006	7.9	6.3
1991	12.1	10.3	2007	8.0	6.0

Source: Statistics Canada. 2008. Labour Force Historical Review. Minister of Industry. Ottawa.

In Nova Scotia, some regions are much worse off than others, and in Halifax, the jobless rate is less than the national average, even though provincial rates have remained consistently higher. As Figure 4-3 below illustrates, unemployment in 2007 was least severe in the Halifax region—at 5.2%, down from 7.1% in 2001. Not far away, however, the proportion of jobless soars. In Cape Breton 13.6% were unemployed in 2007, down from 17.2% in 2001 and a staggering 23.7% in 1994.[7] Between 2001 and 2007 the unemployment rate decreased in all regions of Nova Scotia except for the Southern region, where it increased slightly from 10.9% to 11.1% (Figure 4-3).

As discussed below, these official unemployment figures exclude discouraged workers—those who have given up looking for work. When these are included, the actual jobless rate in Cape Breton and elsewhere is actually higher than the official numbers indicate.

Figure 4-3. Official unemployment rates by region, Nova Scotia, 2001–2007



	2001	2002	2003	2004	2005	2006	2007
Cape Breton	17.2	15.1	15.8	15.6	14.4	13.1	13.6
North Shore	11.3	10.8	9.8	10.0	8.7	9.4	10.4
Annapolis Valley	7.8	8.0	8.4	8.6	8.4	7.8	7.5
Southern	10.9	10.8	10.7	10.2	11.2	11.1	11.1
Halifax	7.1	7.6	6.6	6.0	5.8	5.0	5.2

Source: Statistics Canada. 2008. Labour Force Historical Review. Minister of Industry. Ottawa.

According to current estimation methods, the official unemployment rate actually falls when the unemployed stop looking for work. These jobless individuals, referred to as "discouraged workers," have given up looking for work and hence are not included as being part of the "labour force" and are therefore left out of official unemployment numbers.

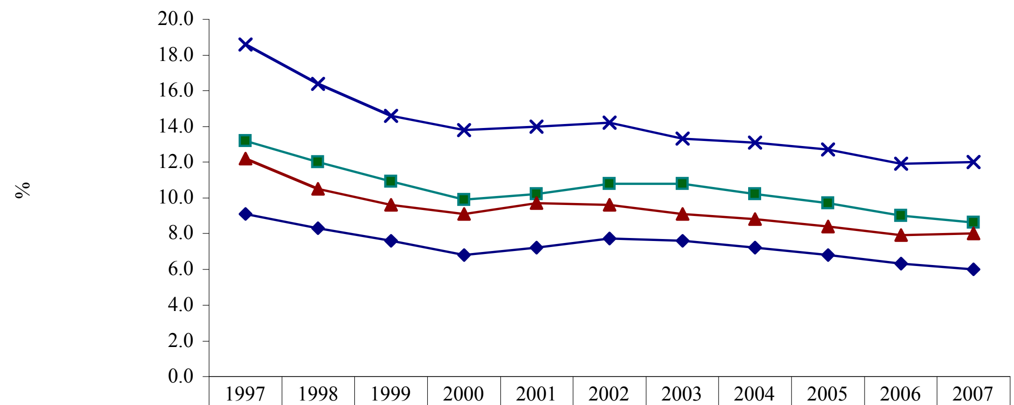
In addition to discouraged workers, the official unemployment statistics exclude a number of other groups unable to find suitable work, including the underemployed—both those who are working part-time but would rather be working full-time and those who are working beneath their skill level—many women who are at home with their children and would like to have paid work but cannot find a job with a flexible schedule or who cannot afford childcare, students who remain in school longer than they wish because no suitable work is available, people on short-term job creation projects, the prematurely retired, and those in prisons.[8]

In 1997, Statistics Canada began collecting and publishing "supplementary" rates of joblessness on a monthly basis, in order to present a more realistic picture of unemployment that includes estimates for discouraged workers and for a portion of the underemployed. The latter are calculated on the basis of the difference between the current hours of involuntary part-time workers and the full-time hours they would work if full-time work were available to them.

In 2001, once some of these "hidden" unemployed (discouraged workers and underemployed) were added to the official numbers, the unemployment rate was 3 percentage points higher for Canada—10.2% rather than 7.2%—and more than 4 percentage points higher for Nova Scotia—14% rather than 9.7% (Figure 4-4 below).

In 2007, the gaps between the official and supplementary unemployment rates remained unchanged. The supplementary rate for Canada declined to 8.6%—still nearly 3 percentage points higher than the official 2007 rate of 6%. In Nova Scotia, the supplementary unemployment rate was 12% in 2007, compared to the official rate of 8%—maintaining the gap of about 4 percentage points (Figure 4-4).

Figure 4-4. Comparison of official and supplementary unemployment rates, Nova Scotia and Canada, 1997–2007



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Official rate (CAN)	9.1	8.3	7.6	6.8	7.2	7.7	7.6	7.2	6.8	6.3	6.0
Supplementary rate (CAN)	13.2	12.0	10.9	9.9	10.2	10.8	10.8	10.2	9.7	9.0	8.6
Official rate (NS)	12.2	10.5	9.6	9.1	9.7	9.6	9.1	8.8	8.4	7.9	8.0
Supplementary rate (NS)	18.6	16.4	14.6	13.8	14.0	14.2	13.3	13.1	12.7	11.9	12.0

Source: Statistics Canada. 2008. Labour Force Historical Review. Minister of Industry. Ottawa.

4.1.1. Economic costs associated with unemployment

As previously noted, GPI Atlantic's 2004 report on work hours conservatively estimated that illness associated with unemployment cost the Nova Scotia economy $202 million ($2006) in 2001. As Table 4-1 below demonstrates, lost output alone attributable to the 9.7% unemployment rate that prevailed in Nova Scotia in 2001 and, accounting for a 3.5% base rate of unemployment, was $3.4 billion ($2006) or $3,744 per capita ($2006). This amounted to 12.4% of the province's 2001 GDP.[9]

For the purposes of this update, we estimate output losses, fiscal costs (including lost tax revenues and EI payments), and some of the social costs associated with unemployment in Nova

Scotia in 2006 using the official unemployment rate of 7.9% and the supplementary unemployment rate of 11.9% that prevailed in Nova Scotia in 2006.[10]

Based on total actual provincial production (GDP) in 2006 of $31.4 billion ($2006) and on the 2006 official unemployment rate of 7.9%, and again accounting for a 3.5% base rate of unemployment, lost provincial production attributable to unemployment in 2006 can be estimated at $2.76 billion (Table 4-1 below).[11] This amounts to 9% of GDP or $3,021 per capita.[12]

Thus, the decline in the unemployment rate from 9.7% in 2001 to 7.9% in 2006 represents a saving of roughly $689 million to the Nova Scotiaeconomy in avoided output losses. In other words, economic production and output in 2006 were about $689 million higher than if the unemployment rate had remained at the 9.7% level that prevailed in 2001. The reduction in the provincial debt-to-GDP ratio and the increased revenues to government that in turn have facilitated balanced budgets can therefore be attributed in large part to the reduction in unemployment.

However, when we count some of the hidden unemployed (particularly discouraged workers and the underemployed)—who are captured in Statistics Canada's supplementary rates of unemployment—the production losses attributable to unemployment in Nova Scotia are substantially higher than indicated above. In 2006, with a supplementary unemployment rate of 11.9% in Nova Scotia, lost production due to unemployment, again using the 3.5% base rate, can be estimated to amount to $5.28 billion ($2006)—16.8% of GDP or $5,780 per capita.

The decline in the supplementary rate from 14% in 2001 to 11.9% in 2006 represents a saving of roughly $534 million in avoided output losses. In other words, economic production and output in 2006 were about $534 million higher than if the supplementary unemployment rate had remained at the 14% level that prevailed in 2001.

Fiscal costs are related to transfers between government and citizens—money paid to government by citizens and businesses generally in the form of taxes and then paid back to citizens in the form of income supports and other transfer payments. Unemployment produces both lower tax revenues *and* higher transfer payments. Fiscal costs are particularly important to assess in weighing the cost-effectiveness of alternative policy options. For example, an economic policy that stimulates employment may actually have a very low *net* cost to government when the savings due to increased tax revenues and decreased benefit payments are figured into the equation (let alone the additional indirect savings that might accrue from reduced illness and other social costs). Such estimations can only be made if information on the costs of unemployment is known.

Data for Employment Insurance (EI) and Social Assistance benefits paid to Nova Scotians are from the Nova Scotia Department of Finance *Statistical Review*, and indicate that between 2001 and 2005 (the most recent year for which data were available) the total amount paid for these two categories of transfers has decreased. For example, when figures are adjusted for inflation, $593 million ($2006) in federal EI payments were transferred to jobless Nova Scotians in 2005, down from a total of $613 million ($2006) in 2001. Similarly, in 2005, $185 million ($2006) in provincial social assistance was paid to Nova Scotians in need, compared to $238 million in 2001.

Without further investigation, the causes of this decline, and the proportion attributable to the decline in unemployment during this period, cannot be definitively determined. Based on a preliminary analysis, however, it is clear that there is a connection between the decline in total benefits paid and a concomitant decline in the numbers receiving the benefits. For instance, there were roughly 4,500 fewer Nova Scotians receiving EI benefits in 2005 than in 2001—down from 105,730 individuals to 101,220—and nearly 5,000 fewer people on social assistance—down from 37,632 to 32,700.[13] What is not known at this point is the proportion of the payments decline that is due to fewer people being unemployed or in need of social assistance on the one hand, and the proportion attributable to changes that may have been made to eligibility requirements and benefit levels. Time and resources did not allow such an analysis at this time.

In any case, cost calculations have been made in relation both to a hypothetical 0% unemployment rate (completely full employment) and a 3.5% unemployment base rate. However the same EI and Social Assistance figures were used in both scenarios because a) EI and Social Assistance do not apply to all unemployed in any case; and b) unlike estimates of lost output and lost taxes attributable to unemployment, EI and Social Assistance expenditures are not hypothetical numbers, but actual direct payments.

In estimating the fiscal costs of unemployment for Nova Scotia, we have further assumed that the unemployed came from the private sector. If they came from the public sector, the government would save on their wages and salaries. In order to calculate fiscal costs, it is also necessary:

- to estimate the probable average earnings of the unemployed if they were to become employed
- the average direct taxes paid by the unemployed
- the average benefits received by an unemployed person, and
- the average consumption levels of the unemployed (compared to those of the employed), which in turn determines how much they contribute to the indirect tax base (particularly sales taxes) and how much more they would likely contribute to indirect taxes if they were employed

In 2005, (the most recent year for which data were available at time of writing) federal EI benefits to persons in Nova Scotia totalled $593.3 million ($2006). Provincial transfers to Nova Scotians on social assistance in 2005 came to $184.8 million ($2006).[14] In 2005, 32,700 Nova Scotians were on social assistance and about 40,800 were jobless (somewhat more than the 38,100 jobless in 2006).

In order to estimate the loss of direct taxes attributable to unemployment, we have taken the difference between the income tax paid on the average income of an employed Nova Scotian and the income tax paid on the average income of someone on regular EI benefits, and then multiplied that difference by the number of unemployed.[15]

According to the Nova Scotia Statistical Review, which reports earnings data from Statistics Canada, the average weekly wage of an employee in Nova Scotia in 2006 was $659—or $34,269/year ($2006). This includes both part-time and full-time workers, and all goods and services jobs. The income taxes paid on this average wage are estimated to be $5,684. In 2006, the average regular EI benefits paid were $295/week—or $15,354/year. The income taxes paid on this amount are estimated to be $1,430.[16] Thus, an employee in Nova Scotia receiving the average wage would pay $4,254 more in income taxes per year than a person receiving the average EI benefits.

Based on a 7.9% unemployment rate in 2006, it can be estimated that the federal and provincial governments lost $162.1 million ($2006) in potential direct taxes that would have been collected had these Nova Scotians been employed (Table 4-1 below). It should also be noted that this assumes completely full employment (0% unemployment), and does not make allowances for a "natural" or base rate of unemployment. Therefore, if the 2006 unemployment rate of 7.9% were brought down to 3.5%—the base rate estimated by the Canadian Centre for Policy Alternatives—then the government would have collected an additional $89.8 million ($2006) in direct taxes in 2006 (Table 4-1).[17]

Based on an 11.9% supplementary unemployment rate in 2006—which includes some of the hidden unemployed[18]—and assuming full employment, it may be estimated that the federal and provincial governments lost $243 million ($2006) in potential direct taxes. If the supplementary rate of 11.9% were brought down to 3.5%, the government would have collected an additional $172 million ($2006) in direct taxes in 2006 over and above what it took in based on the 11.9% unemployment rate. Obviously these cost estimates based on the expanded supplementary unemployment rate *include* the costs estimated for the official unemployment rate of 7.9%.

In order to calculate the loss in indirect taxes (in this case sales taxes), we have taken the difference between the average expenditures of those at the average wage level and the average expenditures of those on EI benefits, based on Statistics Canada data on spending patterns by household income group.[19] For this purpose, Statistics Canada divides households into five income groups (quintiles) each representing 20% of Canadian households—from the 20% with the highest incomes (fifth quintile) to the 20% with the lowest incomes (first quintile).[20] Then we have estimated the percentage of those consumption items which are subject to HST (harmonized sales tax), calculated the difference in HST paid by the higher quintile (reflecting average wages) compared with the lower quintile (reflecting EI benefits), and then multiplied by the number of unemployed to determine the loss in indirect taxes.[21]

There are several acknowledged problems with this approach, including the fact that Statistics Canada quintile data are for households, while unemployment numbers are for individuals. Therefore, a number of adjustments should rightly be made to the results. For example, some households may contain two or more unemployed individuals, while a relatively high income for one partner may elevate a dual-earner couple to a higher quintile even if the other partner is unemployed. Time and resources did not permit such adjustments here. However, the results for this estimate depend less on absolute numbers than on a relational comparison, since the concern is to estimate the likely *difference* in HST paid by the unemployed compared to those on average wages, so the proportional difference in spending between household quintiles is fairly likely to reflect the proportional difference in spending between unemployed individuals and those earning average wages.

As noted above, the average Nova Scotia wage in 2006 was $34,269/year ($2006), and average EI earnings were $15,354/year. According to Statistics Canada spending data, the total current consumption of a person in a second quintile household—one with an income approximating the average wage—was $16,207 in 2006, while the total current consumption of a person in the lowest quintile—one with an income approximating EI benefits—was $14,623.[22]

Following the steps outlined above, and based on a hypothetical 0% unemployment base rate (completely full employment), the unemployment rate of 7.9% in 2006 (38,100 people) in Nova Scotia resulted in a likely loss of about $3.9 million ($2006) in indirect (sales) taxes. If the official unemployment rate of 7.9% were brought down to 3.5%, the federal and provincial governments would have collected roughly $2.2 million ($2006) more in additional indirect (sales) taxes (Table 4-1 below).

Based on the supplementary unemployment rate of 11.9% in 2006—or 57,120 people jobless or underemployed—and assuming full employment, there was a loss of about $5.9 million ($2006) in indirect taxes. If the supplementary rate of 11.9% were brought down to 3.5%, the federal and provincial governments would have collected about $4.2 million ($2006) in additional sales taxes.

Table 4-1. Summary of economic costs of unemployment using official unemployment rates ($2006), Nova Scotia, 2001 and 2006

ECONOMIC COST CATEGORIES	ESTIMATED ECONOMIC COSTS OF UNEMPLOYMENT ($2006 MILLIONS)			
	2001		2006	
	9.7% jobless rate using 0% base rate	9.7% jobless rate using 3.5% base rate	7.9% jobless with 0% base rate	7.9% jobless rate using 3.5% base rate
1. Output loss	$5,452	$3,449	$4,961	$2,760
2. Fiscal Costs				
• Employment Insurance	$613	$613	$593	$593
• Social Assistance	$238	$238	$185	$185
• Lost direct taxes	$170	$108.5	$162.1	$89.8
• Lost indirect taxes	$3.5	$2.45	$3.9	$2.2
TOTAL	**$6.5 billion**	**$4.4 billion**	**$5.9 billion**	**$3.6 billion**
COST PER CAPITA	$7,159	$4,846	$6,459	$3,941

Sources: Department of Finance. Nova Scotia Statistical Review 2007. Economics and Statistics Division. Available from http://www.gov.ns.ca/finance/publish/statsrev/2007/NSSTATS_Review_2007.pdf. Accessed June 17, 2008. Department of Finance. Nova Scotia Statistical Review 2004. Available from http://www.gov.ns.ca/finance/publish/statsrev/2004/sr2004.pdf. Statistics Canada. 2008. Spending Patterns in Canada 2006. Minister of Industry. Catalogue no. 62-202-X. Ottawa. Mary MacInnis, Certified General Accountant, Personal Communication, June 17, 2008.

Notes:

- When a portion of the hidden unemployed are included in Statistics Canada's supplementary unemployment rates, the costs are significantly higher. Please refer to the text above, which provides the costs as calculated using the 2006 supplementary unemployment rate for Nova Scotia.
- 2001 figures have been converted to $2006 for comparison purposes. In 2001, the Nova Scotia population was 908,007 and in 2006 it was 913,462.[23]
- Some of the data to derive these calculations were from 2005 (EI payments and Social Assistance payments) because they were the most recent data available. These payments have been converted to 2006 dollars.
- Some of the costs in Table 4-1 above are borne by the province and others, such as employment insurance and lost federal income and sales taxes, are borne by the country as a whole.
- Data on social assistance recipients were not included in the calculations for direct / indirect taxes lost due to the unavailability of data. Those on social assistance would pay some taxes and these have not been included in the calculations above.
- The use of the 3.5% unemployment base rate is in keeping with the Canadian Centre of Policy Alternatives' paper, *Real Costs of Unemployment in Canada*, and assumes that even in a situation of "full employment," there will always be some people between jobs who are on the unemployment rolls. However, the experience of some countries like the Netherlands, which have experienced rates of unemployment below 3%, indicate that the CCPA's 3.5% base rate may be too high.
- All calculations in this update use the most recent adjusted Labour Force Survey data available at the time of writing, which may explain slight discrepancies between the cost estimates reported in GPI Atlantic's 2004 work hours report (which used the most recent Labour Force Survey data available at the time) and those reported here.

4.1.2. Social costs associated with unemployment

In addition to economic costs cited above, there are also many social costs associated with unemployment. The loss of a job can have devastating consequences. Paid work fulfills crucial functions for people, even beyond its main role of providing sustenance. Work literally "shapes the experience of the employed"—by imposing a time structure, by enlarging the circle of the individual beyond his or her family, by allowing the worker to participate in a collective purpose or effort, and by assigning the individual with a status or identity.[24]

According to Jahoda, the absence of these functions due to job loss can have "destructive" psychological consequences, particularly since existing social norms allow very few of the unemployed to establish their own substitutes for these functions outside of paid employment. In the end, analysts have noted that the jobless suffer "impoverishment of social experience," which can ultimately lead to mental and physical illness, family breakdown, crime, and loss of human potential.[25]

In the section that follows, we will update the GPI cost estimates for three areas of social costs attributable to unemployment: health, family breakdown, and crime.

The evidence indicates that the unemployed suffer higher rates of a wide range of physical and mental ills than those with jobs. According to the literature, the mental and physical health of the unemployed is generally worse than that of the employed population for a wide range of health indicators. For example, studies have found that unemployment can be a precursor to severe chronic stress and hence to cardiovascular disease.[26] The evidence indicates that the unemployed also tend to be less satisfied with their mental and physical wellbeing; they report more long and short-term disabilities; they are sick almost twice as often as those with jobs; and they visit physicians more frequently than those with jobs. A seminal Canadian study also found that the unemployed are 20% to 25% more at risk for heart disease, chest pain, high blood pressure, and joint pain than the general employed population.[27]

Health costs associated with unemployment in Nova Scotia are estimated using evidence on relative risks from the literature, and then applying cost estimates from Health Canada's 2002 Economic Burden of Illness in Canada (EBIC), which estimated direct and indirect costs of illness by diagnostic category in Canada for 1998. More recent EBIC data are currently unavailable, though new EBIC data are scheduled to be released in the fall of 2008. Because the EBIC cost estimates are for 1998, the provincial health care costs for 1998 have also been used, and all estimates then adjusted for inflation. However, this will underestimate the actual costs, as health care costs have been rising at a faster rate than the general Consumer Price Index, leading to conservative estimates in Table 4-2 below.

Direct costs are defined as the value of goods and services for which payment was made and resources used in treatment, care, and rehabilitation related to illness or injury. The five direct cost components in EBIC are hospital care expenditures; drug expenditures; physician care expenditures; expenditures for care in other institutions; and additional direct health expenditures (including other professionals, capital, public health, prepayment administration, health research, etc.). Other direct costs borne by patients or other payers (such as costs for transportation to health providers, special diets and clothing) are not included. Indirect costs measured in EBIC are defined as "the value of economic output lost because of illness, injury-related work disability, or premature death."[28]

We also use Marcel Bedard's relative risk ratios associated with unemployment, as culled from the literature and prepared for Human Resources Development Canada, and we then estimate the population attributable fractions (PAF) for selected diseases, health risks, and health care utilization attributable to unemployment in Nova Scotia.[29] Based on a number of studies, Bedard assessed the excess risks of various diseases and other health effects due to unemployment, and summarized these risks as odds ratios compared to either the general population or employed workers. He then scaled rates of hospitalization and physician use of the general or employed population at 100, with numbers in excess of 100 representing the estimated excess risks among the unemployed.

The studies referenced by Bedard, and therefore used as the basis for the GPI cost estimates for Nova Scotia, controlled for confounding factors, including economic and socio-demographic variables, and health risk behaviours. Because of the methodological and data challenges involved in this exercise (such as difficulties involved in converting odds ratios to relative risk ratios, for example), the following results should be understood as illustrative rather than definitive.

Based on the available data, and bearing in mind the numerous methodological and data limitations discussed in detail in the 2004 GPI *Work Hours* report,[30] the potential economic burden of illness in Nova Scotia that may be associated with the 2006 official unemployment rate of 7.9% is estimated to be $162.2 million—down from $202 million in 2001 when the jobless rate was 1.8 percentage points higher.

When we include a portion of the hidden unemployed—captured in the supplementary (comprehensive) rates of unemployment—the economic burden of illness associated with the 2006 supplementary rate of 11.9% is estimated to be $241 million—down from $285 million in 2001 when the supplementary rate was 2.1 percentage points higher (see Table 4-2).[31]

It should be noted that these estimates are conservative because they do not take into consideration the duration of unemployment and the more acute health effects suffered by the long-term unemployed. Long-term unemployment has been particularly associated with livelihood insecurity, poverty, stress, poor health, and a range of social problems. According to Williams and Windebank: "Long average spells of unemployment tend to imply greater economic costs and social costs than shorter spells." These costs include the depreciation of skills, and loss of confidence, leading to eventual withdrawal and "exclusion" from the labour force.[32] Studies have also indicated that those who experience longer spells of unemployment are at greater risk of illness and even death.[33]

Table 4-2. Economic burden of illness linked to unemployment ($2006), Nova Scotia, 2001 and 2006

	Category	Total Cost of Illness or Health Care Use in Nova Scotia 1998 ($2006 millions)	Potential Cost Associated with Unemployment in 2001 (Millions) A) Official Rate (9.7%) B) Comprehensive Rate (14%)	Potential Cost Associated with Unemployment in 2006 (Millions) A) Official Rate (7.9%) B) Comprehensive Rate (11.9%)
1.	Hospitalization	$1,199.7	a) $37.2 b) $52.8	a) $29.9 b) $44.4
2.	Physician use	$383.4	a) $11.9 b) $16.9	a) $9.6 b) $14.2
3.	Other direct health costs *	$1,490.2	a) $46.2 b) $65.6	a) $37.3 b) $55.1
4.	**Total direct health care costs (1+2+3)**	**$3,073.3**	**a) $95.3** **b) $135.3**	**a) $76.8** **b) $113.7**
5.	Short-term disability	$264.1	a) $17.4 b) $24.0	a) $14.3 b) $20.9
6.	Long-term disability	$1,153.4	a) $13.8 b) $19.6	a) $10.4 b) $15.0
7.	Mortality	$1,380.4	a) $75.9 b) $106.1	a) $60.7 b) $91.1
8.	**Total indirect costs / productivity losses (5+6+7)**	**$2,797.9**	**a) $107.1** **b) $149.7**	**a) $85.4** **b) $127.0**
9.	**TOTAL: direct + indirect costs (4+8)**	**$5,871.2**	**a) $202.4** **b) $285.0**	**a) $162.2** **b) $240.7**

Sources: Relative Risk Ratios: Bedard, Marcel. 1996. The Economic and Social Costs of Unemployment. Applied Research Branch. Human Resources Development Canada. Ottawa. Cited in Pannozzo and Colman. 2004. p. 317, Table 37. Total cost of illness amounts from Health Canada. 2002. Economic Burden of Illness in Canada, 1998 Policy Research Division. Available from http://www.phac-aspc.gc.ca/publicat/ebic-femc98/pdf/ebic1998.pdf. Accessed June 17, 2008.

Notes: Numbers have been rounded. In order to avoid double counting, individual disease cost estimates—part of hospital, doctor and other costs—have not been included here. All figures were adjusted for inflation for comparison purposes. Total direct health care costs are higher than estimates in the provincial accounts because they include a portion of private (non-taxpayer funded) costs, including drug expenditures.
* Other direct health care costs include expenditures on other health professionals (e.g., dentists and physiotherapists), home care, health research, spending on drugs, and expenditures for care in other institutions or residential care facilities for the chronically ill or disabled who reside at the institution more or less permanently.

4.1.3. Unemployment and family breakdown

There is also consensus in the literature that unemployment jeopardizes the wellbeing of the family and its members. When a family member loses a job, this generally puts financial pressure on the family and may result in relationships of dependency that did not previously exist. In addition, when one family member is experiencing shock, grief, and / or loss of identity due to job loss, these mental states inevitably affect other family members. For example, the evidence indicates that spouses often feel shock, anger, and resentment over a partner's job loss, as well as anxiety over an uncertain future.[34]

It is extremely difficult to quantify the costs associated with family breakdown, as it may include not only the economic costs associated with divorce attributable to job loss but also a wide range of psychological and health costs, as well as the numerous (but extremely difficult to quantify) effects on the children of broken homes. Thus, family breakdown stemming from job loss by a primary earner may impose a significant burden on children's mental and physical health and sense of general wellbeing, limit their opportunities, and affect their future financial insecurity.

In the United States, Redefining Progress did attempt to put a dollar value on the costs associated with divorce as part of its Genuine Progress Indicator. It estimated that in 2000, the cost of family breakdown in the United States, including lawyers' fees and indirect costs, amounted to US$63 billion ($1996) [or CAD$85.5 billion ($2006)].[35, 36]

For a description of methodological and data limitations and of the methodology involved in the costing of divorce resulting from joblessness in Nova Scotia, please refer to GPI Atlantic's original 2004 *Work Hours* report.[37]

In 2004, GPI Atlantic estimated that the divorce costs associated with an unemployment rate of 9.7% in Nova Scotia in 2001 amounted to roughly $11.2 million ($2006). In 2006, when the unemployment rate was down to 7.9%, divorce costs associated with joblessness can be estimated at $6 million. [38]

4.1.4. Unemployment and crime

Numerous studies, cited in the original 2004 GPI Atlantic *Work Hours* report, show a positive correlation between unemployment and crime, especially in regard to property offences. One of these studies concludes: "Unemployment is an important determinant of the social conditions in which crime becomes more prevalent."[39]

In Nova Scotia there is also evidence of a positive correlation between unemployment and crime. According to data reported by GPI Atlantic in 2004, 57% of Nova Scotia adults committed to sentenced custody in 2001-02 were unemployed at the time of sentencing, nearly six times the unemployment rate in the general population at the time. Similarly, in 2001-2002, nearly 63% of young offenders in Nova Scotia were unemployed.[40]

As well, GPI Atlantic in 1999 tracked unemployment rates with robbery rates and found a high apparent correlation, though adjustments were not made at the time for possible confounding factors. Both in Canada and in Nova Scotia and, indeed, in almost all provinces, the robbery rates peaked during the recessions of the early 1980's and early 1990's, easing off as employment rates rose.

Just as the average overall unemployment rate has been higher in each decade, never quite returning to pre-recession levels, so robbery rates have also increased steadily each decade. As Canadian unemployment rates rose from an average of 4% in the late 1960s to 6.7% in the 1970s to 9.3% in the 1980s to an average of 10% between 1992 and 1997, robbery rates rose correspondingly from 34 per 100,000 in the 1960s to 68, 93 and 106 per 100,000 in each of the succeeding decades. The Nova Scotia progression follows a similar trend, as do most other provinces (Table 4-3 below). [41]

Table 4-3. Robbery rates and unemployment rates (average rates by decade), Canada and Nova Scotia, 1962–1997

	CANADA		NOVA SCOTIA	
	Robbery Rate (per 100,000)	Unemployment Rate (%)	Robbery Rate (per 100,000)	Unemployment Rate (%)
1962–1969	33.6	4.0*	16.0	4.9*
1970–1979	68.1	6.7	32.8	8.1
1980–1989	93.3	9.3	38.3	11.8
1992-1997	105.7	10.0	41.6	12.5

Sources: Statistics Canada, ESTAT and CANSIM databases.

Note: Unemployment rates are averaged for the years 1966–1969, the earliest available on Statistics Canada's ESTAT and CANSIM databases.

It should be noted that the high apparent correlation between robbery rates and unemployment rates is only true relatively speaking, when examining a particular provincial or a national trend over time. Social and cultural factors clearly play a major role as well in determining crime levels, and no claim can be made that an absolute level of unemployment is likely to produce a certain rate of robbery. Thus Newfoundland and Labrador, for example, consistently has the lowest robbery rate and the lowest overall crime rate in the country, and also has the highest unemployment rate. However, within each province over time, there is a significant enough correlation between unemployment rates and robbery rates, even to the extent of following temporary short-term fluctuations in the business cycle, that the relationship warrants serious attention.

In order to calculate the crime costs associated with unemployment we have used GPI Atlantic's conservative estimate of the full costs of crime in Nova Scotia, as published in GPI Atlantic's 1999 *Cost of Crime* study and adjusted to 2006 dollars—$672.5 million ($2006).[42]

Based on the assumption that a 50% reduction in unemployment would result in a 10% reduction in crime, it may be estimated that Nova Scotia could save $66.8 million/year ($2006) in avoided crime costs by cutting the jobless rate from the 2006 rate of 7.9% to 4%. In other words, each additional percentage point of unemployment may be estimated to cost the Nova Scotia economy roughly $16.7 million a year ($2006) in crime costs. Thus, by comparison with 2001 unemployment-related crime costs, it may be estimated that—by reducing its unemployment rate from 9.7% to 7.9%—Nova Scotia saved about $30 million in avoided crime costs attributable to unemployment.

Again, a note of caution must be added here: since these cost estimates are based on many assumptions that require testing and verification, and in the absence of precise data allowing for accurate relative risk ratios and the calculation of population attributable fractions, the estimates provided here should be used for illustrative purposes only. Considerable further empirical investigation is required to produce more accurate estimates. Based on the limited evidence available, it is nevertheless clear that the social, health, and crime costs attributable to unemployment are likely to be very considerable, and that even crude attempts at estimation are likely to be considerably more accurate than the arbitrary assignment of a zero value to these social costs, as implied by their absence in the conventional economic accounts.

4.2. Hours polarization

Data source: Statistics Canada, Labour Force Survey

Result: There has been a move away from hours polarization, with fewer people working at the extreme ends of the scale.

"Hours polarization" refers to a decline in the proportion of workers working standard hours (35-40 hours/week), coupled with increases in the proportions working long and short hours. In Canada, hours polarization, which grew in the 1980s and particularly in the 1990s, was accompanied by a growing inequality in both employment opportunities and earnings. A 1994 report by the Advisory Group on Working Time and Distribution of Work, which reported on trends in work at that time, stated: "Hours of work are increasing for some full-time workers while, for others, only part-time work is available. This increased labour market polarization raises the stakes of winning and losing in the employment lottery."[43]

Statistics Canada also reported at that time that the increasing polarization of work hours contributed substantially to the growing income gap in Canada since the early 1990s. It noted that the increase in earnings inequality that took place in the l980s and l990s occurred in conjunction with changes in the distribution of annual and weekly hours worked. Although there had been some reversal of this trend by the late 1990s, the proportions of long-hours and short-hours workers in 2001, as documented in Statistics Canada's Labour Force Survey data and reported by GPI Atlantic in its 2004 *Work Hours* report, were still considerably greater than they were 25 years previously—even if down somewhat from their mid-1990s peaks.

Statistics Canada analyst, Rene Morissette, summarized the key reasons for the growing inequality in weekly earnings that occurred in the 1980s and 1990s in Canada as tied to three factors: 1) the decline in the real hourly wages of young workers; 2) the decline of the standard workweek coupled with hours polarization; and 3) a growing tendency for workers with high wages to work longer hours and for lower wage workers to work below average hours.[44]

Other evidence indicates that these trends in turn are tied to global trading patterns and competition from low-wage countries, and to cost-cutting measures by businesses that led them to downsize their workforces, shed workers, increase the contingent work force, and increase the workload of remaining workers (often the most highly skilled and educated) who were expected to retain the same levels of output with fewer personnel.

Based on Statistic Canada's 1976-2001 Labour Force Survey data, GPI Atlantic's 2004 *Work Hours* study reported that a growing proportion of workers were working longer work hours, while at the opposite end of the scale, a growing number could not find enough work hours. In other words, a decline in the standard workweek (35–40 hours) was producing a growing gap between long and short hours workers.

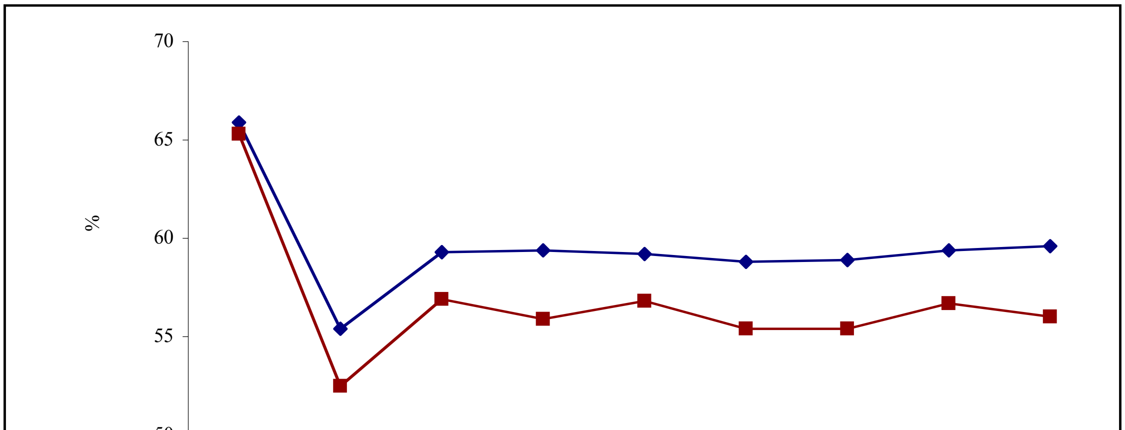
According to more recent data, there seems to have been a shift away from this growing hours polarization, with fewer people now working at the extreme ends of the scale than ten years ago.[45] Statistics Canada attributes the shift that occurred between 1997 and 2006 to the following:

- Fewer men are now working very long hours than a decade ago.
- Women, with a stronger presence in the labour market now than ever before, have tended to increase their hours—often moving from part-time hours a decade ago to 30-40 hours a week more recently.
- The roughly ten-year period (1997–2006) attracted more women, mothers with dependent children, youth, and older workers into the labour force—groups that generally prefer varied hours due to personal, family, and educational circumstances and responsibilities.
- The decline in long hours (49 or more) can also be attributed partially to strong growth in the service sector (where hours tend to be more flexible and varied); and in the concomitant decline in economic sectors and occupations where workers have tended to work long hours (i.e., the self-employed, the goods-producing sector, managers, and blue-collar workers).
- The influence of work-life balance considerations has been growing as more women, particularly mothers with young children, join the labour market. For these women, achieving such balance is often a more important consideration than it has been for many other groups.

- The trend toward fewer people working long hours has also been occurring in other countries, so Canadian trends are part of a global pattern.[46]

As Figure 4-5 below shows, the reduction in hours polarization in the present decade has not been enough to restore the standard workweek to the level of primacy it held three decades ago. Thus, by 2007, only 59.6% of paid workers in Canada were putting in a *standard* or 35-40 hour workweek, down from 66% in 1976. In Nova Scotia, the percentage working standard hours fell from 65% in 1976 to 56% in 2007. Figure 4-5 below shows that the proportion of Canadians and Nova Scotians working standard workweeks reached its low point in 1996, when only 55% of Canadians and less than 53% of Nova Scotians worked a standard workweek. Between 2001 and 2007 the trend has stabilized at about 59% in Canada and 56% in Nova Scotia.

Figure 4-5. Percentage of total employed working a standard workweek (35–40 hours per week) at their main jobs, Canada and Nova Scotia, 1976–2007



	1976	1996	2001	2002	2003	2004	2005	2006	2007
Canada	65.9	55.4	59.3	59.4	59.2	58.8	58.9	59.4	59.6
Nova Scotia	65.3	52.5	56.9	55.9	56.8	55.4	55.4	56.7	56

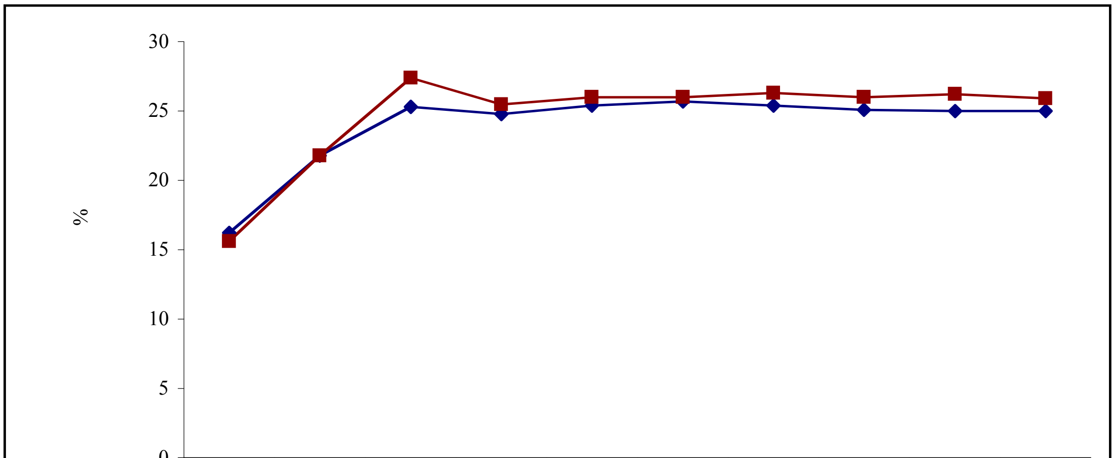
Source: Statistics Canada. 2008. Labour Force Historical Review. Minister of Industry. Ottawa.

Notes: Total employed includes all employees and the self-employed. Usual hours data have been used here. Usual hours are defined as normal paid or contract hours, not counting overtime, vacations, or work absences. By contrast, actual hours are the number of hours actually worked by the respondent during the reference week, and include paid and unpaid overtime, as well as holidays, vacations, sick days, etc. Actual hours also reflect temporary increases or decreases in work schedules. Typically, total actual weekly hours are consistently lower than total usual hours because, according to Statistics Canada, "net time lost from work is always greater than net hours worked in excess of the regular schedule."[47]

In 2001, 25% of all workers in Canada put in less than 35 hours a week, up sharply from 16% in 1976. Between 2001 and 2007 the incidence of short hours stabilized, with 25% of all Canadian workers now putting in short workweeks.

In Nova Scotia the trend has been similar. In 2001, 25.5% of all workers clocked less than 35 hours a week—also up from 16% in 1976. Since 2001, 26% of all employed Nova Scotians have been working short workweeks—down marginally from a peak of 27.4% in 1996 (Figure 4-6 below).

Figure 4-6. Percentage of total employed working *less than* a standard workweek (< 35 hours per week) at their main jobs, Canada and Nova Scotia, 1976–2007



	1976	1986	1996	2001	2002	2003	2004	2005	2006	2007
Canada	16.2	21.8	25.3	24.8	25.4	25.7	25.4	25.1	25	25
Nova Scotia	15.6	21.8	27.4	25.5	26	26	26.3	26	26.2	25.9

Source: Statistics Canada. 2008. Labour Force Historical Review. Minister of Industry. Ottawa.

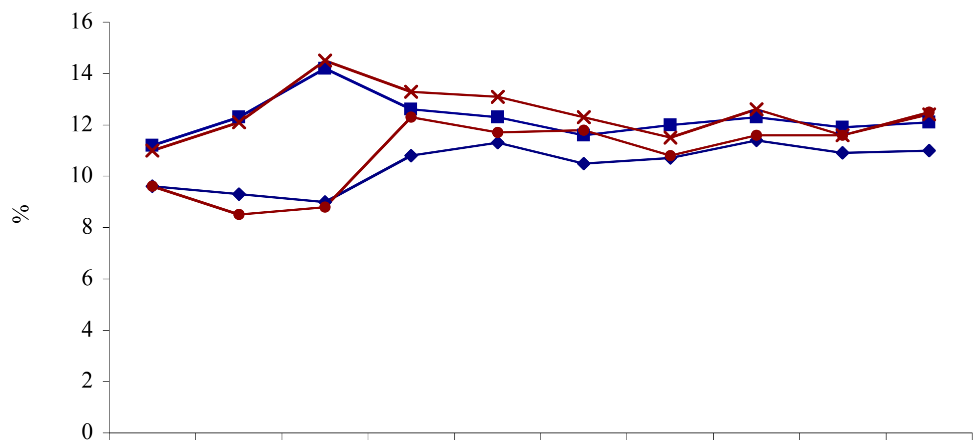
Note: Usual hours data have been used to construct this figure.

At the same time as the proportion of short hours workers was increasing in the 1980s and 1990s, the proportion of long hours workers was also increasing. Using actual hours data—because it includes paid and unpaid overtime—the incidence of long hours (those working 50 hours or more per week) among all employed Canadians increased from 11.2% in 1976 to 14.2% in 1996 before falling off to 12.6% in 2001 and then stabilizing at about 12% from 2002 to 2007.

In Nova Scotia, 11% of the employed worked more than 50 hours a week in 1976, increasing to 14.5% in 1996 and then falling to 13% in 2001-02 before stabilizing at about 12% from 2003 through 2007. Thus, in both Nova Scotia and nationwide, the incidence of long work hours (50 or more / week) in recent years has remained below the 1996 peak but still higher than levels three decades ago (Figure 4-7 below).

In both Canada and Nova Scotia, the incidence of those working between 41-49 hours a week remained roughly stable at about 9% between 1976 and 1996, and then increased to about 11% in Canada and 12% in Nova Scotia in 2001, remaining fairly stable at those levels since that time (see Figure 4-7 below).

Figure 4-7. Percentage of total employed working *more than* a standard workweek (41–49 hours and 50 or more hours per week) at their main jobs, Canada and Nova Scotia, 1976–2007



	1976	1986	1996	2001	2002	2003	2004	2005	2006	2007
Canada 41-49 hours	9.6	9.3	9	10.8	11.3	10.5	10.7	11.4	10.9	11
Canada 50 hours +	11.2	12.3	14.2	12.6	12.3	11.6	12	12.3	11.9	12.1
NS 41-49 hours	9.6	8.5	8.8	12.3	11.7	11.8	10.8	11.6	11.6	12.5
NS 50 hours +	11	12.1	14.5	13.3	13.1	12.3	11.5	12.6	11.6	12.4

Source: Statistics Canada. 2008. Labour Force Historical Review. Minister of Industry. Ottawa.

Notes: Actual hours data are used to construct this figure. Total employed include both part-time and full-time employed.

When only the full-time employed are included, the incidence of long hours is significantly higher than indicated above, since Figure 4-7 above represents the proportion of all employed, including part-time workers. Thus, in 1976, one-quarter of all Canadian workers in full-time jobs worked 41 hours or more. By 2001, nearly one-third of full-time Canadian workers were working 41 hours or more, a proportion that had remained relatively unchanged since the mid-1990s and that was considerably higher than the 23% of all workers putting in 41 or more hours. Unfortunately, due to financial constraints, it was not possible to update the incidence of long work hours among full-time employed Canadian workers.[48]

In Nova Scotia, the proportion of the full-time employed working long hours (50 hours or more) increased sharply between 1976 and 2001 from 12.6% in 1976 to more 18% in 1994, before falling back somewhat to 12.3% in 2001. In 1976 roughly one in five full-time workers in Nova Scotia clocked more than 41 hours a week. By 2001 nearly one in three workers was doing so. Financial constraints again did not allow an update of these Nova Scotia numbers to 2007 at this time due to the high cost of these Statistics Canada custom tabulations.

Full-time employed men in Nova Scotia saw an even more dramatic 35% increase in long work hours during this time period. In 2001, 22.4% of full-time employed Nova Scotian men worked 50 hours or more a week—up from 16.6% in 1976. In this same time period there was also a very substantial increase in the proportion of full-time employed Nova Scotian women working 41 or more hours per week—up from 12.2% in 1976 to 20.3% in 2001. The proportion of full-time employed Nova Scotian women working 50 or more hours a week almost doubled—from 4.5% in 1976 to 8.4% in 2001. Again financial constraints did not allow the purchase of the updated data to 2007 at this time.

Average usual work hours differ substantially by region in Canada. According to a Statistics Canada's study using data from the Survey of Labour and Income Dynamics, workers in the Prairie provinces and Ontario put in more working hours in 2004 than their counterparts in other regions of Canada. Workers aged 25-54 in Alberta averaged the highest number in the country (1,880), followed by those in Manitoba and Saskatchewanatchewan (1,860) and Ontario (1,850). By contrast, 25-54 year old workers in British Columbia averaged 1,790 hours, those in the Atlantic region worked 1,780 hours, and workers in Quebec averaged the lowest annual work hours in the country at 1,750.[49]

According to the study, the low working hours in Quebec can be attributed to the fact that a much higher proportion of workers in that province (28% compared to about 16% in other regions) had low full-time, full-year schedules of 1,500 to 1,900 hours (30-38 hours a week). Low working hours in the Atlantic region and British Columbia, on the other hand, were mostly due to a larger share of individuals working short work years (less than 1,500 hours a year). Thus, more than one-quarter (26%) of workers in Atlantic Canada worked a short year of fewer than 1,500 hours. Nearly one in five men in Atlantic Canada worked a short year, compared with only 11% to 15% in other regions.[50] This may be due to the higher incidence of seasonal work in Atlantic Canada.

Trends in work hours in Canada are similar to trends occurring in other industrialized countries. According to OECD data reported by Statistics Canada, most OECD countries (11 out of 14), including Canada, saw a decline between 1997 and 2006 in the proportion of workers clocking 50 or more hours a week.[51]

Despite the fact that there has been a reversal of the trend toward increasing hours polarization, levels remain above those thirty years ago, and there continue to be substantial numbers of workers working both short hours and long hours. These extremes in the work hours spectrum—particularly if they are not freely chosen—have been associated in the literature with a number of negative outcomes.

Short work hours are often associated with lack of job security, poor pay, and few if any non-wage benefits. Working long hours has been associated with stress and poor health outcomes. For example, a Statistics Canada study found that women moving to longer work hours were four times more likely to smoke than women working shorter hours, twice as likely to drink more, 1.8 times more likely to experience an unhealthy weight gain, 40% more likely to decrease their physical activity, and more than twice as likely to suffer bouts of major depression.[52] In fact a Japanese study found that those working long hours and those unable to get the hours they need to make ends meet were at equal risk of heart attack.[53]

Short work hours in Canada may also be problematic from the perspectives of security, income, and wellbeing for a number of reasons, including the prevailing quality of much part-time work. Part-time work in countries like the Netherlands generally fetches equal hourly pay, pro-rated benefits, and equal opportunity for seniority, career advancement, promotion, and training. This is because the Netherlands has laws and labour practices that prevent discrimination against part-time workers in terms of promotion, pay, and fringe benefits. However, here in North America, part time work tends to be much less desirable than full-time work, and is associated more often than in many European countries with work that is temporary, insecure, fetches lower pay, rarely carries benefits, and does not advance careers.[54]

Therefore, even for those who freely choose to work shorter workweeks, part-time work generally does not promote financial and job security or quality of life. Those who do not freely choose to work part-time but do so only because no full-time work is available are often faced with the additional burden of not being able to make ends meet. Please see Section 1.3.5 below on "involuntary part-time" work.

A 2007 study by Mercer Human Resources Consulting found that Canada lags far behind other countries—particularly European ones—in the amount of vacation time to which workers are entitled by law. In fact, Canada ranked forty-sixth out of 49 countries examined, ahead of only Thailand, the Philippines and the USA, in mandated vacation time. In the Mercer study, assessments of the number of vacation days were based on the minimum number of days required by the country's Labour Standards. Statutory holidays were not counted in this assessment.

In Canada, 10 days of vacation time are required after one year of employment. By contrast, France, Finland, and the United Arab Emirates all require employers to provide 30 days of vacation, while Sweden, Denmark, Greece, and Luxembourg each require 25 days, and Germany 24. In the US, where there is no federal law mandating paid or unpaid vacation days or holidays, the practice in some large US firms is to offer 15 paid vacation days to full-time employees with at least 10 years of tenure.[55, 56]

The Mercer study also indicated that—despite the fact that Canadians have relatively little mandated vacation time—employees in this country are not using up all of the vacation days to which they are entitled. On average, Canadian workers do not take 2.4 of their allocated vacation days each year—totalling 41 million unused vacation days annually. This amounts to a Canada-wide loss of $3.6 billion worth of vacation time.[57] Roughly 30% of employed Atlantic Canadians do not take all of their vacation days, compared with 42% of British Columbians, 41% of Albertans, 37% of workers in Saskatchewanatchewan and Manitoba, and 36% in Ontario. Only 19% of Quebec employees did not take all of their vacation time.[58]

According to the Mercer study, the reasons workers gave for not taking full vacations included being too busy at work, trading days in for money, and not being able to make plans far enough in advance.[59]

Nevertheless, abundant evidence indicates that vacations contribute to a sense of work-life balance and wellbeing. Conversely, therefore, not taking vacation time and, more broadly, the inability to achieve satisfactory work-life balance, may lead to lower levels of job satisfaction and, almost ironically, to higher levels of absenteeism. According to Dr. Linda Duxbury and Christopher Higgins, who have studied the issue of work-life balance in Canada extensively, Canadian corporations are losing roughly $3 billion a year to employee absenteeism.[60]

> High work-life conflict negatively impacts the employer, the employees' colleagues, the employee, the employees' family, and Canadian society as a whole. From the employer's perspective, the inability to balance work and family demands has been linked to reduced work performance, increased absenteeism, higher turnover, lower commitment and poorer morale. Work-life conflict has also been linked to productivity decreases associated with lateness, unscheduled days off, emergency time off, excessive use of the telephone, missed meetings, and difficulty concentrating on the job. [. . . E]mployees with high work-family conflict missed an average of 13.2 days of work per year—a substantially higher number than the 5.9 days missed by employees with low work-life conflict.[61]

In an important 2002 national work-life conflict study, cited in GPI Atlantic's *Work Hours* report, Duxbury and Higgins found that the l990s were a "turbulent" period for most Canadian families, who found themselves struggling for some job security. The study found that:

- Throughout the l990s a greater percentage of Canadian workers assumed more responsibilities, as the number of working women, dual-earner and single-parent families, "sandwich" employees (who take care of both children and aging parents),[62] and employees with responsibilities for elder care increased over the decade.
- Labour market changes and technological changes increased job insecurity, elevated work demands, and blurred the boundary between work and family.[63]

The study found that for many Canadian workers, the conflict between their family responsibilities and their paid jobs has become more acute, in large part because their work schedules have shifted away from standard and predictable daylight hours. Over the l990s in particular, the incidence of rotating shifts, fixed shifts, and atypical work hours increased. Contrary to widespread belief, the study found that most Canadian workers are not offered any flexibility in their work schedules to accommodate family responsibilities and that the incidence of such flexible work arrangements has not expanded in tandem with growing needs and with the increased labour force participation of working mothers and those with responsibility for elder care. The study examined the available data on the subject and found that:

> The percentage of respondents using the most desired family-friendly flexible work arrangements (flexitime and telework) has not changed over the decade and remains relatively low (approximately 20% work flexitime and 1% telework).[64]

In 2003, another study by the same authors compiled comments by Canadian workers regarding how they feel about the stresses they are facing in their daily lives to seek work-life balance. Nearly two-thirds of respondents reported difficulty in achieving work-life balance, while only a small minority of the comments were positive.[65]

More recent data from Statistics Canada's 2005 General Social Survey (GSS) indicate that one out of every three Canadians identifies themselves as a workaholic, and that these individuals are much more likely to be dissatisfied with the balance between their work and family time than those who do not classify themselves as workaholics.[66] In a Statistics Canada analysis of the 2005 GSS results, quality of life was measured using three criteria: balance between work and family time, time pressure, and general life satisfaction. The study found that almost one-third (31%) of working Canadians aged 19 to 64 identify themselves as workaholics—unchanged since the GSS first collected this information in 1992. Approximately 39% of self-identified workaholics reported that they usually worked 50 or more hours a week—twice the proportion among non-workaholics. Workaholics were also much more likely (65%) to worry they do not spend enough time with their family and friends than non-workaholics (45%).[67]

In 2006, a report commissioned by Human Resources and Social Development Canada (HRSDC), and authored by Judy Fudge of Osgoode Hall Law School, examined Canadian legislation regulating working time within the federal jurisdiction, and whether Canada's existing Labour Codes were effectively able to promote flexibility in the workplace and work-life balance.[68] The study found that since the 1980s, Canadian workers have been placed under increasing pressure, thus increasing the need for such balance and flexibility.

The study found that, on the demand side, the process of globalization, the intensification of competition, the spread of digital technologies, the rise of "just-in-time" production, and the 24-hour service economy have led to the proliferation of flexible forms of working time that diverge from traditional standards. As a result, the standard reference points in traditional working-time regulation, such as daily and weekly working time or the boundary between standard working time and overtime, have become increasingly blurred. However, such "flexibility" in employment conditions is not the kind that necessarily promotes work-life balance.

On the supply side, the study found that demographic changes such as the feminization of the labour force, the increasing labour force participation of women with young children, the shift to dual-earner households, and the aging of the population, have all led to a variety of working-time arrangements that also do not conform to the norm. Part-time work has increased, as has the range of family-related leaves to which workers are entitled.[69]

Overall in Canada, the study found that there has been a "growing diversification, decentralization, and individualization of working time."[70] However, as the demand and supply side analysis above clearly indicates, "flexibility" in working time tends to mean very different things to employers and employees. According to Fudge:

> Employers want to be able to organize working time in accordance with variations in the volume of an undertaking's activities over a certain period and to calculate overtime entitlements over that period. They also want to reduce the legal restrictions on the scheduling of work. By contrast, employees want to be able to control their work schedules, and they want the flexibility to design working-time arrangements that accommodate their other responsibilities and their lifestyles.[71]

The study points to a "large body of reliable data of different kinds" that demonstrate the numerous costs associated with the conflict between work and life—the adverse health implications of long work hours, the negative impact of work-life conflict on family life, and costs in reduced mental and physical health, job satisfaction, and productivity. Fudge notes that these costs are borne not only by the worker and his / her family but by employers and society at large.

The Canada Labour Code, Part III, provides various some mechanisms that might potentially allow for flexibility in work schedules including:

- exemptions
- averaging agreements (for overtime and for maximum hours of work)
- modified work schedules (for overtime)
- permits for excess hours
- regulations for specific sectors or occupations
- emergencies

However, if the worker is not represented by a trade union, the Code in most cases requires the employer either to obtain the consent of a majority of affected employees or the permission of a designated official—thus making the process of injecting flexibility into the working-time rules "very complex."[72]

The study found that—practically speaking—Canada's Labour Code does not currently provide workers with much flexibility to determine their schedules or to vary their regular work hours to accommodate family obligations or education. According to Fudge:

> The evidence indicates there is a widespread failure to comply with hours of work rules in the federal jurisdiction, that overtime hours are increasing, and that work-family conflict is also on the increase. There is a great deal of evidence that the direct costs to individuals, their families, employers, and the health-care system are immense. However, there is little evidence that either large or federally-regulated employers are putting work-life arrangements in place. The research reveals that employers prefer to retain control over the scheduling of working time, and they want increased flexibility to use overtime. It is also clear that enterprises in the federal sector are relying on a large proportion of employees to work chronic overtime.[73]

The report concludes that current hours and guidelines specified by existing work rules are outdated and it "is time to revise the working-time regime in the federal jurisdiction and to institutionalize a form of regulated flexibility that better addresses the needs and preferences of the workforce and the operational requirements of employers."[74]

4.3. Overtime

Data source: Statistics Canada Labour Force Survey

Result: Between 1997 and 2007, there was an increase in the incidence of overtime in Canada and Nova Scotia.

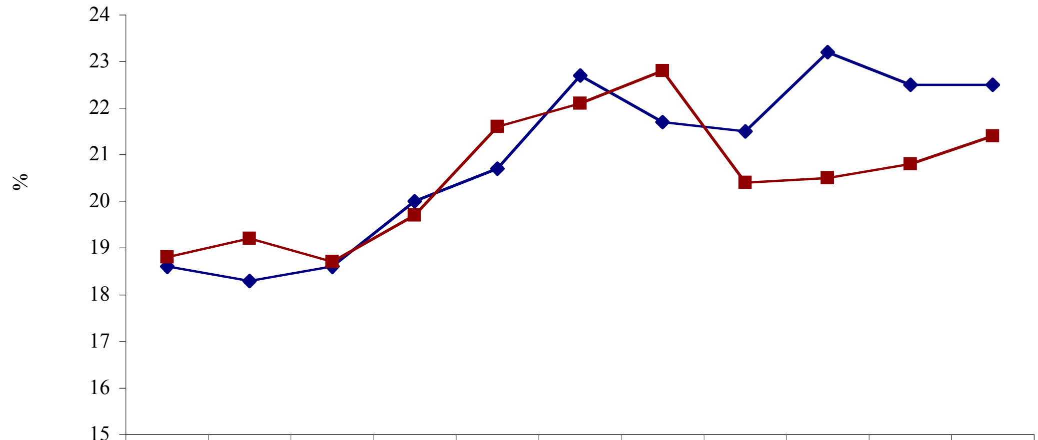
In 2002, Health Canada released a seminal study in Canada showing that having too many hours of work was the most important contributor to stress.[75] Stress, in turn, can result in a myriad of behavioural, psychological, and physiological effects. The physiological health effects of work stress and stress resulting from poor work–life balance are well documented and include depression, heart disease, arthritis, peptic ulcers, digestive tract disorders, cancer, asthma, hypertension, menstrual disorders, skin diseases, and more.[76]

According to Health Canada, both chronic stress and stressful life events can have "at least a strong indirect impact on physical and mental health, by affecting physiology and morphology of the circulatory system and—by psychoneuro-immunological mechanisms—by affecting the development of cancer."[77] In a wide-ranging review of the literature, the *American Journal of Health Promotion* found stress to be the most costly of all modifiable risk factors.[78]

To the extent that working overtime hours contributes to a long hours culture, it may also contribute to stress and poor work–life balance. One Statistics Canada analysis concluded: "Working excessively long hours does not generally lend itself to a healthy, balanced way of living."[79]

According to Labour Force Survey (LFS) data, the incidence of overtime increased sharply between 1997 and 2002 in both Canada and Nova Scotia. Since that time, it has remained relatively stable nationwide and fallen off slightly in Nova Scotia. As Figure 4-8 below indicates, the incidence of overtime in 2007 in both Canada and Nova Scotia remained well above 1997 levels.

Figure 4-8. Percent of employees working overtime, Canada and Nova Scotia, 1997–2007



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Canada	18.6	18.3	18.6	20	20.7	22.7	21.7	21.5	23.2	22.5	22.5
Nova Scotia	18.8	19.2	18.7	19.7	21.6	22.1	22.8	20.4	20.5	20.8	21.4

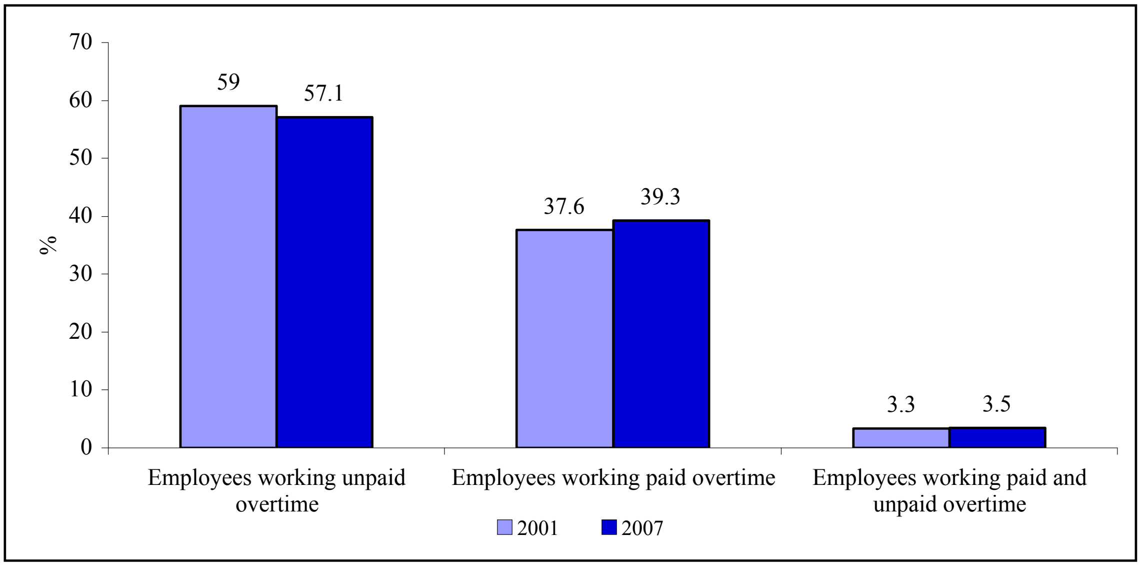
Source: Statistics Canada. 2008. Labour Force Historical Review. Minister of Industry. Ottawa.

In 2001, GPI Atlantic reported that 2.4 million Canadians or 21% of the workforce, clocked more than 20 million hours of overtime every week—an average of more than eight hours per employee each week. In Nova Scotia in 2001, 71,800 employees (about 22% of the workforce) worked 639,000 hours of overtime each week—an average of nearly nine hours overtime per employee each week. Among those who worked overtime in this province, nearly 38% got paid for it, while a striking 59% did not. In a typical week in 2001, therefore, roughly 373,000 additional hours were worked free of charge in this province.[80]

Six years later, the situation in Nova Scotia has improved in terms of the proportion of overtime that is compensated—but only marginally. In 2007, the incidence of unpaid overtime among those who work overtime decreased to 57.1% (down from 59% in 2001), while the proportion of paid overtime among those working overtime increased to 39.3% (up from 37.6% in 2001). There was also a slight increase in those working both paid and unpaid overtime—up from 3.3% in 2001 to 3.5% in 2007 (Figure 4-9 below).

Despite the marginal improvement in the proportion of overtime being compensated, there were actually more Nova Scotians—in absolute numbers—working unpaid overtime in 2007 (43,800) than in 2001(42,400). Therefore, in a typical workweek in 2007, roughly 381,000 hours were worked free of charge (up from 373,000 in 2001).[81]

Figure 4-9. Employees working paid and unpaid overtime as percent of total employees working overtime, Nova Scotia, 2001 and 2007



Source: Statistics Canada. 2008. Labour Force Historical Review. Minister of Industry. Ottawa.

According to Statistics Canada, legislated benefits requirements often make it more efficient for employers to pay overtime to existing workers than to hire and train new workers. Due to ceilings on Employment Insurance, Canada Pension Plan, and Workers Compensation Board contributions, employers' fixed costs increase less by scheduling existing workers to work overtime, since contribution ceilings for those employees have generally been reached and employers therefore do not need to pay more into those funds, than by hiring new employees who likely require full employer contributions to those funds.[82]

This trade-off, however, may not be true in cases where overtime is paid and fetches a premium. Thus, in 2004, GPI Atlantic reported on a study of British Columbia pulp and paper mills conducted by the Communications, Energy, and Paperworkers (CEP) Union, which found that it was not in fact cheaper for employers to use overtime than to hire new workers. The CEP study found that the cost of hiring and training new workers was less than employers' costs in paying time-and-a-half for overtime. The study concluded that when the overtime premium is time-and-a-half, hiring new workers in effect costs employers nothing. When overtime is paid at the rate of double-time, hiring more workers would actually bring "substantial savings" to the firm.

The CEP argued that the reason employers were willing in this case to pay more costly overtime than to hire more workers was because of the "trend to downsize," which was only assumed to be cost-effective in the absence of careful accounting. In other words, in a globalized, competitive climate, "being profitable is regarded as virtually synonymous with having the fewest possible workers."[83]

Just prior to GPI Atlantic's *Work Hours* report going to press in 2004, the Nova Scotia government had made amendments to new legislation that promised changes to Nova Scotia's labour laws. The amendments stipulated that overtime would be paid at time-and-a-half of a worker's regular hourly wage (as opposed to 1.5 times the minimum wage, as the legislation had previously specified), after 48 hours a week. When the new legislation was introduced, however, the business community protested, and argued that the economic impact of paying these overtime rates would be too severe.[84] In response to the outcry from the business community, the government again amended the overtime provisions so that the new rules applied only to particular classes of workers and to some salaried workers. Instead, "special rules" and exemptions were applied to those industries "characterized by irregular working hours and conditions."[85]

For example, by extending the workweek in the road building and construction industry, and for sawmillers, machine shop workers, metal fabricators, snow removal workers, and other categories of workers to 55 hours, instead of 48, overtime at 1.5 times regular pay only has to be paid after 110 hours of work every two weeks in these sectors. The new regulations also reinstated some pre-existing exemptions for professionals, managers, and supervisors. The minimum wage order, specifying overtime to be paid at 1.5 times the minimum wage, was also restored for oil and gas workers, those in transport, primary fish and agricultural processors, ship builders, auto mechanics, and others. Certain groups of workers are not covered at all by overtime rules including certain farm workers, fishermen, those in the logging and forest industry, and live-in health and personal care providers.[86]

When compared to other provinces and territories, Nova Scotia still has one of the longest workweeks, at 48 or 55 hours, depending on the sector, for purposes of calculating when premium overtime rates apply. At the Federal level, the Canada Labour Code stipulates that federally regulated undertakings or businesses must pay overtime of 1.5 times regular pay after 40 hours of work a week. Most Canadian provinces and territories require that the overtime premium be paid after 40 or 44 hours.

4.4. Temporary work

Data source: Statistics Canada's Labour Force Survey.

Result: The incidence of temporary work in Nova Scotia remained fairly steady between 2001 and 2007, but remains above 1997 levels.

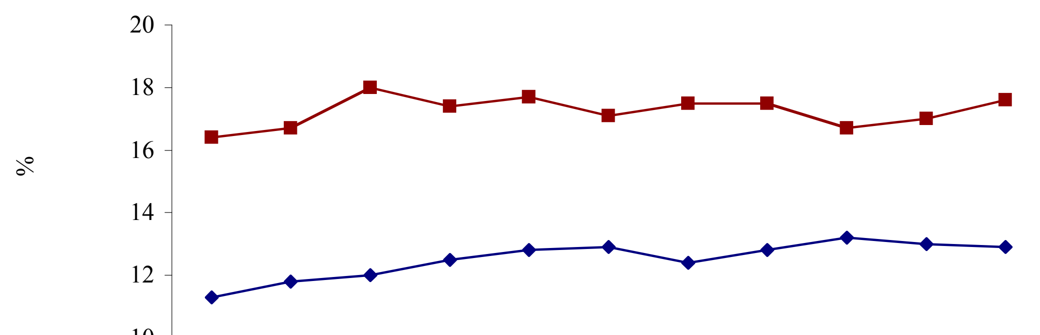
Statistics Canada defines a permanent job as one that is expected to last as long as the employee wants it, so long as business conditions persist. A temporary job is defined as one with a predetermined end date, or one that will end as soon as a project or contract is completed.[87] This work category includes contract employees, seasonal workers, casual and on-call employees, and workers hired through employment agencies. Temporary work is included by Statistics Canada under the broad category of "non-standard" work, which also includes part-time work, own-account self-employment, or multiple jobholding.[88]

According to Statistics Canada's Labour Force Survey (LFS), non-standard work (including temporary work) grew in the 1990s but has since stabilized. However, a Statistics Canada analysis notes: "This does not correspond with studies documenting workers' experiences of increasing insecurity, suggesting that the broad definition of non-standard employment is too heterogeneous to reflect aspects of precarious employment."[89]

Data on temporary employment in Canada have only been collected by Statistics Canada's LFS since 1997. Prior to that, data on temporary work were collected through the General Social Surveys (GSS) in 1989 and 1994. In 2004, GPI Atlantic reported, based on data from Statistics Canada's GSS and Labour Force Survey, that the incidence of temporary work steadily increased in Canada from 7% in 1989 to 11.4% in 1997 to 12.8% in 2001. The incidence of temporary work in Nova Scotia has exceeded the Canadian average in every year for which comparable data are available, with nearly 18% of Nova Scotian workers employed on a temporary basis in 2001—up from 16.7% in 1997.[90,91]

Between 2001 and 2007, the incidence of temporary work in both Canada and Nova Scotia remained fairly steady at about 13% in Canada and 17.5% in Nova Scotia, and in both cases has remained higher in each of those years than the 1997 averages. In 2007, the incidence of temporary work was 12.9% in Canada and 17.6% in Nova Scotia (see Figure 4-10 below).

Figure 4-10. Percent of total employees engaged in temporary work, Canada and Nova Scotia, 1997–2007



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Canada	11.3	11.8	12	12.5	12.8	12.9	12.4	12.8	13.2	13	12.9
Nova Scotia	16.4	16.7	18	17.4	17.7	17.1	17.5	17.5	16.7	17	17.6

Source: Statistics Canada. 2008. Labour Force Historical Review. Minister of Industry. Ottawa.

A 2005 Statistics Canada study reported that, between 1989 and 2004, the incidence of temporary work in Canada among newly hired private sector employees aged 25-64 (who are not full-time students) nearly doubled, rising by ten percentage points from 11% to 21%—more than twice the increase observed for all private sector employees. In other words, by 2004, more than one in every five new jobs was a temporary one. Among employees with one year of seniority or less, the incidence of temporary work increased from 14% in 1989 to 25% in 2004.[92]

When all industries are included (private and public), the incidence of temporary work among newly hired employees rose from 12% in 1989 to 22% in 2004. According to Statistics Canada, the increase in temporary work among new employees was "widespread" and affected full-time jobs, unionized and non-unionized workers, individuals aged 25 to 34 as well as their older counterparts, both men and women, and university graduates as well as individuals with other levels of education.

The Statistics Canada analysis found that younger workers were affected most by the trend towards temporary employment of new workers. In 1989, just 11% of newly hired workers (not full-time students) between 17 and 24 years of age held a temporary job. By 2004, nearly 3 times that proportion of newly hired 17 to 24-year-olds—32%—were temporarily employed.[93]

According to another 2005 study by Statistics Canada, temporary jobs are generally less well paid than permanent ones. While temporary workers are not a homogeneous group—that is, their jobs could be term or contract, seasonal, casual, or obtained through an employment agency—they earned 16% less per hour on average than their permanent counterparts ($16.69 versus $19.98).[94]

Of the four types of temporary work, contract workers showed the smallest wage gap with permanent workers—earning 8% less on average than their permanent counterparts—while seasonal workers, casual workers, and those using employment agencies earned 28%, 24%, and 40% less respectively than their permanent counterparts on an hourly basis.[95]

Temporary workers, like many part-timers, generally do not receive benefits, and their income, like their work hours, are more insecure and varied than those of permanent workers.[96] Thus, Statistics Canada data indicate that variability in work hours occurs more often in non-standard or low-quality jobs, including temporary jobs, than in permanent ones.

According to a 2006 Statistics Canada study that looked at work hours instability, variability in both income and work hours may be associated with stress and poor health outcomes. The study found that employees with the highest deviation in work hours have higher incidences of low-income, low earnings, high stress, and bad health than those with comparatively stable hours—suggesting that it is fairly unlikely that most employees are voluntarily *choosing* variable annual work hours. According to the study, a lack of stability in work hours may be an indicator of low job quality and of a low level of wellbeing altogether. It found that employees with variable annual hours did not maintain a very high standard of living through periods of either overwork or under-work, apparently indicating that periods of excess did not effectively balance periods of deprivation. The analysis concluded: "The lack of studies examining the amount and consequences of variation in working hours overtime has created a serious gap in our understanding of working time."[97]

In 2004, Harry Arthurs headed a Commission that reviewed the Federal Labour Standards for the purpose of producing recommendations for legislative and non-legislative changes to "modernize federal labour standards to ensure that they remain relevant and effective."[98] In 2006, the Commission released its report, titled *Fairness at Work: Federal Labour Standards for the 21st Century*.

The Commission paid particular attention to "vulnerable workers"—those who are vulnerable beyond the norm and who "experience deep and multiple disadvantages" in income, work conditions, living standards, education, financial security, and other circumstances. The report goes on to describe vulnerable workers as those who lack either collective or individual bargaining power, who are less likely to retain a decent job, and who are more likely to work under conditions that most Canadians would view as "highly inappropriate or even exploitative."

> Typically, they are paid low salaries and receive few—or no—fringe benefits, work unsociable hours or in difficult conditions, have little or no access to training, enjoy poor prospects of career advancement and relatively short job tenure. And—as tends to be the case with vulnerable people—they often lack the knowledge, capacity or financial means to enforce whatever statutory or contractual rights they supposedly enjoy.[99]

According to the commission's report, non-standard forms of employment—including part-time and temporary work, agency postings, and self-employment—are important indicators of vulnerability. This group of non-standard workers accounts for an astonishing 32% of the total Canadian workforce, says the report, but in the federal sector—the sector which this Commission has been charged with targeting—it accounts for about 26%. The Commission also reports that temporary employment and contract work are much more common in small and medium-sized firms than in larger firms, which employ the overwhelming majority of federal jurisdiction employees.[100]

The report also confirms what has already been reported in the literature on this subject and summarized in GPI Atlantic's 2004 *Work Hours* report—namely that non-standard work arrangements are more likely to be associated with poor pay and to carry few or no benefits. Women, young people, Aboriginals, and immigrants tend to be "overrepresented in the ranks of the vulnerable," says Arthurs.

Among the commission's many and detailed recommendations are several relating to agency and temporary workers in particular. These include:

- The Federal government should undertake a study of employment practices in the temporary placement industry to determine a) the extent to which the industry is in compliance with existing federal and provincial labour standards, and b) whether inappropriate practices exist within the industry that ought to be regulated under Part III of the Code.

- The Federal government should draw up a code of conduct which would prohibit practices or contractual terms that a) deprive agency workers of access to proper pay and benefits, b) interrupt their tenure of service after each assignment, or c) prevent them from taking permanent jobs with client firms after a defined interval.

- Employers should be required to provide temporary workers with a statement setting out the nature of the relationship, its anticipated duration, and the conditions—if any—under which the employee may be considered for permanent employment.

- Temporary employees who have worked for an employer for continuous or non-continuous periods that cumulatively total one year should be entitled to be considered for permanent employment, and should have access to the same pay that is provided to other employees with equivalent jobs.[101]

4.5. Involuntary part-time work

Data source: Statistics Canada, Labour Force Survey.

Result: Rates of involuntary part-time work have declined since 2002, though they remain considerably higher than thirty years ago.

This distinction between voluntary and involuntary part-time work is important, as high rates of part-time work only signify a real problem when they are involuntary—i.e., undertaken only because full-time work is unavailable—and when part-time work is associated with lower pay, job insecurity, and poorer work conditions.

In the Netherlands, for example, part-time work is generally seen as desirable because it fetches the same hourly pay as full-time work, and provides pro-rated benefits and equal opportunities for career advancement. Not surprisingly, rates of "*involuntary part-time work*" are generally 2.5 to 5 times higher in Canada and Nova Scotia than in the Netherlands, where part-time jobs made up a third of all employment in 2006 (and 60% of female jobs)[102]—the highest rates of part-time work in any OECD country—and where only 6% of part-timers say they would prefer full-time work.[103] By contrast, in 2007, 22% of Canadians working part-time and nearly 29% of Nova Scotians working part-time did so involuntarily and would have preferred full-time work if it were available to them.[104]

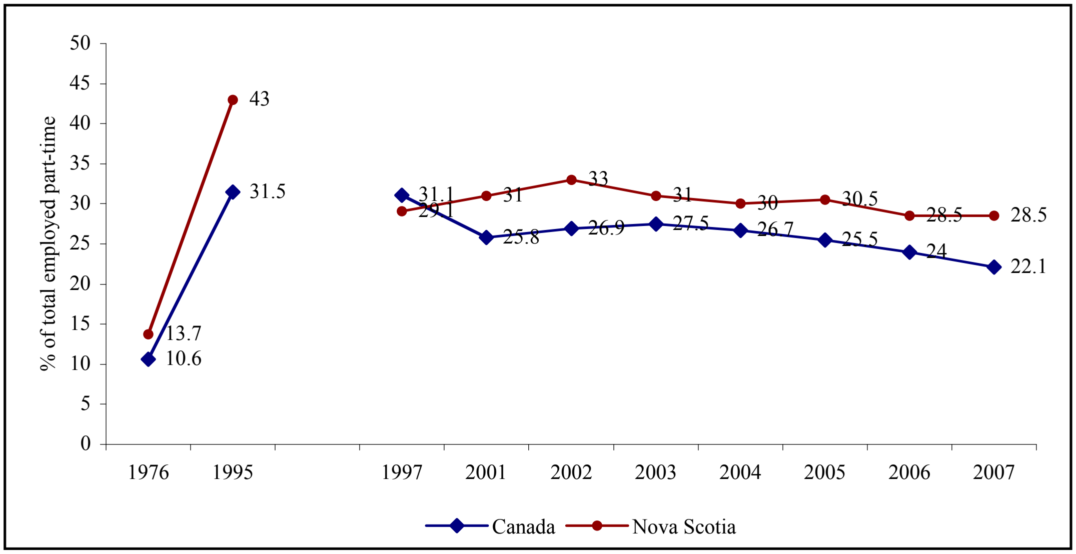
Undoubtedly, a shorter workweek can be very positive for health, family, and social reasons and therefore is not problematic in and of itself when chosen voluntarily. The majority of Canadian part-time workers choose to work part-time in order to accommodate family responsibilities, university studies, and other priorities.

However, many Canadians who do work part-time would rather be working full-time, but are unable to find full-time work. These same individuals often experience economic hardship and insecurity because their hourly pay is low and their jobs insecure, and because they have insufficient work hours to make ends meet. Involuntary part-time work is therefore a key indicator of underemployment.[105] Indeed, Statistics Canada counts the difference between standard full-time hours and the number of hours actually worked by involuntary part-timers as a measure of underemployment, and it adds these missing hours (translated into full-time job equivalents) to its "supplementary" unemployment statistics.

GPI Atlantic's 2004 *Work Hours* study reported that between 1953 and 2001 rates of part-time work in Canada more than quadrupled from 3.8% to 18.1% over this 48-year period, reaching a peak of nearly 20% in 1993.[106] In 2007, 18.1% of all employed in Canada worked part-time. In Nova Scotia, part-time employment increased from 12.5% in 1976 to a peak of nearly 20% in 1996, before dropping of somewhat to 17.8% in 2001 and 18.4% in 2007.[107] Thus, between 2001 and 2007, rates of part-time employment in both Canada and Nova Scotia have not changed significantly.

In 2004, GPI Atlantic reported that the proportion of involuntary part-timers in Canada, as a percentage of all part-timers, more than doubled from 10.6% in 1976 to 26% in 2001, though changes in Statistics Canada Labour Force Survey questionnaire and definitions render pre-1996 rates of involuntary part-time not properly comparable to post-1996 rates. Similarly, and with the same caveat, in Nova Scotia the proportion of involuntary part-timers also more than doubled from 13.7% in 1976 to 31% in 2001. By 2007, the proportion working part-time involuntarily had declined somewhat to 28.5% in Nova Scotia and 22.1% in Canada overall, though it remained considerably higher than rates reported 30 years earlier (Figure 4-11 below).

Figure 4-11. Involuntary part-time employment as percent of total part-time employment, Nova Scotia and Canada, 2001–2007



Source: Statistics Canada. 2008. Labour Force Historical Review. Minister of Industry. Ottawa.

Note: Due to changes in the Labour Force Survey (LFS) questionnaire and definitions, there was a break in the LFS series in 1995, so that pre-1996 results are not properly comparable with post-1996 results.

4.6. Work effort

Data sources: Statistics Canada Survey of Consumer Finances; Statistics Canada Survey of Labour and Income Dynamics; Statistics Canada Labour Force Survey

Result: Forty percent of the increase in real earnings between 1980 and 2001 for dual-earner Nova Scotian couples with children was purchased with increased work hours. The proportion is higher for couples shifting from single-earner to dual-earner status. Due to the high cost of data purchase from Statistics Canada, it is not possible at this time to assess progress for this indicator since 2001.

A comparison of trends in work hours with trends in income has shown that a substantial portion of people's increased real annual income does not come from improved wages but instead comes from working longer hours. Many workers have essentially "bought" their increased disposable income with increased work effort. Yet at the same time, many of these same Canadians feel overworked, and may feel none the richer if they experience what Harvey and Mukhopadhyay have labelled "time poverty".[108]

In 2004, GPI Atlantic reported that middle class Canadians had more real disposable income than they did 20 years earlier, but that they were working longer hours to get it. Between 1980 and 2001, the average disposable income of working couples with children increased by 14% in real terms, and between 2001 and 2006 it increased a further 4.1%. But in 2000, employed Canadian parents were actually working 206 more hours per year for pay—equal to 26 more eight-hour workdays or more than five additional full-time weeks of work each year—than they did in 1981. This means that 24% of the increase in real earnings between 1980 and 2001 was actually purchased with more hours worked.[109]

In Nova Scotia between 1980 and 2001, the average disposable income of couples with children and full-time jobs increased by just over 8%, and between 2001 and 2006 it increased a further 10%. But in 2000, dual-earner parents were working 141 more hours a year for pay—equal to 18 more eight-hour work days or three and a half additional full-time workweeks a year—than they did in 1981. This means that 40% of the increase in real earnings between 1980 and 2001 was purchased with more hours worked.

Due to financial constraints, and the high cost of data purchase from Statistics Canada, it was not possible at this time to update this indicator.[110] This is unfortunate, as the relationship between work hours and income trends (here labelled "work effort") is a vital indicator in assessments of work-life balance, wellbeing, and quality of life that is missed in conventional indicator systems and accounting mechanisms that track real income changes without regard to their causes. Indeed, this indicator well illustrates the seminal difference between measures of progress like the GPI that are based on net changes and those based on GDP that consider only gross changes over time. Because of the importance of this work effort indicator, GPI Atlantic strongly recommends that Statistics Canada make work effort data publicly available without charge.

It should also be noted that the increase in disposable income purchased through increased work effort calculated above is actually an underestimate because it only tracks changes for couples that were *already* dual-earner couples in 1980. However, female labour force participation has risen sharply since the early 1980s, so that many formerly single-earner households have now become dual-earner households. For these households, this rise in women's labour force participation constitutes an "increased work effort" that is not captured in the statistics presented above. Indeed, for these households, there is no question that increased household income was purchased with longer household work hours. In short, the increased household work effort of families switching from single-earner status to dual-earner status is missed in our analysis above.

4.7. Work stress

Data sources: Statistics Canada, National Population Health Survey (NPHS), Canadian Community Health Survey (CCHS)

Result: Data from these two surveys are not comparable, and it is not therefore possible to ascertain a trend at this time.

While unemployment and underemployment create their own major stresses, paid work can also create significant stresses on employees as a result of excess demands and hours, personnel conflicts, job insecurity, lack of decision-making latitude, and other job-related pressures. The Canadian Centre for Occupational Health and Safety defines workplace stress as “the harmful physical and emotional responses that can happen when there is conflict between job demands on the employee and the amount of control an employee has over meeting these demands.”[111]

Work stress can result from a number of work-related conditions including quantitative or qualitative overload such as long work hours, too much to do, time pressure, and repetitious work combined with high output expectations. Work stress is also caused by the absence of job security, lack of control or autonomy, fear of accident or injury, poor interpersonal relationships with co-workers or supervisors, lack of support from management or co-workers, and the “treadmill syndrome”—the sense of never being able to leave work, which is exacerbated by use of email and other difficult to escape technologies.[112]

Statistics Canada found that key factors which played a significant role in producing and exacerbating work stress were job strain (defined as the “measure of the balance between the psychological demands of a job and the amount of control or decision-making power it affords”); job insecurity; high physical demands; and lack of supervisor support and co-worker support.[113]

Work “underload,” and lack of stimulus, challenge, and variety of work, can also cause work stress. Inadequate work, demand, and hours may be associated with a perceived threat of layoff, with potential consequent income loss and the economic stress of not being able to make ends meet.[114]

As previously noted, Health Canada released a seminal study in 2002 showing that having too many hours of work was one of the most important contributors to stress in Canada.[115] A 2003 Statistics Canada study on work stress, based on General Social Survey data, also found that over one-third of Canadians cited too many demands and long hours as the most common source of workplace stress—more than cited any other cause. The self-employed (37%) and full-time employees (37%) were the most likely to feel stressed by too many demands / hours, and nearly 50% of employees who worked 41 or more hours per week cited too many demands and long hours as the key source of work stress.[116]

The literature indicates that stress can result in a myriad of behavioural, psychological, and physiological effects. For example, the physiological health effects of work stress and of stress resulting from poor work–life balance have been well documented and include depression, heart disease, arthritis, peptic ulcers, digestive tract disorders, cancer, asthma, hypertension, menstrual disorders, skin diseases, and more.[117]

According to Health Canada, both chronic stress and stressful life events can have "at least a strong indirect impact on physical and mental health, by affecting physiology and morphology of the circulatory system and—by psychoneuro-immunological mechanisms—by affecting the development of cancer."[118]

Numerous studies suggest that stress plays a key role in suppressing our immune systems, thereby making us more susceptible to infectious diseases, as well as increasing the rate of growth of certain tumours. According to one analysis:

> Stress has been linked to changes in the levels of circulating antibodies, lymphocyte cytotoxicity, and lymphocyte proliferation. [. . .] There is every reason to believe that stressful elements of the work environment also may elicit changes in immunocompetence and thereby influence health status.[119]

And, according to Lowe and Northcott: "Psychological distress often goes hand in hand with a deterioration in physical health. [. . .] Stressors undermine and wear away at psychic and bodily defences."[120]

Data from the 2002 Canadian Community Health Survey cycle on Mental Health and Wellbeing, indicate that nearly 9% of workers reported they were either "not too satisfied" with their work or "not at all satisfied" with their work—amounting to a total of 1.3 million Canadians. According to a Statistics Canada analysis of these results, there are clear associations between the amount of job stress workers perceive and their job satisfaction levels. One out of 15 workers who found most days "not at all" stressful, "not very" stressful, or "a bit" stressful, were dissatisfied. Among workers who found most days to be "quite a bit" stressful, the number dissatisfied increased to 1 in 10. Among workers who found most days "extremely" stressful, 1 in 4 were dissatisfied with their jobs.[121]

The same study also found that job satisfaction was related to a number of job characteristics. For example, job dissatisfaction was higher among men and women who:

- worked in sales or service, processing, manufacturing, or utilities
- did shift work that involved evening or night shifts
- had only some postsecondary education
- had incomes less than $20,000[122]

According to the same 2002 CCHS data, working women were more likely than their male counterparts to report high job strain and high work stress. The survey indicated that 28% of employed women have high job strain, compared with 20% of men. In addition, one-third of women felt quite a bit or extremely stressed most days at work, compared with 29% of men.[123]

Statistics Canada also undertook a longitudinal analysis of the effects of work stress using the National Population Health Survey beginning in 1994/1995 and re-interviewing respondents every two years (1996/1997, 1998/1999, 2000/2001, 2002/2003, and 2004/2005). The study found that workers with active jobs[124] were twice as likely as those with low-strain jobs to have reduced work activities two years later. Statistics Canada notes:

> This is not consistent with the assumption that active jobs create the context of growth and learning conducive to high productivity. Being in active jobs may raise current productivity, but working under high demands and high responsibility (control) may cost workers health and productivity later.[125]

In addition, both men and women who worked in physically demanding jobs were 1.6 times more likely than those in other jobs to reduce their work activities two years later. Men with high strain jobs were also more likely than workers with low-strain jobs to reduce their work activities, suggesting that these types of work stress may contribute to long-term health problems that have an impact on productivity.[126]

A Statistics Canada analysis of 1994/1995 National Population Health Survey (NPHS) health survey data found that psychological distress tended to be highest among workers in jobs with high demands but little decision-making power. As Table 4-4 below shows, fully 40% of workers in these kinds of jobs had high levels of psychological distress. Twenty-seven per cent of those who had demanding jobs but who had freedom to make decisions about their work experienced distress. Workers with the lowest job demands were least likely to report high levels of distress, but even in these types of jobs, the level of distress increased as decision latitude declined.[127] These results indicate that lack of decision-making latitude at work may play a key role in exacerbating work stress at every level of job demand.

In addition the same analysis showed that women experience higher levels of psychological distress than men, and that people working directly with people (particularly in the service industry) were most likely to suffer from job strain.[128]

According to Statistics Canada, it is not possible to update these 1994/1995 data relating work conditions with psychological distress, because the original table below, created in 1998, used data from the cross-sectional file of the NPHS. Since then, the NPHS has evolved into a strictly longitudinal survey, and therefore the same table cannot be reproduced.

The Canadian Community Health Survey (CCHS) added an optional module on work-related stress to its 2002 survey, some results of which are reported above based on Statistics Canada analytical papers. GPI Atlantic attempted unsuccessfully to access Statistics Canada data for the optional module on stress now contained in the CCHS. These data are available either for purchase at a cost not financially feasible for GPI Atlantic at this time or can be accessed by those with a university affiliation through university Research Data Centres. Another potential avenue of access to these data is through Statistics Canada's research proposal request procedure (http://www.statcan.ca/english/freepub/82-221XIE/2008001/tblstructure/2nonmed/2lw/lw2dla-en.htm).[129] None of these options were feasible for GPI Atlantic at this time due to resource constraints, but it is recommended here these CCHS stress data be included in future updates of this material.

Table 4-4. Workers reporting high psychological distress (% with high psychological distress score), Canada, l994–1995

JOB DEMANDS	JOB DECISION LATITUDE			
	High	Moderate	Low	Very low
High	27	33	33	40
Moderate	24	26	30	35
Low	19	20	21	30
Very low	16	18	22	20

Source: Wilkins, Kathryn and Marie P. Beaudet. l998. "Work Stress and Health." Health Reports. Statistics Canada. Catalogue. No. 82-003. Minister of Industry. Ottawa. p. 52.

LIVING STANDARDS

5. Employment

For the original GPI Atlantic report on employment, please see the following:

Working Time and the Future of Work in Canada: A Nova Scotia GPI Case Study (2004)
http://gpiatlantic.org/pdf/workhours/workhours.pdf

Headline Indicators

1. Official unemployment rate and supplementary unemployment rate
2. Extent of "hours polarization"
3. Incidence of overtime
4. Incidence of temporary work
5. Rate of involuntary part-time work
6. Increase in real annual income as a proportion of increase in work effort
7. Extent of high chronic and accute stress due to work-related issues

Note: For this chapter, please see the previous chapter, "Paid Hours of Work," which falls into both the Time Use and the Living Standards domains.

6. Income Distribution

For the original GPI Atlantic report on income distribution, please see the following:

Income Distribution in Nova Scotia (2001)
http://gpiatlantic.org/pdf/incomedist/incomedist.pdf

Headline Indicators

1. Income inequality (gap between rich and poor)
2. Prevalence of low income
3. Gini coefficient
4. Gender wage gap: hourly female to male wage ratio

6.1. Why income distribution matters

Income and its distribution are widely acknowledged as core and basic indicators of wellbeing. Abundant evidence links poverty with physical deprivation, illness, crime, poor educational attainment, low productivity, stress, and other detriments to wellbeing. Income inequality also affects societal wellbeing and cohesiveness more broadly. According to Dalhousie University economist Lars Osberg:

> Increasing inequality has both a direct and an indirect effect on everybody's well-being. Social Capital has been defined as the "shared values and rules for social conduct expressed in personal relationships, trust and a common sense of 'civic' responsibility"—it is the glue that holds our social institutions together, and which enables our society to function, either well or poorly. But when monster homes devour the landscape while the homeless clutter the sidewalks, that glue weakens.[1]

Indeed, since ancient times, political analysts have observed that extreme inequities can undermine political stability and social cohesion. Nearly 2,500 years ago, for example, Aristotle warned that "revolutions arise from inequalities." By contrast, Aristotle wrote that the most secure, stable, cohesive, and harmonious state is one "composed, as far as possible, of equals and similars; and these are generally the middle classes." Thus, "moderation and the mean are best, and therefore it will clearly be best to possess the gifts of fortune in moderation; for in that condition of life men are most ready to follow rational principle."[2]

Poverty and inequality are among the most reliable predictors of poor health. According to Statistics Canada, "The relationship between socioeconomic status and health is one of the most pervasive in the epidemiologic literature and has held up over time and in countries throughout the world."[3] The World Health Organization (WHO) states that people who are poor run at least twice the risk of serious illness and premature death when compared to those with higher incomes.[4] Socioeconomic status has been identified as a precursor cancer, cardiovascular disease, arthritis and musculoskeletal disorders, diabetes mellitus, dental diseases, drug dependence and abuse, and infant mortality and morbidity.[5]

Child poverty has been linked to a wide array of physical, psychological, emotional, and behavioural problems among children, including higher rates of respiratory illnesses and infections, sudden infant death syndrome, obesity, high blood lead levels, iron deficiency anaemia, chronic ear infections, mental retardation, fetal alcohol syndrome, and dental problems.[6] Low-income children are more likely to have low birth weights, poor health, less nutritious foods, higher rates of hyperactivity, delayed vocabulary development, and poorer employment prospects.[7]

Although they engage in less organized sports, poor children have higher injury rates and twice the risk of death due to injury than children who are not poor.[8] A study published in *Psychological Science*, found that the longer children spent in poverty, the worse their bodies were at handling the stressors of their environment—increasing their risk for long-term health problems.[9]

A Canadian analysis of the impacts of income on child wellbeing concluded that: "As family incomes fall, the risks of poor developmental outcomes in children's health, behaviour, learning and socialization rise."[10] A detailed analysis of both the National Longitudinal Survey on Children and Youth and the National Population Health Survey found that some 31 different indicators all showed that as family income falls, children are more likely to experience problems.[11]

However, a growing body of evidence indicates that not only poverty, but also the *distribution* of income—the gap between rich and poor and the extent of income inequality—has important consequences for health. For example, higher income inequality has been correlated with higher rates of mortality,[12] lower self-rated health,[13] and greater prevalence of obesity.[14] According to the *British Medical Journal*:

> What matters in determining mortality and health in a society is less the overall wealth of the society and more how evenly wealth is distributed. The more evenly wealth is distributed, the better the health of that society.[15]

And a November 2007 analysis in the *British Medical Journal*, concluded that: "Improvements in child wellbeing in rich societies may depend more on reductions in inequality than on further economic growth."[16]

According to Statistics Canada, there are two key reasons why income distribution may affect health. Socio-psychological research suggests that individuals at the bottom of the income ladder may feel greater "anxiety and shame" about their lot in comparison with those better off. Over time, this negative emotion can lead to chronic stress, which in turn can lead to adverse physical health outcomes. The second key reason, based on what is called the neo-material approach, suggests that the poor suffer adverse health effects from not having access to the same resources or living conditions, such as health care, nutritious food, housing, secure employment, and a sense of social belonging.[17, 18]

The association between inequality and mortality is particularly strong in the United States, where access to health care and high-quality education is very limited for many of the poor. In Canada, by contrast, basic health care services remain publicly funded and universally available. Examining the comparative US and Canadian data, Statistics Canada finds that: "As a consequence, in the United States, an individual's income, in both a relative and absolute sense, is a much stronger determinant of one's life chances, and, in turn, their 'health chances,' than in Canada."[19]

It should be noted, however, that a growing proportion of Canada's health care spending is now in the private sector and that there have been sharp increases in direct private health expenditures as a proportion of disposable income.[20] As a result, low-income Canadians are less able to afford certain health care costs than they were once were and they have less access to private health care providers than those with higher incomes. Also, only the richer provinces may be able to afford high quality public health care if federal transfers fail to deal adequately with regional disparities.[21]

> Poverty and income distribution have also been demonstrated to affect productivity, educational attainment, and a wide range of other determinants of wellbeing. For example, results from the Programme for International Student Assessment (PISA) show that—in all 32 participating countries—students from higher socioeconomic backgrounds had stronger literacy skills and performed better in math.[22] Canadian PISA results revealed a clear income-related performance gradient, with scores increasing with each income level in every province in the country.
>
> In 2000, in a book analysing the PISA results, the OECD observed that "the school students attend is strongly predictive of their performance" and that "the socio-economic composition of schools explains far more of the differences in student performance between schools than do other school factors that are more easily amenable to policy makers, such as school resources and school policies."[23]

A growing body of evidence has also linked greater equity with improved economic performance. Analysts have linked poverty and inequality to a loss of innovation potential and a waste of precious human assets.[24] And studies have found that nations with greater income equality are more economically successful according to a wide range of performance indicators.[25]

Despite the proven importance of income distribution and low income in affecting health, productivity, educational attainment, social cohesion, economic performance, and other determinants of personal and societal wellbeing, GDP-based measures of progress report only total and average income, but tell us nothing about how that income is shared. Indeed, GDP growth statistics and GDP per capita averages can be deceptive markers of wellbeing, since an increase in income among the wealthy can skew the averages up, even if most people are getting poorer and if inequality is growing.

By contrast, and for the reasons outlined above, declines in poverty and income inequality and improvements in income security and equity are core indicators of wellbeing and progress in the Genuine Progress Index (GPI). Indeed, without income data by income group, we can never test the assumption that a growing economy makes us "better off." Measures of income distribution are also crucial for practical policy purposes in order to assess how different economic policies—such as free trade, tax cuts, debt reduction, or cuts in particular government services—differentially affect different sectors of the population and impact their livelihood security. Indeed, economic growth itself may have a different impact on the rich than on the poor, since the changing composition of the GDP may impact lower income groups differently than higher income groups.

6.2. Income inequality (gap between rich and poor)

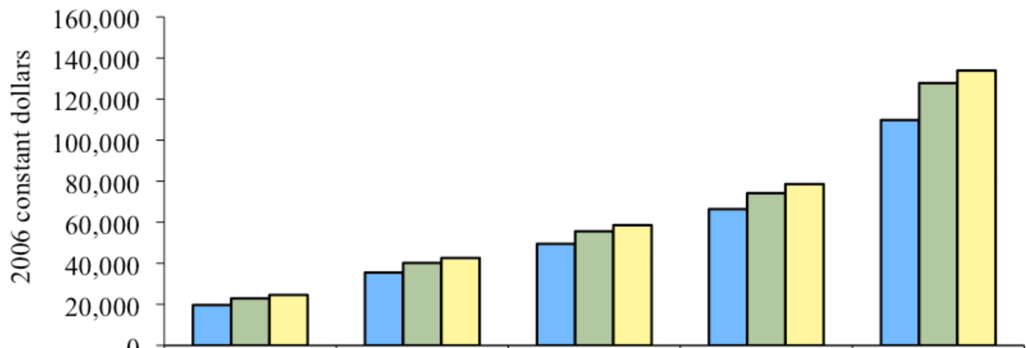
Data sources: Statistics Canada, Income in Canada, 2006: Survey of Consumer Finances and Survey of Labour and Income Dynamics.

Result: The gap between rich and poor Canadians has widened substantially since 1981, while it has narrowed somewhat in Nova Scotia. The regional income gap (between the richest and poorest provinces) continues to widen.

According to the most recent income data reported by Statistics Canada, the difference between the average after-tax income of the richest 20% of Canadian households and that of the poorest 20% continues to widen.[26] The real income gap between rich and poor increased by 27% between 1996 and 2006 for families of two or more persons, and by 32% among unattached individuals.[27]

As Figure 6-1 below illustrates, between 1997 and 2006, the gap increased by 21% among economic families of two persons or more. This is because real disposable income increased by $24,100 for the richest 20% but only by $4,900 for the poorest 20% during this ten-year period. Figure 6-2 below shows that, between 1997 and 2006, the income gap increased by 30% for unattached individuals, because the richest 20% of unattached Canadians saw their real disposable income grow by $13,600, while the poorest 20% saw a gain of only $700.

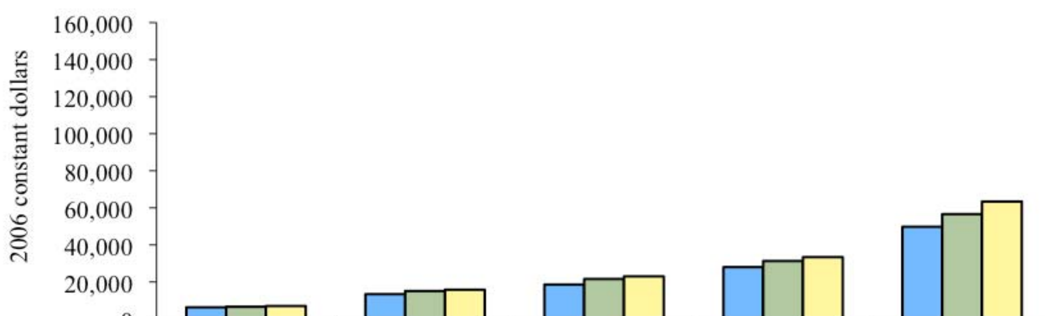
Figure 6-1. Average after-tax income for economic families (2006 constant dollars), by quintile, Canada, 1997, 2001, and 2006



	Lowest quintile	Second quintile	Third quintile	Fourth quintile	Highest quintile
1997	19,700	35,500	49,500	66,400	109,800
2001	22,900	40,200	55,600	74,200	127,800
2006	24,600	42,600	58,600	78,600	133,900

Source: Statistics Canada. 2008. *Income in Canada 2006*. Catalogue no. 75-202-XIE. Minister of Industry, Ottawa. Table 8-5.

Figure 6-2. Average after-tax income for unattached individuals (2006 constant dollars), by quintile, Canada, 1997, 2001, and 2006



	Lowest quintile	Second quintile	Third quintile	Fourth quintile	Highest quintile
1997	6,300	13,400	18,600	28,000	49,800
2001	6,600	15,100	21,600	31,300	56,600
2006	7,000	15,800	23,000	33,400	63,400

Source: Statistics Canada. 2008. *Income in Canada 2006*. Catalogue no. 75-202-XIE. Minister of Industry, Ottawa. Table 8-5.

The impact of government transfers and taxes in reducing the income gap is seen by comparing market income with income after transfers and after taxes. In 2006, the average market income for Canadian families in the highest quintile was 12.3 times higher than for those in the lowest quintile and 6.7 times higher when government transfers were included. When taxes are deducted (after-tax income), the highest quintile had 5.4 times more disposable income than its counterparts in the lowest quintile. When after-tax income is adjusted for family size, the ratio was 5.0, since low-income households include more students, youth, and unmarried individuals, and thus tend to have fewer household members than higher income households.[28]

Table 6-1 below shows how this ratio of after-tax income for the richest and poorest 20% of Canadian households (adjusted for family size) has changed between 1981 and 2004 in Canada and the provinces.[29] In Canada, the ratio increased from 4.6 to 5.1 in this time period, peaking at 5.2 in 1998, while in Nova Scotia it rose dramatically from 4.3 in 1981 to 5.3 in 1998 and then decreased sharply to 4.3 in 2004. Purchased Statistics Canada data for 2006 indicate that the ratio decreased to 5.0 in Canada and to 4.1 in Nova Scotia in 2006.[30] Thus the rich-poor income gap in 2006 was 18% narrower in Nova Scotia than nationwide.

Table 6-1. Average disposable household income ratios—richest 20% : poorest 20% ($2004), Canada and provinces, 1981–2004

	1981	1993	1998	2004
CAN	4.6	4.7	5.2	5.1
NL	4.5	4.8	4.4	4.5
PE	4.1	3.5	3.8	3.9
NS	4.3	4.6	5.3	4.3
NB	4.7	4.2	4.5	4.6
QC	4.4	4.1	4.5	4.3
ON	4.2	4.7	5.3	5.3
MB	5.0	4.6	4.5	4.5
SK	5.5	4.7	4.5	4.6
AB	4.5	5.5	6.0	5.2
BC	4.6	4.8	5.2	6.0

Source: Statistics Canada. CANSIM Table 202-0706C—Survey of Consumer Finances and Survey of Labour and Income Dynamics.

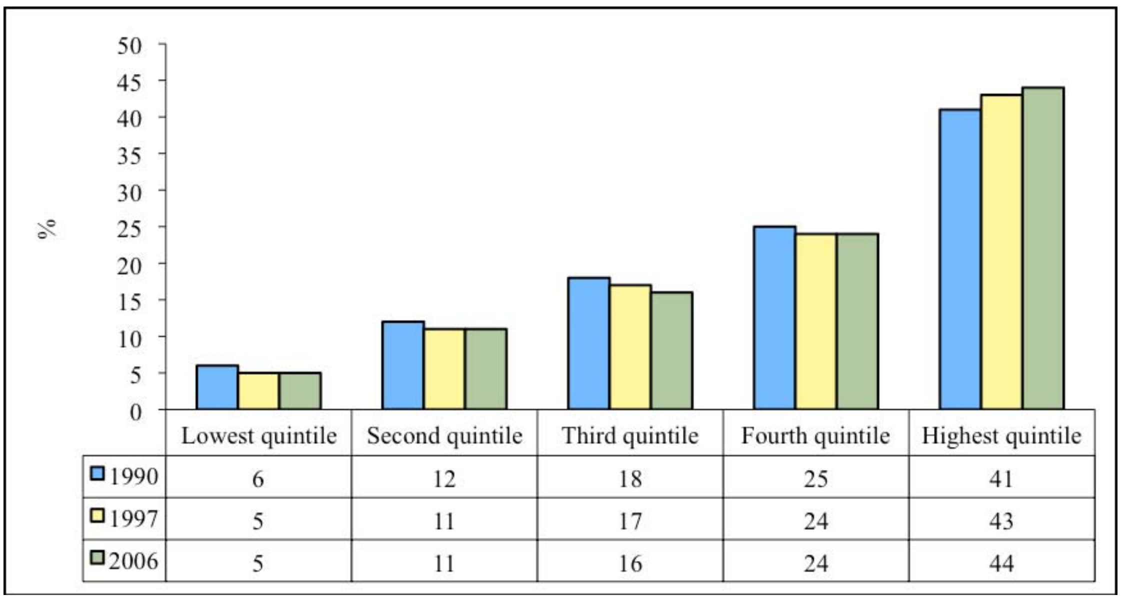
Note: After-tax income is adjusted for family size.

Table 6-1 above indicates that Prince Edward Island had the most equitable distribution of income in the country in 2004, with the smallest ratio between the richest and poorest 20% at 3.9, down from 4.1 in 1981, followed by Nova Scotia and Quebec at 4.3. British Columbia had the least equitable distribution of income in 2004 at 6.0, up sharply from 4.6 in 1981, followed by Ontario (5.3) and Alberta (5.2). It is likely that the difference is largely explained by the greater proportion of high-income households in those provinces compared to the rest of Canada.

In 2006, when all Canadian family units are considered, the lowest quintile earned 5% of the total Canadian after-tax income while the highest quintile earned 44%. This means that the richest 20% of Canadian households had nearly nine times the income share of the poorest 20%. Combining the two bottom quintiles and two top quintiles, the poorest 40% earned 16% of after-tax income while the richest 40% earned 68% (Figure 6-3 below).

When income shares by quintile are analysed over a 16-year period, it is seen that the share of total after-tax income has decreased for all quintiles except for the highest, which increased its share from 41% in 1990 to 44% in 2006. In other words, even after taking into account the ameliorating effect of transfers and taxes on the income gap, it is apparent that the richest 20% of Canadians have steadily increased their share of total income at the expense of the remaining 80%. Proportionally, the biggest losers have been middle-income Canadians, whose share of total income declined from 18% in 1990 to 17% in 1997 to 16% in 2006 (Figure 6-3 below).

Figure 6-3. Income shares for all family units (% of total after-tax income), by after-tax income quintiles, Canada, 1990, 1997 and 2006



Source: Statistics Canada. 2008. *Income in Canada 2006*. Catalogue no. 75-202-XIE. Minister of Industry, Ottawa. p. 80; Statistics Canada. 2001. *Income in Canada 1999*. Available from http://www.statcan.ca/english/freepub/75-202-XIE/75-202-XIE1999000.pdf. Accessed September 9, 2008.

Table 6-2 below shows the average disposable income for economic families by quintile for Canada, Nova Scotia, and Ontario from 1976 to 2006, adjusted for family size. It is clear that real after-tax incomes largely stagnated in all three jurisdictions for the 20-year period from 1976 to 1996, but have increased dramatically since then.

While incomes in Nova Scotia have generally been lower historically than those in Canada and Ontario for all quintiles, Table 6-2 indicates that the biggest difference is that Nova Scotia has fewer rich families than Canada and Ontario. For the poorest 20% of Nova Scotians, average disposable income in Nova Scotia ($15,200) was virtually identical to that in Canada and Ontario. For the second lowest 20% it was 5.5% lower than in Canada; for the middle 20% it was 8.8% lower, and for the second highest 20% it was 11.3% lower. But the richest 20% in Nova Scotia had after-tax incomes 16.6% lower than nationwide and 20.9% lower than in Ontario.

Nevertheless, the richest 20% of Nova Scotians have seen a dramatic 45% increase in real disposable income since 1976—up by an average of $19,400 from $43,500 in 1976 to $62,900 in 2006. While the poorest 20% of Nova Scotians saw a large relative increase in after-tax income (41%), the absolute value of that increase was a modest $4,400—virtually all of which occurred in the last decade—from $10,800 in both 1976 and 1996 to $15,200 in 2006 (Table 6-2).

Table 6-2. Average disposable (after-tax) income for families of two persons or more ($2006), income by quintile, adjusted for family size, Canada, Nova Scotia, and Ontario, 1976–2006

	1976	1981	1986	1991	1996	2001	2006
CANADA							
Lowest quintile	$11,500	$12,600	$12,800	$12,600	$11,800	$13,900	$15,100
Second quintile	$20,600	$21,900	$21,600	$21,200	$20,800	$23,900	$25,300
Third quintile	$27,600	$29,000	$28,600	$28,000	$28,100	$31,900	$34,100
Fourth quintile	$36,200	$37,700	$37,000	$36,600	$36,800	$42,000	$45,000
Highest quintile	$57,500	$57,500	$58,500	$58,100	$59,600	$71,400	$75,400
NOVA SCOTIA							
Lowest quintile	$10,800	$10,700	$11,300	$11,900	$10,800	$12,900	$15,200
Second quintile	$17,500	$17,900	$18,500	$19,300	$18,700	$21,200	$23,900
Third quintile	$22,700	$23,800	$24,200	$24,900	$24,700	$28,200	$31,100
Fourth quintile	$28,800	$30,300	$31,800	$32,100	$32,400	$36,500	$39,900
Highest quintile	$43,500	$46,300	$50,700	$49,000	$50,300	$61,900	$62,900
ONTARIO							
Lowest quintile	$12,500	$14,000	$14,700	$13,800	$12,800	$15,300	$15,200
Second quintile	$22,000	$23,600	$24,400	$23,200	$22,800	$26,100	$26,400
Third quintile	$29,200	$30,900	$31,300	$30,700	$30,700	$34,900	$35,900
Fourth quintile	$38,100	$39,500	$39,900	$40,200	$39,800	$45,400	$47,100
Highest quintile	$60,100	$58,900	$63,400	$64,100	$65,100	$79,100	$79,500

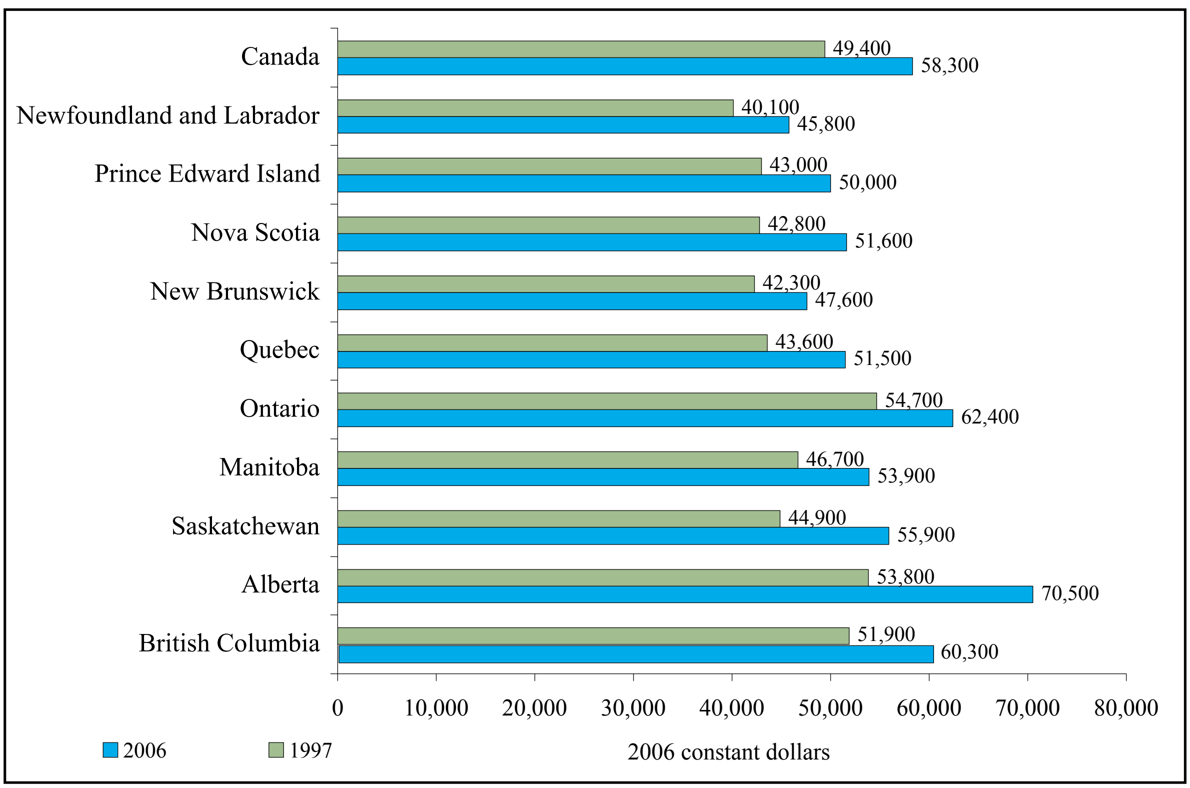
Source: Statistics Canada. CANSIM Table 202-0706—Market, total and after-tax economic family income, by adjusted after-tax income quintiles, 2006 constant dollars, annual. Accessed July 15, 2008.

Notes: Statistics Canada ranks all population units, whether unattached individuals or families, from lowest to highest by the value of their income of a specified type, such as market income, total income (including transfers), and after-tax or disposable income. Then the ranked population is divided into five groups of equal numbers, called quintiles. Table 6-2 above shows the average after-tax income for economic families of two persons or more (adjusted for family size), and does not include unattached individuals.

According to Statistics Canada, Albertan families had the highest median after-tax incomes in the country for the third consecutive year, ($70,500 in 2006), followed by Ontario ($62,400) and British Columbia ($60,300). Families in the Atlantic provinces had the lowest median after-tax incomes in both 1997 and 2006, with Newfoundland and Labrador ranking lowest ($45,800) in 2006, followed by New Brunswick ($47,600), Prince Edward Island ($50,000) and Nova Scotia ($51,600).[31]

Median income figures reveal a growing regional income disparity between Alberta and the rest of the country. Among the Atlantic provinces, Nova Scotia alone exceeded the national rate of median disposable income growth, but the Atlantic region as a whole lagged behind the Canadian rate, while Alberta shot ahead dramatically. Thus, in the ten-year period from 1997 to 2006, median family income increased by 31% in Alberta, 21% in Nova Scotia, 18% nationwide, 16% in Prince Edward Island, 14% in Newfoundland and Labrador, and 13% in New Brunswick (Figure 6-4 below).[32]

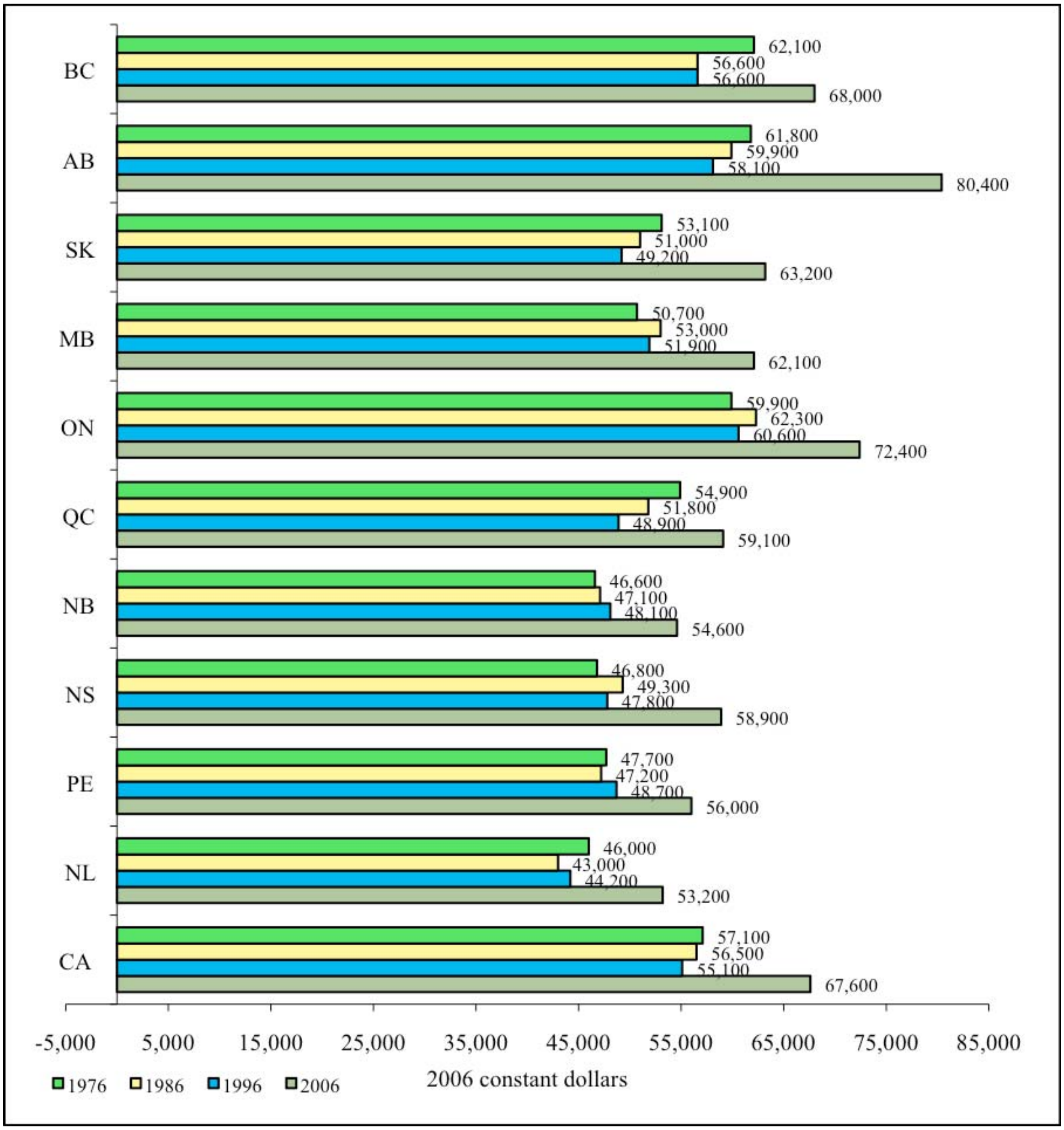
Figure 6-4. Median after-tax income for families of two persons or more ($2006), Canada and provinces, 1997 and 2006



Source: Statistics Canada. 2008. *Income in Canada 2006*. Catalogue no. 75-202-XIE. Minister of Industry, Ottawa. Table 6-1.

Over a longer 30-year time span (1976–2006), and considering average rather than median incomes, the income gap between the richest provinces (Alberta and Ontario) and the rest of the country generally grew between 1976 and 2006. In 2006, average family after-tax incomes in Alberta ($80,400) and Ontario ($72,400) far exceeded those in the Atlantic region—Nova Scotia ($58,900), Prince Edward Island ($56,000), New Brunswick ($54,600), and Newfoundland and Labrador ($53,200) (Figure 6-5 below). As noted earlier, averages can be skewed up by the incomes and gains of the richest, so the larger proportion of high-income families in Alberta and Ontario accounts for the increasingly sharp disparity between these two provinces and the rest of the country.

Figure 6-5. Average after-tax income for families of two persons or more ($2006), Canada and provinces, 1976, 1986, 1996, and 2006



Source: Statistics Canada. CANSIM Table 202-0702—Survey of Consumer Finances and Survey of Labour and Income Dynamics. Purchased.

In 1980, the average Nova Scotian family had 80 cents of disposable income for every $1 in Ontario (after-tax incomes of $48,600 and $61,100 respectively). In 1996 the ratio was 79 cents in Nova Scotia for every $1 in Ontario ($47,800 versus $60,600), and in 2006 it was 81 cents in Nova Scotia for every $1 in Ontario. In 2006, Nova Scotians had only 73 cents for every $1 in Alberta compared to 82 cents in 1986 and 1996 (Figure 6-5 above and Table 6-3 below).

Table 6-3. Average disposable income for families of two persons or more compared to Ontario ($2006), Canada and provinces, 1976, 1986, 1996, and 2006

	PERCENT OF ONTARIO			
	1976	**1986**	**1996**	**2006**
CAN	95.3	90.6	90.9	93.3
NL	76.7	69.0	72.9	73.4
PE	79.6	75.7	80.3	77.3
NS	78.1	79.1	78.8	81.3
NB	77.7	75.6	79.3	75.4
QC	91.6	83.1	80.6	81.6
MB	84.6	85.0	85.6	85.7
SK	88.6	81.8	81.1	87.2
AB	1.03	96.1	95.8	1.11
BC	1.04	90.8	93.3	93.9

Source: Statistics Canada. CANSIM Table 202-0702—Survey of Consumer Finances and Survey of Labour and Income Dynamics. Purchased.

For economic families overall, the largest single component of income is employment earnings. According to Statistics Canada, for every $100 of income received in 2005 by all economic families (including those without employment), employment earnings accounted for $78. When trends in employment earnings are examined, the role of transfers and taxes in reducing disposable income inequality becomes even clearer.

According to Statistics Canada census data, the gap in real employment earnings widened sharply between 1980 and 2005. After factoring in inflation, real median earnings among the top 20% of full-time full-year earners increased by 16.4%, while median earnings among the poorest 20% dropped by 20.6% during the same 25-year time period. Among the middle 20%, median earnings stagnated, increasing by only 0.1%.[33]

Census data show that full-time workers in Nova Scotia have seen almost no increase in real wages over the last quarter century. The median income of full-time workers in Nova Scotia increased by only 1.1% (only $385) between 1980 and 2005 ($2005).[34]

According to a recent study by Lars Osberg for the Canadian Centre for Policy Alternatives, Canada's inequality in both wealth and income grew between 1981 and 2006, and average real wages have stalled since 1979. At the same time, the incomes of the richest Canadians (especially the top 1%) have grown strongly, especially since the 1990s, while the lot of the disadvantaged got much worse, since cuts to social programs in the 1990s "substantially increased the poverty gap."[35]

Table 6-4 below presents summary data on pre-tax income for all households from 1951 to 2005. Between 1951 and 1981, the share of the top 20% fluctuated between 41.1% and 43.3% and has increased fairly steadily since then to reach nearly 47% in the present decade. Between 1981 and 2005 the middle 60% have lost 4.7 percentage points, from 53.8% to 49.1% of household pre-tax income, which is roughly the same proportionate loss as the bottom 20%.

Table 6-4. Share of aggregate pre-tax incomes received by each quintile of families and unattached individuals (%), Canada, 1951–2005

QUINTILE	1951	1961	1971	1981	1991	1996	2001	2005
Bottom 20% (poorest)	4.4	4.2	3.6	4.6	4.5	4.2	4.1	4.1
Second 20%	11.2	11.9	10.6	11	10	9.6	9.7	9.6
Middle 20%	18.3	18.3	17.6	17.7	16.4	16	15.6	15.6
Fourth 20%	23.3	24.5	24.9	25.1	24.7	24.6	23.7	23.9
Top 20% (richest)	42.8	41.1	43.3	41.6	44.4	45.6	46.9	46.9

Source: Osberg, Lars. 2008. A Quarter Century of Economic Inequality in Canada: 1981–2006. Canadian Centre for Policy Alternatives. Ottawa, Table 1. Available from http://www.policyalternatives.ca/documents/National_Office_Pubs/2008/Quarter_Century_of_Inequality.pdf. Accessed July 14, 2008.

6.3. Prevalence of low income

Data sources: Statistics Canada, Income in Canada, 2006: Survey of Consumer Finances; Survey of Labour and Income Dynamics. Statistics Canada 2001 Census

Result: There has been a decline in the prevalence of low income in both Canada and Nova Scotia. However, economic vulnerability remains highly concentrated among certain groups.

In the absence of an official poverty measure in Canada, many organizations and researchers use Statistics Canada's Low Income Cut-Off (LICO)—a threshold of low income—as a proxy measure for poverty, although Statistics Canada itself does not do so.[36] The first LICO was produced in 1967, and its developers essentially looked at what, on average, Canadians at that time spent on food, clothing, and shelter (the necessities of life). They found that this amounted to roughly 50% of household income in 1959, and they hence determined that families that spent 70% or more of their household income on basic necessities (20 percentage points more than the average) were likely in "straitened circumstances"—or with incomes sufficiently low so as to cause financial strain.

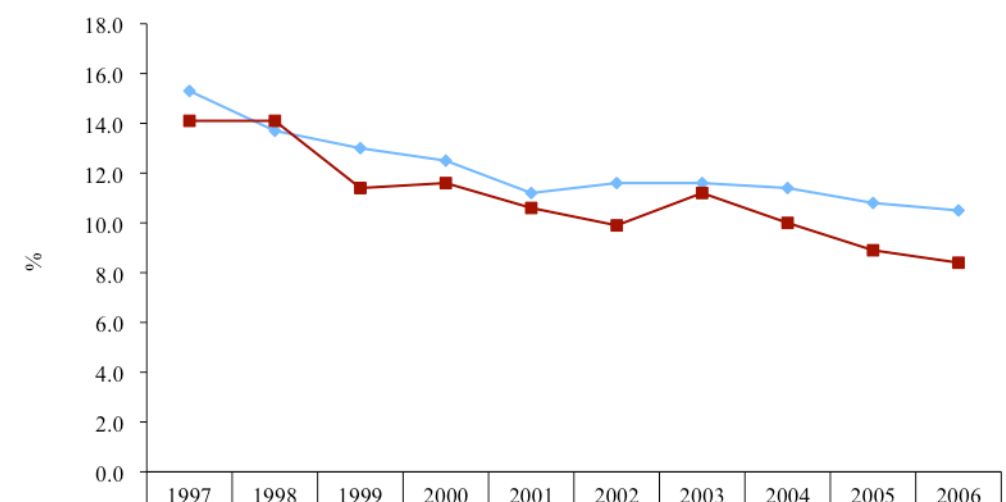
According to the most recent base for LICOs—the 1992 Family Expenditure Survey (FAMEX)—the average family spends 43% of its disposable income on necessities. The current low income cut-off is set at 63% of household income (or 20 percentage points more than the average proportion of income spent on necessities). This process is carried out for seven family sizes and five community sizes and results in a table of 35 cut-offs.[37]

Reductions in low-income rates are recognized as a sign of progress that may have a positive impact on health and wellbeing. However, the caveat must be added that income interacts with other health determinants, and that increases in income may not affect health positively if they are related to increases in workload that raise time stress levels and that reduce the free time needed for rest, relaxation, and physical exercise.

In 2006, according to data from Statistics Canada's Survey of Labour and Income Dynamics (SLID), the national rate of low income was 10.5%—10.1% of men, 10.9% of women, and 10.5% of children. British Columbia had the highest prevalence of low income among the provinces—13% overall. In Nova Scotia, 8.4% of the total population were below the low income cut-off—7.3% of men, 9.4% of women, and 8.7% of children.[38] This is down sharply from 14% of the total population in 1997, which was the highest rate of low income recorded in the province since 1981.[39]

According to SLID data, Nova Scotia's rate of low income has been consistently below the Canadian rate in recent years, and in 2006 was 20% below the Canadian average (Figure 6-6 below), though census data show Nova Scotia's rate of low income to be higher than the Canadian average, as seen below.

Figure 6-6. Prevalence of low income after tax (1992 LICO base), total population, Canada and Nova Scotia, 1997–2006



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Canada	15.3	13.7	13.0	12.5	11.2	11.6	11.6	11.4	10.8	10.5
NS	14.1	14.1	11.4	11.6	10.6	9.9	11.2	10.0	8.9	8.4

Source: Statistics Canada. 2008. Income in Canada, 2006. Catalogue no. 75-202-XIE. Tables 11-1 and 11-4. Original data from the Survey of Consumer Finances and Survey of Labour and Income Dynamics.

However, census statistics yield higher rates for low income than those published in Statistics Canada's annual *Income in Canada* report, which relies on SLID data. According to the 2001 Census (2000 income), 12.8% of all economic families in Canada, 16.2% of the total population in private households, and 18.2% of children aged 17 and under were below the low income cut-off.[40] In Nova Scotia, 13.4% of all economic families, 16.6% of the population in private households, and 19.7% of children (29% of children in Cape Breton) were living in low income in 2000.[41]

By contrast, *Income in Canada* reports that 9.3% of Canadian economic families, 12.5% of all Canadians, 8.6% of Nova Scotian economic families, and 11.6% of all Nova Scotians were below the low income cut-off in 2000—considerably fewer than reported for that year in the census statistics. [42] According to Statistics Canada, the difference between the census data and the data reported in *Income in Canada* has to do with differing methodologies, sample sizes, and questionnaires. According to Statistics Canada, the census data provide a "more accurate portrait" of the incidence of low income than the SLID data reported in *Income in Canada*, because the census sample size is so much larger.[43]

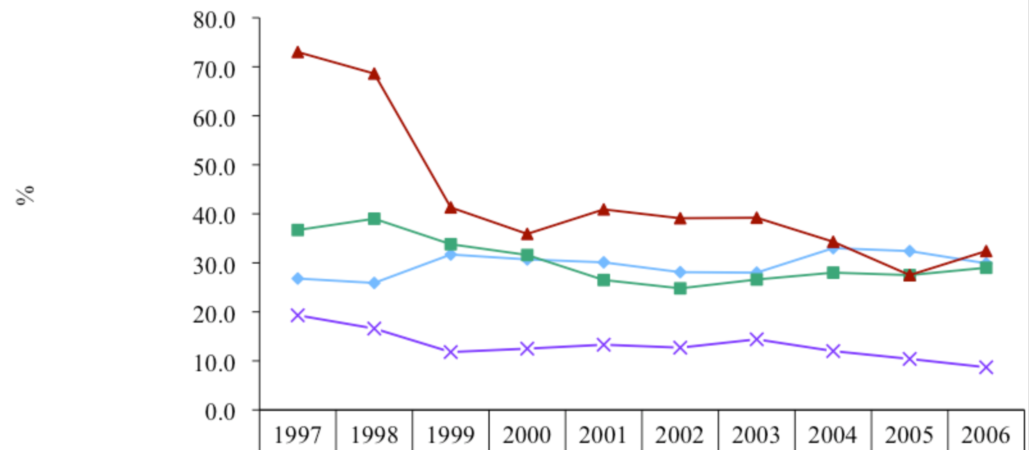
However, these overall figures and low-income averages hide the fact that low income is concentrated within certain groups. While it is certainly a sign of genuine progress and improvement that low-income rates have fallen steadily and significantly over the last decade—by 31% in Canada, and by more than 40% in Nova Scotia, they remain much higher for some groups than the overall rates of 10.5% and 8.4% (in Canada and Nova Scotia respectively) indicate.

For example, in 2006, Nova Scotian children under age 18 in female lone-parent families were nearly four times as likely as other Nova Scotians to be living below the low income cut-off. The low-income rate for children of single mothers is the same provincially and nationally (32%). However, even this unacceptably high rate constitutes a significant improvement since 1997, when the prevalence of low income among children living in female lone-parent families in Nova Scotia was a staggering 73% (Figure 6-7 below).

Unattached Nova Scotians were also much more likely than other Nova Scotians to be living in low income in 2006—nearly 30% of unattached men (up from 27% in 1997) and 29% of unattached women (down from 37% in 1997) (Figure 6-7).[44]

In Canada in 2006, the prevalence of low income was highest for two-parent families with children and no earner (82%), for female lone-parent families with no paid work (81%), for unattached non-elderly, non-earning men (77%), and for unattached non-elderly, non-earning women (73%).[45] As indicated above, employment earnings constitute the lion's share of income ($78 out of every $100 for all economic families). These extremely high rates of low income for non-earning groups indicate clearly that the absence of paid work is the most proximate and immediate cause of poverty in Canada.

Figure 6-7. Prevalence of low income after tax (1992 LICO base), selected groups, Nova Scotia, 1997–2006

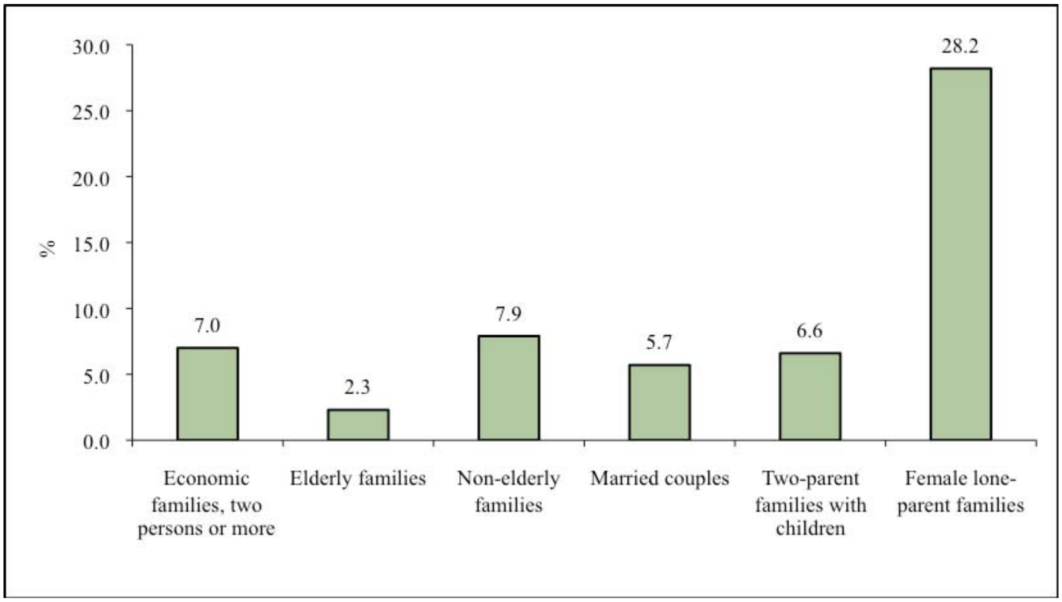


	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Unattached men	26.8	25.9	31.7	30.7	30.1	28.1	28.0	33.0	32.4	29.9
Unattached women	36.7	39.0	33.8	31.6	26.5	24.8	26.6	28.0	27.5	29.0
Children in female lone-parent families	73.0	68.6	41.3	35.9	40.9	39.1	39.2	34.3	27.5	32.4
Children (under 18 yrs)	19.3	16.6	11.8	12.5	13.3	12.7	14.4	12.0	10.4	8.7

Source: Statistics Canada. 2008. Income in Canada, 2006. Catalogue no. 75-202-XIE. Table 11-4.

The incidence of low income among female lone-parent families in Canada (when employed and non-employed single mothers are combined) declined from 49% in 1997 to 28.2% in 2006 (see Figure 6-8 below). This decline can be attributed mostly to the decline in the incidence of low income among female lone-parent families where the mother is employed—down from 34% in 1997 to 20% in 2006. Between 1994 and 2000 alone, the number of single mothers in Canada without jobs fell by more than 40%—from half a million to less than 300,000—while the number of employed single mothers jumped 32%—from 700,000 to 925,000.[46]

Figure 6-8. Incidence of low income after tax (%), by different family types, Canada, 2006



Source: Statistics Canada. 2008. Income in Canada, 2006. Catalogue no. 75-202-XIE. Table 13-1.

Lower poverty rates among single mothers are clearly a sign of genuine progress. But there have been trade-offs as a result of the gains having come almost entirely from increasing employment rates for single mothers. As noted above, low-income rates for single mothers have fallen sharply only for those with jobs, and because far more single mothers are now working for pay. As also noted, the low-income rate for Canadian single mothers without jobs in 2006 was a staggering 81%.

Interestingly, it was likely a highly adverse condition that prompted the dramatic changes witnessed in the last decade. Sharp cuts in federal budget transfers to the provinces in the 1990s led to major reductions in social service payments, which in turn forced large numbers of single mothers into the market economy just to make ends meet. However, evidence indicates that higher incomes and reduced poverty rates for single mothers have come at the price of reduced parenting time and higher rates of time stress. Time-use surveys indicate that single mothers have much less time to spend with their children than both their non-employed counterparts and working mothers in two-parent families. That is because they carry the sole burden of unpaid household work in addition to their paid work responsibilities. When they come home from their paid jobs, employed single mothers have to shop, cook, and clean without assistance.

Not surprisingly, Statistics Canada's time stress surveys show working single mothers to be the most highly time-stressed demographic group.[47] Harvey and Mukhopadhyay have estimated that more than half of all Canadian single mothers suffer time poverty, which may be defined as less than the minimum necessary to accomplish basic household tasks, and that more than 90% of full-time employed single mothers are time poor (93% of single mothers with one child, and 100% of those with two children).[48]

According to Statistics Canada, women consistently record significantly higher rates than men of life stress in general and time stress in particular. Thus, the 2007 Canadian Community Health Survey found that 21.4% of Canadian men and 23.4% of Canadian women were experiencing "quite a lot of life stress." [49] Statistics Canada's General Social Survey time use surveys have also recorded sharply increased levels of time stress among Nova Scotia women, with the proportion highly stressed increasing from 17.4% in 1998 to 22.7% in 2005. The male rate of high time stress in Nova Scotia actually fell from 14.7% in 1998 to 13.4% in 2005. Thus, Nova Scotian women were nearly 70% more likely to be highly time stressed than Nova Scotian men in 2005.[50] The degree to which the 30% increase in time stress among Nova Scotia women reflects higher rates of employment among single mothers is not yet known, but is worth investigating.

In addition, when they do work for pay, employed single mothers have significantly higher childcare expenses than their married counterparts, since they cannot share childcare responsibilities and schedules as readily. Those with pre-school aged children also spend 12% of their income on paid childcare—nearly three times the proportion spent by working mothers in two-parent families (4.4%).[51] In short, recorded improvements in income and reductions in low-income among single mothers do not account for the increased expenses they carry in order to work.

In sum, there are important trade-offs that are not apparent in the low-income trends alone, and which have not received adequate investigation. For example, the health impacts of this income-time trade-off remain largely unknown, and the net effect of single mothers' increased employment and income on the one hand, and concomitant higher rates of time stress and time poverty have yet to be determined. The same is true for their children, who clearly benefit from lower rates of poverty and the concomitant opportunities that income brings, but who have considerably less dedicated time with their mothers than previously.

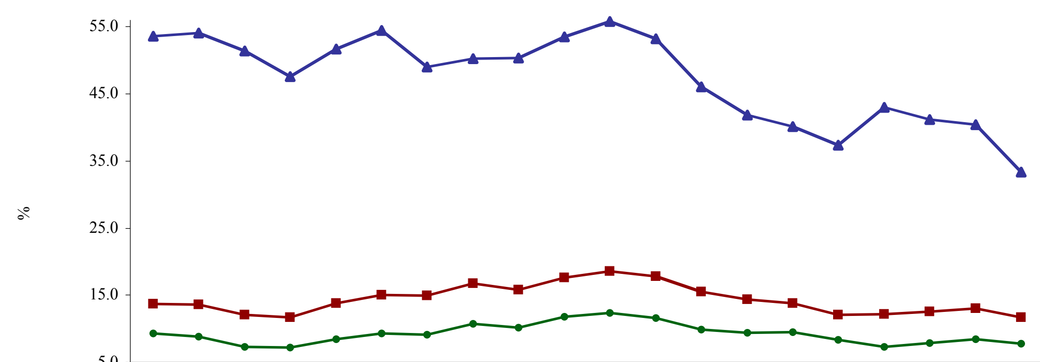
Both sides of this trade-off equation are clearly highly significant. On the one hand, poverty has been identified as one of the most reliable predictors of poor health. So any reduction in low-income rates for women in general, and for single mothers and their children in particular, should signify a health gain. On the other hand, a wide-ranging literature review by the *American Journal of Health Promotion* found stress to be the most costly of all modifiable risk factors in terms of its wide-ranging health impacts.[52] The available evidence does seem to indicate that longer work hours by women have substantially increased their levels of time stress. As well, a seminal Statistics Canada study found that women working longer hours were more prone to higher rates of smoking and alcohol consumption, unhealthy weight gain, physical inactivity, and depression.[53]

These issues are presented in some detail here, because a key purpose of the Genuine Progress Index is to point to the linkages between social, economic, and environmental variables. The evidence touched on in these two pages clearly indicates that the simple reduction in low-income rates of the last decade, though a highly positive trend in itself, does not tell the entire story. There is clearly a larger historical, social, economic, political, and health context for the significant reduction in poverty rates observed above—beginning with the cuts in federal transfer payments to the provinces that precipitated the substantial employment increases (and consequent income gains) of single mothers, and producing impacts on women's and children's health and wellbeing that remain largely unknown and undetermined.

Figure 6-9 below shows the percentage of Canadian children in low income in the 20-year period from 1986 through 2005. Overall, child poverty declined by only two percentage points during this entire period—from 13.7% in 1986 to 11.7% in 2005, though the latter represents the lowest rate of child poverty since 1989. However, there was a substantial increase in child poverty in the mid-1990s, which peaked in 1996 at 18.6% of all Canadian children. The persistence of child poverty in Canada is noteworthy in light of the fact that the House of Commons unanimously voted in 1989 to abolish child poverty in Canada by the year 2000.

As with the overall low-income rates above, it is again striking that the overall child poverty trends conceal a very sizable gap between the percentages of children living in poverty in different family types, as also evidenced in Figures 6-7 and 6-8 above. For instance, in 1986, Canadian children with female lone parents were nearly six times as likely to be poor as children in two-parent families (53.6% versus 9.3%)—a gap of 44.3 percentage points. While this gap had narrowed somewhat by 2005, it was still very large, with children in female lone-parent families more than four times as likely to be poor as children in two-parent families (33.4% versus 7.8%)—a still substantial gap of 25.6 percentage points (Figure 6-9 below).

Figure 6-9. Percentage of Canadians under age 18 living in low income (after-tax LICO, 1986 or 1992 base), total and by family type, 1986–2005



	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Children	13.7	13.6	12.1	11.7	13.8	15.0	14.9	16.7	15.8	17.6	18.6	17.8	15.5	14.4	13.8	12.1	12.2	12.5	13.0	11.7
Two parents	9.3	8.8	7.3	7.2	8.4	9.3	9.1	10.7	10.2	11.8	12.4	11.6	9.9	9.4	9.5	8.3	7.3	7.9	8.4	7.8
Female only	53.6	54.1	51.4	47.6	51.7	54.5	49.0	50.3	50.4	53.5	55.8	53.2	46.1	41.9	40.1	37.4	43.0	41.2	40.4	33.4

Source: Statistics Canada. Persons in Low Income After Tax, by Prevalence in Percent. Accessed July, 2008; 1986–1990 available from http://www40.statcan.ca/l01/cst01/famil19g.htm; 1991–1995 available from http://www40.statcan.ca/l01/cst01/famil19e.htm; 1996–2000 available from http://www40.statcan.ca/l01/cst01/famil19c.htm; 2001–2005 available from http://www40.statcan.ca/l01/cst01/famil19a.htm.

Note: "Female only" refers to those children in female lone-parent households.

In a recent study of low income among Canadian workers, the Caledon Institute reported that one in four workers in Canada make just $10 an hour or less, and 44% of low-income households include at least one working adult. These low-income earners are referred to in the Caledon study as the "working poor."[54] The study notes:

> It is a wonder that so many low-income Canadians work when some of them actually might fare better on welfare, which provides income benefits for spouses and vital services such as supplementary health care, dental care and disability supports. To make matters worse, the working poor must pay income and payroll taxes, and cover the cost of work-related expenses such as clothing, child care and transportation.[55]

The Caledon Institute recommends a variety of ways to "make work pay for the working poor and to break down the welfare wall," by:

- increasing the minimum wage and indexing the minimum wage each year to inflation
- exploring the concept of a "living wage, intended to encourage employers to pay higher wages than the legislated bare minimum"
- implementing a program in which the government offers earning supplements to those whose earnings are too low[56]

6.4. The Gini coefficient

Data sources: Statistics Canada Survey of Consumer Finances; Statistics Canada Survey of Labour and Income Dynamics.

Result: Since 1976, inequality as measured by the Gini coefficient has increased in all provinces, except PEI.

In addition to quintile ratios, two other measures are commonly used for studies of income inequality, namely the Gini coefficient and the Robin Hood index. Both are derived from a plot with the cumulative percentage of households on the horizontal axis and the cumulative share of income earned on the vertical axis. The proportion of the total income accrued within each segment of households is plotted to form a curve—known as a Lorenz curve. If income distribution is perfectly equal—i.e., if each decile (10%) of households receives 10% of total income—the Lorenz curve will match the 45-degree line. As the distribution becomes more unequal, the curve becomes more concave. The Gini coefficient is calculated as the ratio of the area between the curve and the 45-degree line to the entire area under the 45-degree line. Thus, if income is perfectly distributed, the Gini is 0, whereas if it is perfectly unequal (i.e., one person has all the income), the Gini is 1.0.[57] In other words, the Gini coefficient represents the ratio of the gap between perfect income distribution and actual income distribution.

The Gini coefficient has advantages and disadvantages over the quintile comparison method used in the previous section. Because it computes the income gap over the entire income spectrum rather than by comparing only the top and bottom income groups, it is certainly a more comprehensive computation of equality and inequality, because it includes all incomes, including those in the middle. For that reason it is probably the most widely recognized and used overall measure of income inequality.

On the other hand, unlike the quintile comparison, it does not necessarily register changes in the gap between the rich and the poor, or the shares of income held by various income groups. Because it accounts for all incomes, the GINI coefficient can change dramatically as a result of shifts among the middle income groups and even if the gap between rich and poor does not change at all. Conversely, it can stay the same even while the gap between rich and poor increases.[58]

Because the GINI coefficient measures a different dimension of inequality than the quintile group comparisons, the World Bank therefore uses both measures in its “Distribution of Income” figures. For that reason, both measures are also given here.

According to Statistics Canada data, the Gini coefficient of after-tax income for all family units in Canada increased from an average of 0.36 in 1976 to 0.39 in 2006. In Nova Scotia, the after-tax income Gini coefficient increased from 0.34 to 0.37 in this 30-year period. Since 1976, income inequality has grown in every province in the country, except Prince Edward Island.

In 2006, according to the Gini coefficient, Saskatchewan and British Columbia had the highest levels of inequality (0.40) in the country and Prince Edward Island was the most equitable (0.34) (Table 6-5).

Table 6-5. Gini coefficients of after-tax income, all family units (economic families and unattached individuals), Canada and provinces, 1976 to 2006

	1976	1981	1991	1998	2001	2006
CAN	.36	.35	.36	.39	.39	.39
NL	.34	.33	.35	.36	.36	.36
PE	.38	.34	.34	.35	.36	.34
NS	.34	.34	.34	.37	.38	.37
NB	.34	.35	.34	.36	.37	.37
QC	.35	.35	.36	.37	.38	.38
ON	.36	.34	.36	.38	.39	.39
MB	.37	.36	.34	.37	.36	.38
SK	.38	.38	.36	.37	.37	.40
AB	.38	.35	.37	.40	.38	.39
BC	.37	.35	.37	.39	.40	.40

Source: Statistics Canada. CANSIM Table 202-0705c—Survey of Labour and Income Dynamics and Survey of Consumer Finances.

Note: Figures have been rounded.

6.5. Gender wage gap: hourly female to male wage ratio

Data source: Statistics Canada, Labour Force Survey

Result: In Canada generally and in Nova Scotia in particular, the gender wage gap has narrowed in recent years. Nova Scotia women now earn 88 cents for the male dollar on an hourly basis—up from 81 cents a decade ago.

The last thirty years have seen remarkable and positive progress in closing the gender gap in formal educational attainment. Between 1971 and 1996, men doubled and women quadrupled their rate of university graduation.[59] Canadian girls are now more likely to finish high school than boys, and young women are more likely than young men to have a university degree. In the Atlantic provinces, there are now altogether more women than men with post-secondary education.[60]

Yet despite this growing educational parity, there has been a significant and persistent gender wage gap that has puzzled analysts. Two detailed Statistics Canada analyses, in 1999 and 2001, examined 14 different factors to determine why women's hourly wages overall have remained at about 81% of the male hourly wage over time despite women's clear educational gains. After taking into account a wide range of employment characteristics and socio-demographic factors, including education, field of study, hours worked, full-time or part-time status, work experience, job tenure, industry, occupation, job duties and supervisory role, firm size, union membership, and age of children, Statistics Canada analysts concluded that "roughly one half to three quarters of the gender wage gap cannot be explained."[61]

In other words, women have traditionally earned substantially less than men even when they have identical work experience, education, job tenure and other characteristics, when they perform the same job duties and when they work in the same occupations and industries for the same weekly hours. In the absence of any rational explanation, "[t]his 'unexplained' component" of the gender wage gap, says Statistics Canada, "is referred to as an estimate of the gender based labour market discrimination."[62]

Since this wage gap has contributed to higher rates of low income among Canadian women than men, and since inequality has been associated with adverse health impacts, this gender wage gap has significant implications for women's health and wellbeing. Conversely, any narrowing of the gap signifies genuine progress and has potentially positive implications for women's health and wellbeing.

While the gender wage gap gradually narrowed in the 1970s and 1980s, it stabilized in the 1990s and hardly shifted at all from 1997 to 2001 despite continuing educational gains by women. In the last eight years, however, the gender wage gap has narrowed. In 2008, Canadian women earned 85% of male hourly wages—or 85 cents for every male dollar earned—up from 81 cents in 1998–2000 (Tables 6-6 and 6-7 below).[63] In Nova Scotia, the gender wage gap has narrowed even more substantially in recent years. In 2008, Nova Scotian women earned 88% of male hourly wages—up from only 80% in 2000 (see Figure 6-10 below).[64]

Table 6-6. Average hourly wage ($), by gender, Canada and Nova Scotia, 1997–2002

	Gender	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Canada: average hourly wage	Male	17.12	17.40	17.91	18.56	19.02	19.41
	Female	14.01	14.17	14.54	14.95	15.51	16.03
	F:M ratio (%)	**81.8**	**81.4**	**81.2**	**80.6**	**81.6**	**82.6**
Nova Scotia: average hourly wage	Male	14.44	14.80	14.59	15.60	16.04	16.45
	Female	11.77	11.96	12.35	12.52	13.34	13.64
	F:M Ratio (%)	**81.5**	**80.8**	**84.7**	**80.3**	**83.2**	**82.9**

Source: Statistics Canada. CANSIM Table 282-0073—Labour force survey estimates (LFS), wages of employees by job permanence, union coverage, sex and age group, unadjusted for seasonality, monthly. CANSIM database. Accessed October 13, 2008.

Note: Data are unadjusted for seasonality.

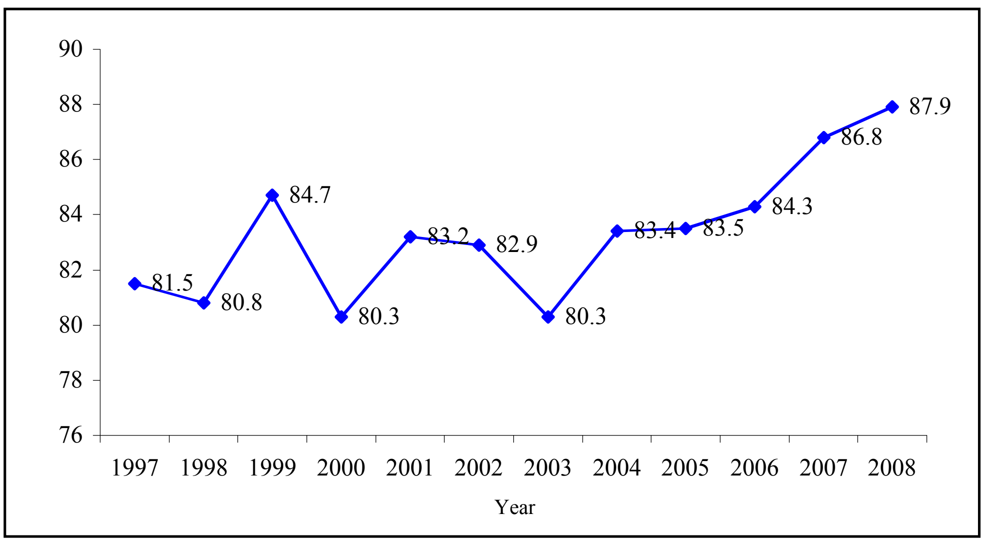
Table 6-7. Average hourly wage ($), by gender, Canada and Nova Scotia, 2003–2008

	Gender	2003	2004	2005	2006	2007	2008
Canada: average hourly wage	Male	19.88	20.25	20.81	21.48	22.46	23.44
	Female	16.52	16.85	17.71	18.22	18.90	19.83
	F:M ratio (%)	**83.1**	**83.2**	**85.1**	**84.8**	**84.2**	**84.6**
Nova Scotia: average hourly wage	Male	17.14	17.30	17.95	18.31	19.21	19.71
	Female	13.76	14.43	14.98	15.44	16.68	17.32
	F:M Ratio (%)	**80.3**	**83.4**	**83.5**	**84.3**	**86.8**	**87.9**

Source: Statistics Canada. CANSIM Table 282-0073—Labour force survey estimates (LFS), wages of employees by job permanence, union coverage, sex and age group, unadjusted for seasonality, monthly. CANSIM database. Accessed October 13, 2008.

Note: Data are unadjusted for seasonality.

Figure 6-10. Female to male wage ratio (%), Nova Scotia, 1997–2008



Source: Statistics Canada. CANSIM Table 282-0073—Labour force survey estimates (LFS), wages of employees by job permanence, union coverage, sex and age group, unadjusted for seasonality, monthly. Accessed October 13, 2008.

Note: Data are unadjusted for seasonality.

7. Financial Security and Debt

For the original GPI Atlantic report on financial security, please see the following:

Financial Security and Debt in Atlantic Canada (2008)
http://gpiatlantic.org/pdf/livstand/finsec-extended.pdf

Headline Indicators

1. Wealth distribution by quintile
2. Regional distribution of wealth
3. Debt growth versus asset growth
4. Debt growth versus income growth

Note to Readers

Since the September 2008 release of GPI Atlantic's report, *Financial Security and Debt in Atlantic Canada*, some major US investment banks have failed and global stock markets have crashed in what many analysts have labelled "the worst financial crisis since the Great Depression."[1] The week of 6–10 October saw the biggest collapse in Wall Street share values since 1929, with the Dow Jones index losing 40.3% of its value since its record high a year earlier and wiping out $US8.4 trillion in stock values. On the Toronto Stock Exchange, the benchmark S&P/TSX composite index has lost roughly C$440 billion in market value since the end of August 2008. These events will have a major impact on the assessment of Canadians' wealth and assets, as documented in the GPI report.

The present crisis, which has sent shock waves around the globe, actually began in 2006–2007 with high default rates on US subprime mortgages that in turn were an outcome of increasingly risky lending and borrowing practices in preceding years.[2] In addition, individual and corporate debt levels had reached record high levels. The increase in default and foreclosure activity in the US—up nearly 80% between 2006 and 2007—eventually triggered the collapse of the asset-backed market in that country. Some of the trends documented in the September 2008 GPI report on debt and financial security, including that household debt has been rising at a faster pace than income or assets in Canada in recent years, point to vulnerabilities on this side of the border as well.

What the recent market crash essentially means in terms of the earlier statistics presented in this summary chapter, is that a significant portion of the assets held by Canadians have been wiped out in recent weeks. Since wealth is defined as assets minus debts, the asset loss in turns signifies a loss of real wealth in Canada. Certainly those assets held in the forms of stocks, mutual funds, pension funds, and other market-dependent resources will be substantially affected by the decline in value of the stock market due to the recent massive selling off of stocks.[3]

In addition, housing prices are dropping. In the Toronto area, for example, home sales have dropped by 11 percent and the average price of homes by six percent in the last year. Since the vast majority of Canadians' wealth (especially in the middle wealth groups) is tied to their houses—this means that this dominant source of wealth is also declining in value.[4]

It is not possible at this time to assess the impact of the present financial crisis, market collapse, and decline in housing prices on Canadians' asset, debt, and wealth levels as documented in the September 2008 GPI report and summarized in the following pages. Nor is it possible to predict the extent to which current US and European rescue efforts, including the purchase of bank shares, will ameliorate the present global crisis and help protect household wealth in this country. Certainly the results presented in the following pages will have to be modified substantially as new data become available. Future updates of the indicators presented below, using data from Statistics Canada's next Survey of Financial Security and from the National Balance Sheet Accounts, will eventually be able to capture the overall impact of current events on the wealth or net worth of Canadians.

7.1. Overview of key issues

The following pages contain a brief summary of selected key results from the recently released GPI Atlantic *Financial Security and Debt in Atlantic Canada* report.[5] In this summary we have focused on two key areas—wealth adequacy and disparities and the ability of individuals to manage their debt—because these are key measures of progress and wellbeing in the Genuine Progress Index (GPI) that directly affect individuals' financial security.

Adequate wealth and savings can enhance financial security by enabling households to weather the financial crises that can result from job loss, sickness, death or disability of an income-earning partner, or other unexpected circumstances. They can also provide a reserve for house or car repairs that are suddenly required, or for other unanticipated financial outlays that would strain normal income. Conversely, the inability to manage debt can seriously compromise financial security and wellbeing and cause a range of other problems including stress, anxiety, illness, and (in extreme cases) even crime and suicide. The ongoing subprime mortgage crisis in the US illustrates clearly that widespread inability to manage debt can also send massive shockwaves through the economy as a whole.

A growing body of evidence also links improvements in equity with positive economic, social, health, environmental, and political impacts. This basic understanding is backed by a growing body of research demonstrating, for example, that greater income equality can enhance productivity and economic success.[6] Conversely, sharp wealth and income inequalities can threaten social stability and cohesion and undermine productivity and health.

Despite the proven links of both indicators to financial security and wellbeing, the evidence examined in the study points to a growing wealth gap in Canada—both between wealth and age groups and between regions, and it points to growing inability to manage debt, particularly in Atlantic Canada. These trends, unfortunately, do not signal genuine progress in the GPI despite the fact that aggregate wealth in Canada has grown enormously and that the wealthy (who already had high levels of financial security) have seen their wealth grow further.

Despite the focus on these two key areas in this summary—wealth distribution and debt management—the full GPI financial security and debt report includes a more detailed examination of many other aspects of financial security and of different kinds of debt, in order to provide a more nuanced understanding of this important subject. For example, distinctions are made between forms of debt (like mortgages and student loans) on the one hand—that are generally available at reasonably low rates of interest and that can potentially be used to leverage appreciating assets (like homes and intellectual capital that can increase earning power)—and forms of debt (like credit cards and payday loans) on the other hand—that generally carry very high interest charges and are mostly used to finance current consumption or pay bills rather than to build assets.

The evidence also points to clear links between these different kinds of debt and the growing wealth gap. For example, wealthier households can more easily use their homes and other assets as equity to secure relatively low-interest loans and lines of credit, while the households that can least afford it are often driven to rely on high interest credit cards and even exorbitant payday loans because they have less access to cheaper sources of credit. Despite these trends, the full GPI financial security and debt report notes that Canadians have hitherto generally had very low rates of debt and mortgage default, though consumer bankruptcies have risen sharply in Atlantic Canada to levels much higher than in the rest of the country.

The issue of student debt is dealt with in some detail in the accompanying education chapter and therefore is not included as an indicator in this summary. However, just a few notes on student debt are provided here to illustrate that a closer analysis of different types of debt, and of who the particular debt holders for different debt types are, is directly related to an understanding of wealth distribution and debt management—the core indicators examined in this summary.

Thus, it should be noted here that student debt from government and private sources across Canada is increasing. The average student debt load in the Maritimes from all sources (government student loans and private sources) increased by 10% in recent years from $24,976 in 2003 to $27,486 in 2007 ($2007).[7]

Survey data from the Maritime provinces Higher Education Commission (MPHEC) indicate that the average amount of student debt in Nova Scotia from all sources for the class of 2003 was $27,148, second to Prince Edward Island ($32,390). New Brunswick students owed $26,199 in student loans. In Nova Scotia, 40% of all graduates with student debt owed more than $30,000 in loans.

Not surprisingly, indebted graduates are having a harder time servicing and managing their escalating student debt loads. Using data from Statistics Canada's National Graduates Survey, the 2005 report of the Pan-Canadian Education Indicators Program notes that in almost all provinces, postsecondary graduates took longer to pay off their government student loan debts in 1995 than in 1990, and even longer still in 2000.[8]

Furthermore, student loan debt is disproportionately concentrated in the poorest 40% of Canadian households, who hold fully 70% (or $14 billion worth) of all student debt in the country. By far the largest holders of student debt in Canada are households in the bottom wealth quintile (i.e., the bottom 20% of households in terms of wealth) who in 2005 collectively owed $9.4 billion or 47% of outstanding Canadian student loans.[9] Households in the third wealth quintile owed $3.6 billion in student loans, or 18% of the total. By contrast, richer Canadian households hold a correspondingly smaller proportion of total student debt in Canada. The second wealthiest quintile (fourth) held 6.5% of total student debt in 2005. Unfortunately, 2005 data for the top quintile is statistically unreliable due to the small sample size of the 2005 SFS.[10]

Similar analyses of other debt types by quintile and according to the socio-demographic profiles of debt holders, as provided in the full 2008 GPI financial security and debt report, can shed further light on the wealth distribution and debt management issues highlighted in summary and aggregate form in this brief update.

7.2. Wealth distribution by quintile[11]

Data sources: Statistics Canada, 1999 and 2005 Surveys of Financial Security; Summary Tables Online. Income, Pensions, Spending and Wealth: Assets and Debts Held by Family Units, Total Amounts, by Net Worth Quintile

Result: Since 1999, Canada's wealth gap has widened with the richest 20% of Canadians increasing their wealth by 43% while the poorest 20% went deeper into debt—so deep in fact that they could not get out of debt even if they sold off everything they owned. The evidence points to declining financial security for millions of Canadians even during an economic boom period.

The balance sheets of households are comprised of debts and assets. The difference between what households own (their assets) and what households owe (their debts) is their net worth or wealth. Net worth or wealth is an indicator of households' financial security because it represents a potential buffer against unanticipated spending needs and a resource that households can draw on in a time of crisis, need, or unanticipated income loss. It also allows investment in housing, car, or other repairs for which income alone may be inadequate, and it obviates the need to rely on new borrowing. Adequate wealth can also leverage investments to build assets and further strengthen financial security.

As previously noted, a growing body of evidence links improvements in equity with positive economic, social, health, environmental, and political impacts. Conversely, sharp wealth and income inequalities can threaten social stability and cohesion, and undermine productivity and health.

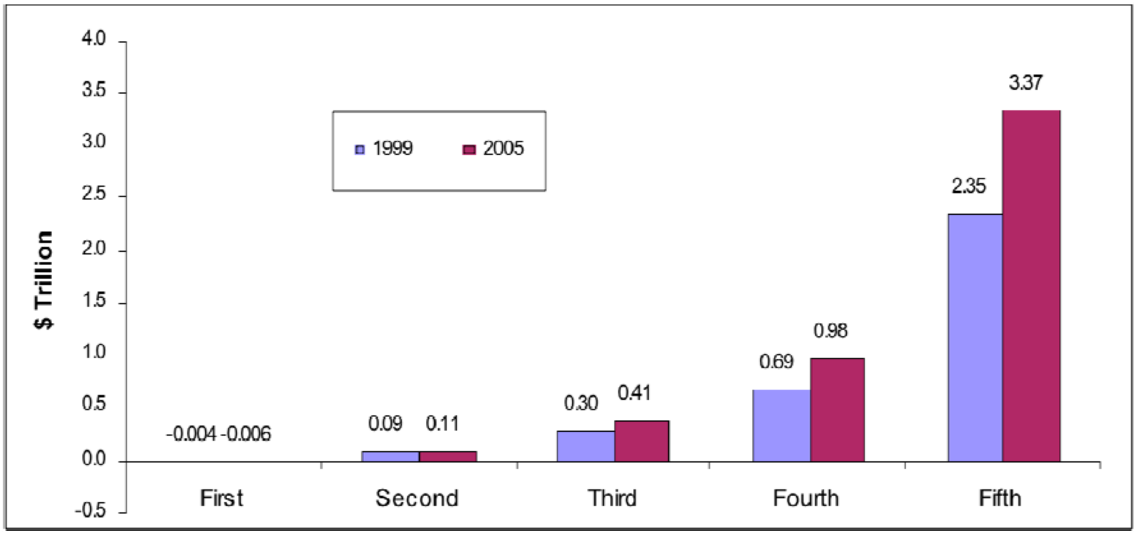
Figure 7-1 below depicts the net worth of Canadians in absolute terms. Since 1999, the richest 20% of Canadian households saw their wealth increase by 43% in real terms to $3.37 trillion in 2005 while the poorest 20% went deeper into debt, with the magnitude of their negative wealth (excess of debts over assets) growing by more than 70% in real terms to $6.4 billion in 2005.[12] In other words, wealthy Canadians are getting wealthier while poor Canadians are getting poorer. Negative wealth means that even if these households sold off everything they owned, they still could not get out of debt.

Those in the middle saw their wealth grow—from $300 billion in 1999 to $400 billion in 2005 (Figure 7-1 below)—largely because the value of their homes increased sharply in the last decade. Unlike the wealthiest 20%, which has more of its assets in stocks, bonds, mutual funds, RRSPs, and other financial investments, homes make up 55% of the assets of the middle 20% of Canadian households, and mortgage debt accounts for three-quarters of their total debt.

But homes are not easily sacrificed or converted to cash at a time of financial crisis. When home values are subtracted, the remaining wealth of those in the middle actually fell by 7% between 1999 and 2005—indicating that the financial security of middle wealth households is tenuous when liquidity is taken into account. Relative to wealthier households, the middle 20% of households also held a smaller portion of the nation's overall wealth in 2005 (8.4%) than in 1999 (8.8%).

As home prices and values fall in the impending economic slump, this dominant component of wealth among the middle 20% of Canadians—and the one primarily responsible for the aggregate appreciation of wealth in that group in the last decade—will also decline in value. When this is added to the 7% fall in wealth among the non-home components of wealth noted above, it can be predicted that aggregate wealth among the middle 20% of Canadians will likely fall in the coming years.

Figure 7-1. Net worth ($ trillions, 2005 constant dollars), by wealth quintile, Canada, 1999 and 2005

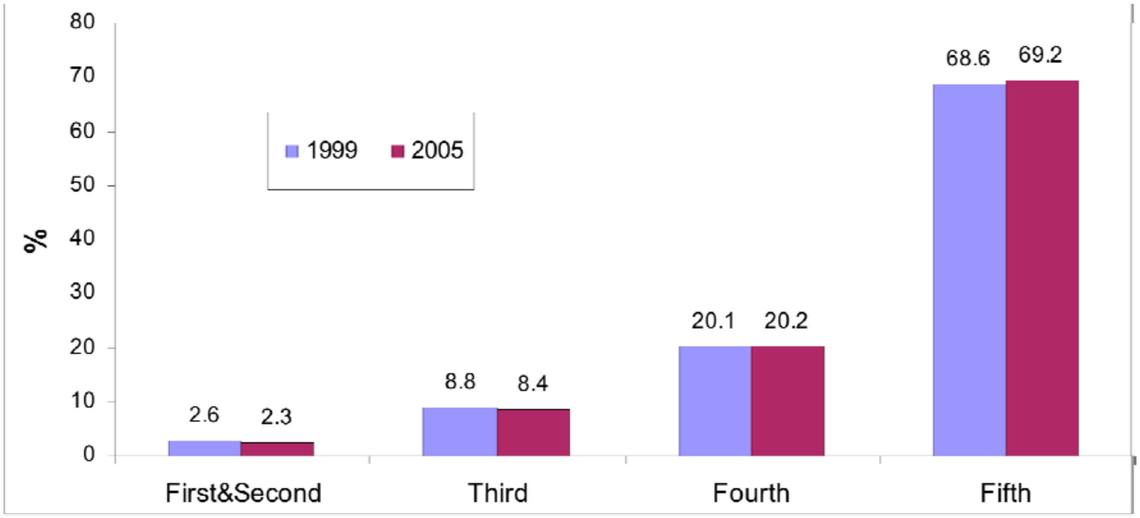


Source: Statistics Canada. Summary Tables Online. *Income, Pensions, Spending and Wealth*: *Assets and Debts Held by Family Units, Total Amounts, by Net Worth Quintile*. Available from http://www40.statcan.ca/l01/cst01/famil115f.htm. Accessed May 7, 2007.

Figure 7-2 below illustrates net worth (or wealth) in relative terms. This further indicates that, since 1999, Canada's wealth gap has widened, with the richest 20% of households now owning nearly 70% of the country's wealth while the poorest 40% together own just over 2%, and the bottom 60% have only 10.7%—down from 11.4% in 1999. Statistics Canada cites an earlier analysis estimating that the richest 5% of Canadians own about 45% of the country's wealth and the richest 1% own about 25%.[13]

Though regional breakdowns by wealth group are not available in the 2005 Survey of Financial Security, due to its smaller sample, an analysis of the larger 1999 Survey of Financial Security indicates that, within the Atlantic region, the richest 10% of Atlantic households own about half of the region's wealth while the poorest 40% together own only 3.6%.[14]

Figure 7-2. Share of wealth (percent), by net worth quintile, Canada, 1999 and 2005



Source: Statistics Canada. Summary Tables Online. *Income, Pensions, Spending and Wealth*: *Assets and Debts Held by Family Units, Total Amounts, by Net Worth Quintile*. Available from http://www40.statcan.ca/l01/cst01/famil115f.htm. Accessed May 7, 2007.

7.3. Regional distribution of wealth

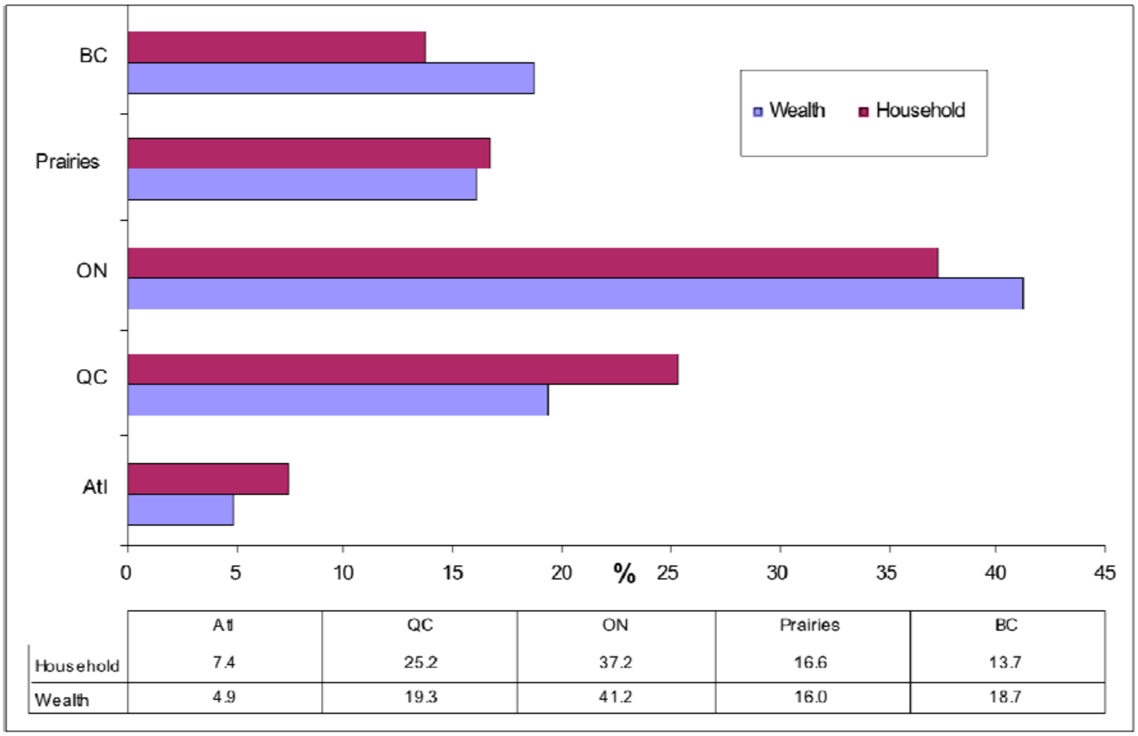
Data sources: Statistics Canada, Surveys of Financial Security (1999 and 2005)

Result: Atlantic Canadians have a declining share of Canada's growing wealth—owning only 4.9% of the country's total household wealth—down from 5.3% in 1999, even though they make up 7.4% of Canada's households.

Wealth inequality has also grown regionally, with the gap between the rich and poor provinces increasing. In 2005, Atlantic Canada accounted for 4.9% of the country's household wealth—down from 5.3% in 1999—even though it had 7.4% of the country's households. On a per household basis, wealth is disproportionately concentrated in Ontario and British Columbia. Ontario accounts for 41.2% of the country's wealth and 37.2% of households, while BC accounts for 18.7% of wealth and 13.7% of households (Figure 7-3 below).

Although the sample size of the 2005 Survey of Financial Security (SFS) does not allow a full provincial breakdown of wealth holdings, and though the Prairie provinces are seen to hold a slightly smaller share of national wealth than their proportion of households, it is likely that households in Alberta are the exception among the Prairie provinces in probably owning a greater share of national wealth than its proportion of national households, given the province's oil-driven economic boom.

Figure 7-3. Share of wealth and households (percent), Canada and regions, 2005



	Atl	QC	ON	Prairies	BC
Household	7.4	25.2	37.2	16.6	13.7
Wealth	4.9	19.3	41.2	16.0	18.7

Source: Statistics Canada, Income Statistics Division. *Survey of Financial Security*, 2005.

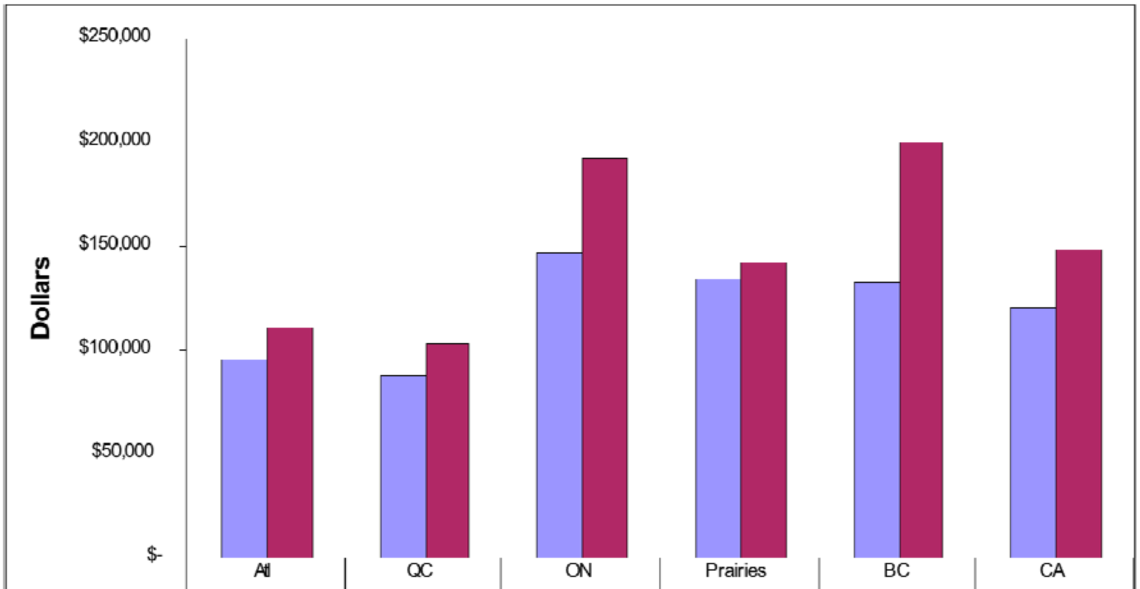
Although the Atlantic region's share of national wealth is eroding, the region's wealth has increased in absolute terms. The net worth of households in Atlantic Canada was valued at $237 billion in the 2005 SFS—31% greater in real terms than in 1999. By comparison, total Canadian wealth grew by 42% during this period, and net worth in Atlantic Canada had the slowest rate of appreciation of any region in the country between 1999 and 2005.

The slower rate of wealth growth in Atlantic Canada reflects the growing gap between debt and asset growth in the region—a gap that was wider than in any other region of the country. Households in the region incurred the fastest increase in debt at 62%, while assets grew by just 35%. As a consequence, we have also seen that Atlantic Canada owns a smaller share of Canada's household assets (4.9%) than its share of total household debt (5.4%). Due to the fact that debt rose faster than assets in this region than in any other part of the country, Atlantic Canada's share of Canada's household debt rose from 4.9% in 1999 to 5.4% in 2005, while its share of national assets dropped from 5.2% to 4.9%.

Atlantic Canada's diminishing share of national wealth is also reflected in the slower growth of median household net worth. Median household net worth in the Atlantic region grew by 16% between 1999 and 2005, trailing the Canadian rate of 23%. Figure 7-4 below shows that, in 2005, the median household wealth in Atlantic Canada was $111,445—25% below the national level

($148,350) and the second lowest among Canadian regions after Quebec ($103,700). In 2005, British Columbia and Ontario led the country in median household wealth at $199,700 and $192,000, respectively (Figure 7-4 below). These two provinces also experienced the fastest rate of growth in overall wealth since 1999—64% in British Columbia and 42% in Ontario.

Figure 7-4. Median wealth of households (2005 constant dollars), Canada and regions, 1999 and 2005



	Atl	QC	ON	Prairies	BC	CA
1999	$95,734	$88,140	$147,514	$135,364	$132,484	$120,451
2005	$111,445	$103,701	$192,161	$141,819	$199,746	$148,350

Source: Statistics Canada, Income Statistics Division. *Survey of Financial Security*. 2005.

7.4. Debt growth versus asset growth

Data sources: Statistics Canada. Survey of Financial Security (1999 and 2005); Statistics Canada. National Balance Sheet Accounts.

Result: The rate of household debt growth is far outpacing the rate of household asset growth, particularly in Atlantic Canada and Ontario. Between 1999 and 2005, household debt grew by 62% in Atlantic Canada, while assets grew by 35%.

As previously noted, the recent subprime mortgage crisis in the US, the subsequent collapse of global stock markets, and the impending economic downturn have combined to tighten the mortgage market, reduce housing prices, and diminish financial assets. The current volatility in financial markets and in the global economy are therefore certain to have a significant impact on Canadians' assets, debts, and wealth in the coming months and years, and on their distribution within the Canadian population.

All that is possible here is to report the most recently available trend data—from 1999 to 2005—with the understanding that these data will soon be superseded by new evidence. However, these recent historical data are pertinent to the current financial crisis, as their careful examination may reveal some seeds of the current turmoil. For example, the pace of debt growth compared to both asset growth and income growth can provide helpful indicators of the capacity to manage and service debt. If debt growth sharply outpaces income and asset growth, this may point to a reduced household capacity to manage debt, which in turn may provide an early warning signal of potential higher rates of defaults and home foreclosures that in turn can undermine the stability and strength of lending institutions and engender financial turmoil in the larger economy. For this reason, a study of relative debt, asset, and income levels and trends in the last decade can be highly relevant to an understanding of the present economic crisis.

For example, we have already noted above that the poorest 20% of Canadian households went deeper into debt between 1999 and 2005, with their negative wealth (excess of debts over assets) growing by more than 70% in real terms during this period.[15] GPI Atlantic's 2008 financial security and debt report also noted a propensity on the part of these poor households to use very high interest short-term loans just to pay bills and cover basic living expenses.

If commercial and lending institutions at the same time attempt to stimulate sales and economic activity by tempting such indebted households with credit cards, waivers of down payments, low introductory interest rates, and further debt beyond the ability of these already indebted households to service—as occurred in the United States with the subprime mortgage fiasco—this is a clear formula for default and eventual financial crisis. The reality that millions of Canadians households slid deeper into debt, even during the previous decade's economic boom, signals that Canada is not immune from the potential financial and economic fallout of high default rates if the current rate of growing indebtedness continues to escalate among such a substantial portion of the nation's households.

The 1999–2005 data also point to an important regional dimension of Canada's changing debt-to-asset ratios. Thus, there has been an ongoing shift of wealth out of this region, continuing a long-term trend in which Atlantic Canada has not shared fully in the increase in Canada's wealth. Thus, households in Atlantic Canada experienced the fastest growth in debt in Canada during the six-year period between 1999 and 2005, and saw a larger gap between debt growth (62%) and asset growth (35%) than in any other region, contributing to its declining share of national wealth.

Extrapolating from the larger 1999 Survey of Financial Security (SFS) to more recent results in the 2005 Survey of Financial Security (with smaller sample size), it can be estimated that about 77,000 Atlantic households are so seriously in debt that they would not be able to pay off their debts even if they sold everything they owned, including their homes. These Atlantic Canadian household do not have the assets to draw on to weather unexpected crises such as job loss, sickness, or loss of an earning partner and they do not have the means or resources to deal with the unforeseen and sudden cash requirements for home or car repairs, medications, or other needs. For these households, financial insecurity has grown in the last decade, along with all the anxiety that this implies.

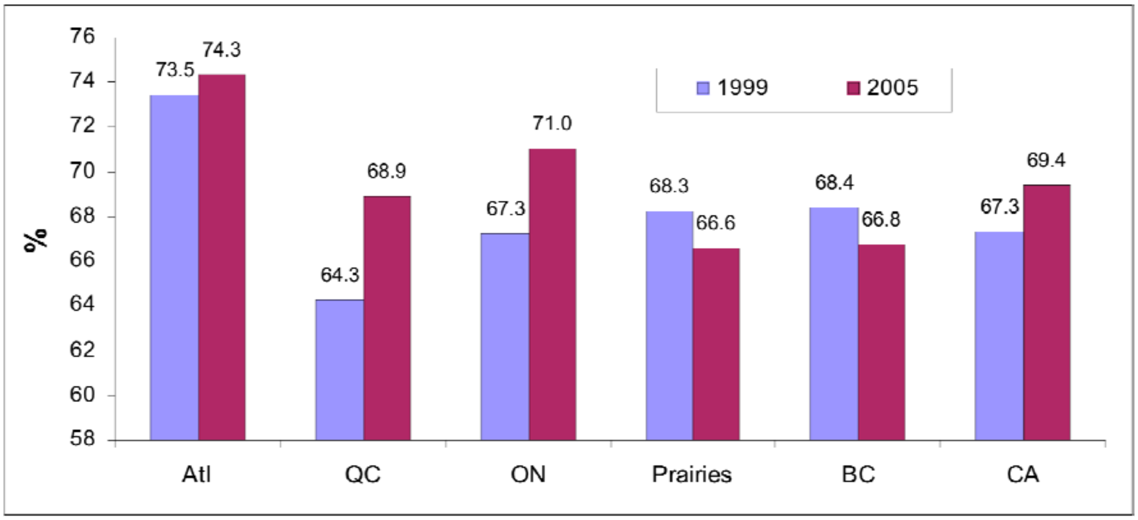
However, none of this implies that there is not substantial wealth in Atlantic Canada. Indeed, the SFS data clearly show that the issue has much less to do with the availability of wealth than with its very uneven distribution, Thus, again extrapolating from the 1999 SFS results that provided more detailed regional breakdowns, it is seen that while the poorest 40% of Atlantic Canadians own only about 3.6% of the region's wealth, the richest 10% of Atlantic Canadian households own about half the region's wealth.

And while 77,000 Atlantic households have debts in excess of their total assets, Atlantic Canada also has about 11,000 millionaire households—or about 1.1% of all households in the region. Atlantic Canada also has its share of billionaires—the Irvings with $5.3 billion, and Harrison McCain and the Sobey family, each with about $2 billion. John Bragg (who owns EastLink) and John Risley (Fishery Products) have about $700 million each, and the Jodrey family in Hantsport has well over half a billion dollars.

Aggregate regional data from the 2005 SFS shed further light on debt holdings in Atlantic Canada. For example, they show that a substantially greater proportion of households in Atlantic Canada hold some kind of debt than in the rest of the country. More than 74% of Atlantic Canadian households owed money in 2005. This rate is marginally higher than in 1999 and substantially greater than the national rate of 69% and the rates in the other regions: 71% in Ontario, 69% in Quebec, and 67% in British Columbia and the Prairie provinces (Figure 7-5 below). The western provinces (BC and the Prairies) are the only regions to have seen a decline since 1999 in the proportion of households with debt. In the country as a whole, a larger proportion of households held some kind of debt in 2005 (69.4%) than in 1999 (67.3%) (Figure 7-5).

In 2005, the number of households with debt in Atlantic Canada constituted 7.9% of the Canadian total, down slightly from 8.3% in 1999. This decline reflects a contraction in the region's population relative to the rest of the country: Atlantic Canadians accounted for 7.7% of Canada's population in 1999 and 7.3% in 2005. However, because debt is growing faster in the Atlantic region than nationally, Atlantic Canada's share of total Canadian household debt rose from 4.9% in 1999 to 5.4% in 2005.

Figure 7-5. Proportion of households with debt (percent), Canada and regions, 1999 and 2005



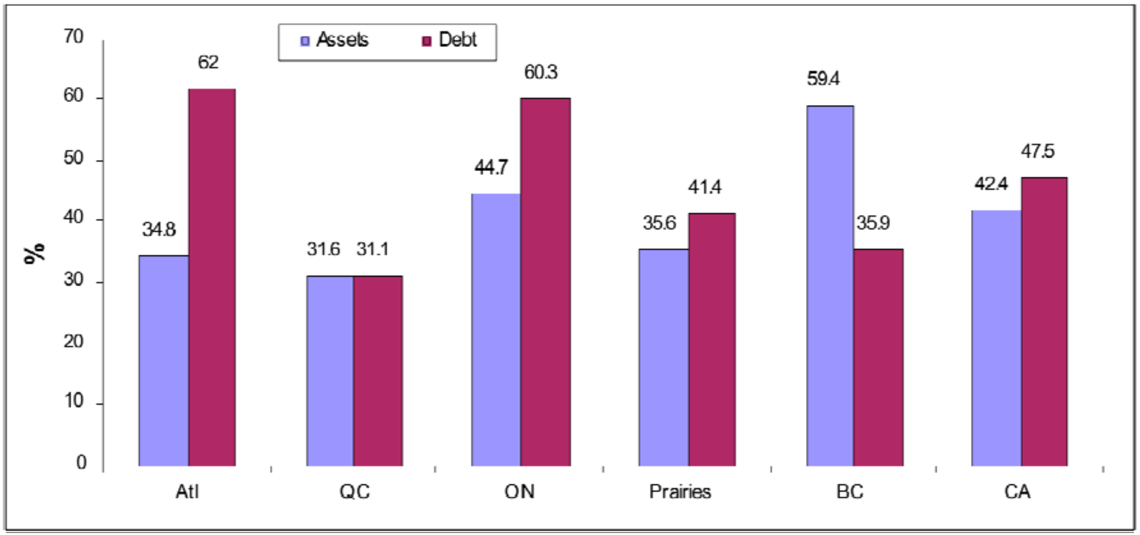
Source: Data and calculations of shares are from Statistics Canada. Income Statistics Division. Survey of Financial Security. 1999 and 2005.

According to the 2005 SFS, Atlantic Canadian households own $278 billion in assets—again reinforcing the reality noted above that the extreme financial insecurity and chronic indebtedness experienced by tens of thousands of Atlantic Canadians has nothing to do with a shortage of overall wealth in the region. Extrapolating from 1999 data, Nova Scotia's share of this total is an estimated $121 billion, up by $31 billion in real terms from 1999, and nearly three-and-a-half times greater than in 1984.[16] The aggregate value of household assets in the Atlantic region grew by 217% in real terms from 1984 to 2005. This robust rate of growth is slower than the national rate of 241%, but still substantial.

The two most recent Surveys of Financial Security show that the value of household assets in Atlantic Canada grew by 35% from 1999 to 2005—the second slowest rate of growth in the country ahead of only Quebec (32%)—while debt grew by 62% in the same period—the fastest rate of debt growth in the country. By contrast, Quebec's rates of asset and debt growth—while both more modest than in any other region—remained almost identical. The gap between the rates of asset and debt growth was steeper in Atlantic Canada than in any other region of the country, as Figure 7-6 illustrates below.

The rate at which debt growth has outpaced asset growth, particularly in Atlantic Canada and Ontario, may create difficulties in the current volatile financial situation, particularly if the newly incurred debt is not adequately supported by ample assets and if difficulties arise in managing and servicing that debt properly. Those conditions cannot be known by the overall rates of debt and asset growth alone or by absolute levels of debts and assets, but require careful analysis of the types of debts incurred and assets accumulated, the relative liquidity of the new assets, the rates of interest paid on debt, the distribution of debts and assets, the profiles of debt holders, and other factors that are all considered in greater detail in the full GPI financial security and debt report.

Figure 7-6. Growth in household debts and assets (percent), Canada and regions, 1999–2005



Source: Statistics Canada. Income Statistics Division. *Survey of Financial Security*. 2005.

A second important caveat must be added to this analysis of relative debt and asset growth, since those increases must be understood in the context of the absolute levels of debts and assets. In absolute dollar terms, assets grew far more than debts—nationwide and in every region including Atlantic Canada. But because, in aggregate dollar terms, assets outweigh debts by more than seven to one according to the SFS and by five to one according to the National Balance Sheet Accounts, the relative rates of asset increase are smaller than for debt.

Thus, according to the 2005 SFS, Canadian household assets totalled $5.6 trillion in 2005 while total household debt amounted to $760 billion in 2005.[17] And although the rate of debt growth exceeded the rate of asset growth between 1999 and 2005, Statistics Canada's Surveys of Financial Security show that—in absolute dollar terms—asset value increased by $1.7 trillion in this six-year period, while the total value of debts increased by $245 billion. In other words, the volume of asset growth was nearly seven times the volume of debt growth, even though the latter grew at a faster relative pace.

Again, these aggregate statistics conceal vast differences among types of assets, debts, interest rates, household characteristics, capacity to service debt, and other factors that must be carefully analysed in order to assess the country's and households' financial health and level of security.

To that end—to give just one example—the full GPI financial security and debt report examines evidence that points to clear links between different kinds of debt and the growing wealth gap.

For example, wealthier households can more easily use their homes and other assets as equity to secure relatively low-interest loans and lines of credit, while the households that can least afford it are often driven to rely on high interest credit cards and even exorbitant payday loans because they have less access to cheaper sources of credit. This well illustrates the complex relationship between types of debt, sharply varying interest rates, household characteristics, and distributive factors—all of which together influence financial security and vulnerability.

On the positive side, the GPI report notes that—financial insecurities and vulnerabilities notwithstanding—Canadians as a whole have generally had very low rates of debt and mortgage default. This reality may quickly change in the new financial circumstances in which Canadians and citizens worldwide find themselves.

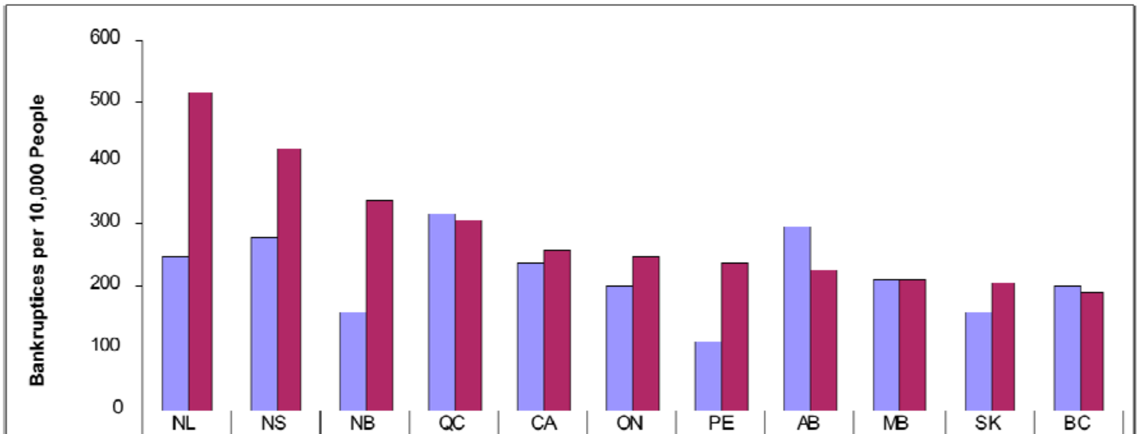
From a regional perspective, one trend of concern, which may possibly be related to the pace at which debt growth has outpaced asset growth in Atlantic Canada, is that consumer bankruptcies have risen sharply in Atlantic Canada in recent years to levels much higher than in the rest of the country (Figure 7-7 below). Since 1980, the number of personal bankruptcies has quadrupled in Canada and increased by nearly ten-fold in Atlantic Canada.[18]

Only very recently did this long-term trend begin to reverse. Thus, in 2006, nearly 3,500 personal bankruptcies were declared in Nova Scotia—a 13% decline from the previous year's total. The number of bankruptcies also declined across Canada between 2005 and 2006, from 84,600 in 2005 to 79,200 in 2006.

Population growth during the last three decades partly explains the longer term upward trend in bankruptcies. Other possible explanations for the increasing trend include national legislative changes in the second half of the 1990s that reduced barriers to declaring personal bankruptcies. However, it is noteworthy that analysts have not adequately been able to explain the longer term upward trend in personal bankruptcies seen in the last quarter century.[19] Canada's Superintendent of Bankruptcy has reported that credit card debt is a leading cause of personal bankruptcies. Tax debt, mortgages, and student loans are also key factors in personal bankruptcies.[20]

With the exception of Prince Edward Island, households in Atlantic Canada are much more likely to declare bankruptcy than elsewhere in Canada, as illustrated by Figure 7-7 below. Personal bankruptcy rates in Newfoundland and Labrador, Nova Scotia, and New Brunswick are well above the national average and highest among all the provinces. In 2005, for example, there were 262 personal bankruptcies per 10,000 people in Canada compared with 517 in Newfoundland and Labrador, 424 in Nova Scotia, and 343 in New Brunswick. In Prince Edward Island, there were 243 bankruptcies per 10,000—somewhat below the national average. Bankruptcy rates in the other provinces range from 192 in British Columbia to 308 in Quebec (Figure 7-7).[21]

Figure 7-7. Consumer bankruptcies per 10,000 people, Canada and provinces, 1999 and 2005



	NL	NS	NB	QC	CA	ON	PE	AB	MB	SK	BC
1999	249.3	283.5	161.5	317.8	240.1	201.9	115.2	297.4	215.8	159.3	203.9
2005	517.3	423.9	343.1	308.4	262.3	249.6	242.6	231.6	212.9	206.1	192.1

Source: Centre for the Study of Living Standards (CSLS). *Living Standards Domain of the Canadian Index of Wellbeing*. Prepared for the Canadian Index of Wellbeing. Forthcoming. Table 21. Calculations by CSLS based on Statistics Canada's CANSIM Tables 177-0001 and 051-0001.

7.5. Debt growth versus income growth

Data sources: Statistics Canada, Survey of Consumer Finances (SCF) / Survey of Labour and Income Dynamics (SLID); Statistics Canada, Summary Tables Online. Income, Pensions, Spending and Wealth: Assets and Debts Held by Family Units, Total Amounts, by Net Worth Quintile.

Result: In both Atlantic Canada and nationwide, debt growth is far outpacing income growth. Only the richest Canadians have seen income grow at a faster pace than debt.

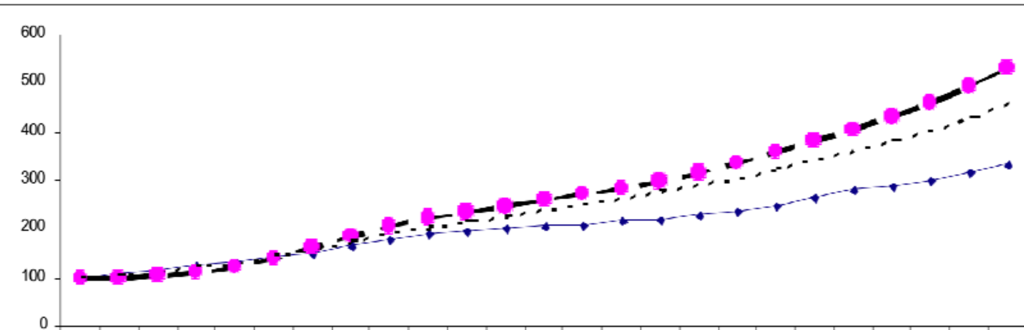
The rate of debt growth compared to the rate of income growth is another good indicator of a household's ability to manage or service its debt, which may be compromised if a household's debt to income ratio grows to the point where it exceeds its capacity to make regular payments. A growing debt to income ratio may also predict higher rates of default and consequent vulnerability among lending institutions that can be a precursor to the kind of financial crisis the world is presently experiencing. Again, these historical data bear particularly close examination at this historical moment in order to assess whether warning signals of the current crisis have been present for some time.

Figure 7-8 below illustrates how the level of household debt (personal liabilities) in Canada has been climbing at a faster rate than personal disposable income since the late 1980s. This gap has widened sharply since the mid-1990s. Indeed, growth in the total value of personal liabilities in Canada outstripped growth in personal disposable income at a particularly strong rate between 2000 and 2005, with debt rising twice as fast as income.[22] In 2005, the debt level appeared to stabilize relative to personal disposable incomes, though the current financial turmoil makes it doubtful that this apparent stability is the beginning of a real long-term trend.

Between 2000 and 2005, the National Balance Sheet Accounts (NBSA) show that the value of personal liabilities (household debt) in Canada averaged an annual real growth rate of 4%, while total personal disposable income averaged an annual real growth rate of 2%.[23] Over the full 24-year period from 1981 to 2005, for which consistent comparative data are available, the real growth rate of personal liabilities (household debt) averaged 3.8% annually while the real rate of increase in personal disposable income averaged 1.8% annually.[24]

Figure 7-8 also shows that the value of assets has also grown much more strongly than income. This is a significant factor not captured by debt-to-income ratios alone, since assets and wealth, if sufficiently liquid, can expand households' spending choices and debt management capabilities beyond the limits of income. Even if they are not so liquid—for example, when asset value increases due to the appreciating value of homes—growing assets and wealth can still provide equity that expands households' borrowing choices and capacity. Needless to say, this observation is subject to the caveat that the value of many assets may currently be compromised both by falling home prices and by the impact of the stock market crash on financial assets, including stocks, mutual funds, and RRSPs.

Figure 7-8. Comparative rates of increase (index: 1981=100), personal liabilities and assets versus personal disposable income, Canada, 1981–2005



	'81	'82	'83	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05
Disposable Income	100	110.4	115.5	125.4	135.4	142.7	151.8	165.6	181.4	191.7	198.0	202.6	207.4	210.3	217.8	221.2	228.9	238.4	249.9	268.0	280.5	290.9	302.1	317.9	331.7
Liabilities	100	99.4	106.9	112.5	124.3	141.9	164.5	185.5	207.3	224.6	234.1	246.8	260.2	273.2	283.9	297.8	316.1	336.4	359.2	380.5	403.4	429.3	459.4	493.3	530.2
Assets	100	107.0	115.8	123.9	133.5	146.8	160.6	176.5	194.9	203.5	215.5	227.0	240.6	253.9	263.8	277.3	292.1	303.9	324.2	344.2	361.7	382.7	401.9	426.5	458.6

Sources: Statistics Canada. CANSIM Table 378–0004—National Balance Sheet Accounts, by Sector, Annual; Statistics Canada. CANSIM Table 380–0019—Sector Accounts, Persons and Unincorporated Businesses, Annual. Index calculations by GPI Atlantic.

The growing gap between household income and indebtedness is confirmed by data from Statistics Canada's Survey of Labour and Income Dynamics (SLID). Real median household income grew by just under 5% nationally between 1999 and 2004—substantially less than the 38% real increase in median household debt from 1999 to 2005.[25]

This gap is also observed in Atlantic Canada. Between 1999 and 2004, the Atlantic provinces experienced growth in median household income ranging from -0.3% in Newfoundland and Labrador to more than 12% in Prince Edward Island. Real median household income in Nova Scotia grew by 3.8% during the same period. In sharp contrast, median household debt increased by 45% in the Atlantic region as a whole between 1999 and 2005.[26] Again, these debt-to-income ratios must be considered in the context of the parallel asset gains during the same period, which in turn are presently subject to the current stock market volatility and decline in home values.

It must again be noted that aggregate data provide only limited information on trends in financial security—a generalization that applies in this case also to debt-servicing capacity. Thus, aggregate debt and income growth trends mask substantial variations among the income and wealth quintiles that, in turn, have important and varying implications both for the financial security of households in general and for their debt-servicing capacity in particular. In other words, debt-to-income ratios vary significantly among households according to their wealth and income.

While income trends are available by income quintile, debt data are only available by wealth (instead of income) quintile, so a comparison of income and debt growth rates by quintile has limitations because income and wealth quintiles do not fully correspond.[27] However, higher income groups do, in general, tend to be wealthier than lower income groups, so the overlap between income and wealth quintiles is sufficient to allow for at least a rudimentary analysis of income and debt growth rates by quintile.[28]

The historical evidence indicates that, after a period of stagnant and even declining real incomes for lower and middle-income Canadians in the early to mid-1990s, Canadian households in all income quintiles have seen their real incomes grow steadily since the late 1990s. Over the longer term, Canadian households in the first to the fourth quintiles experienced growth in real after-tax income ranging from 11% to 14% between 1981 and 2004. The highest income quintile (fifth), however, had by far the largest increase in real after-tax income during this 23-year period at 26%.[29]

During the period between the two latest Surveys of Financial Security (1999 and 2005), growth in median debt has generally outstripped the rise in median income. This observation, which confirms the aggregate National Balance Sheet Accounts (NBSA) trends reported above, is in this case derived from comparing debt trends in the 1999 and 2005 Surveys of Financial Security (SFS) with income trends from Statistics Canada's Survey of Labour and Income Dynamics (SLID) for the 1999–2004 period.[30] While the NBSA data do not allow for disaggregation by either region or quintile, however, the SFS and SLID data do enable at least a rudimentary quintile analysis.

Thus, the lowest net worth households experienced an increase of 30% in the median value of debt between 1999 and 2005, according to SFS data. Correspondingly, however, after-tax income for the lowest income (first quintile) households grew by just 10% between 1999 and 2004.[31] Median debt, in other words, grew at three times the rate of disposable income for the poorest Canadians.

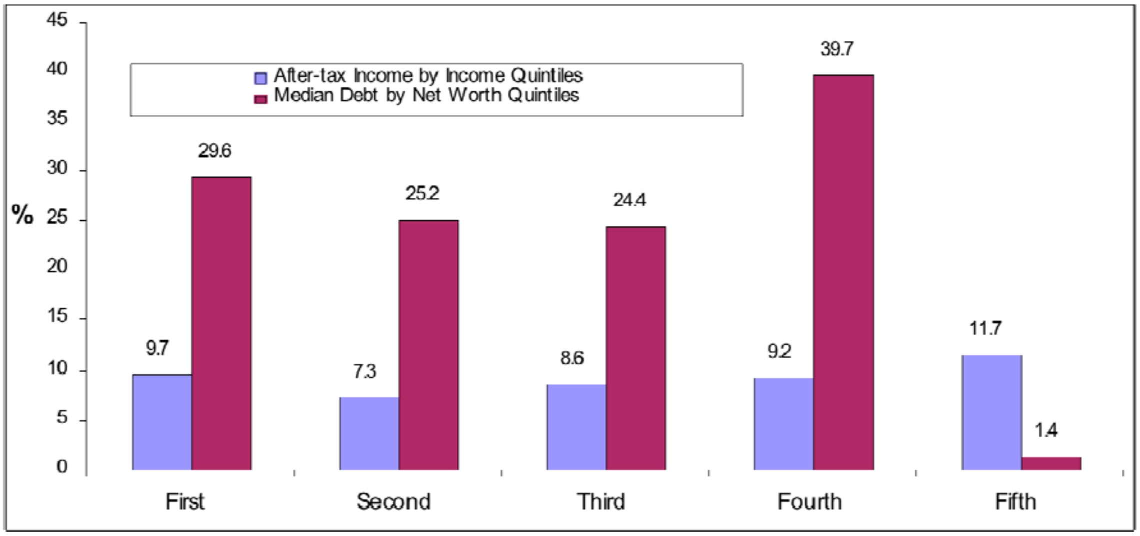
Households in the middle-income (third) quintile experienced real income growth of 9%, while middle-wealth households saw a 24% increase in their median debt. Households in the fourth (upper-middle) quintile saw their after-tax income grow by 9% and their median debt increase by nearly 40% during this period. Thus, for 80% of Canadians, debt growth sharply outpaced real income growth.

Only the richest 20% of Canadians saw an improvement—and a substantial one at that—in their debt to income ratios. Thus, the highest income (fifth quintile) Canadian households experienced the strongest growth in median after-tax income between 1999 and 2005 (over 12%), while the wealthiest 20% of households—in sharp contrast to all others—had the slowest growth in median debt—just 1.4% (see Figure 7-9 below).

With the major caveats noted above, it might be concluded from this comparison that—based on debt-to-income ratios—debt-servicing capacity and ability to manage debt effectively improved substantially for the wealthiest Canadian households, but declined for all other groups. That reality—revealed by analysis of data from the previous decade—might have signalled significant vulnerabilities in our societal lending and borrowing patterns, and acted as a major early warning signal and precursor of the current turmoil besetting lending institutions and financial markets.

As noted, debt-to-income ratios do not tell the whole story. Debt must also be considered in the context of asset accumulation, although that, too, is currently subject to substantial volatility, with assets values no longer as secure as they appeared just months ago. Nevertheless, the contrast between the wealthiest households and all the rest noted above, in terms of the recent rates of change in median after-tax income and median debt, is so striking that it points very clearly to the need to go below the aggregate data to discern shifts in debt-servicing capacity and financial security.

Figure 7-9. Change (percent) in total after-tax income (1999–2004) and median debt value (1999–2005), Canada



Sources: Income growth rates based on Survey of Consumer Finances (SCF) / Survey of Labour and Income Dynamics (SLID) estimates provided by the Centre for the Study of Living Standards (CSLS). *Living Standards Domain of the Canadian Index of Wellbeing*. Prepared for the Canadian Index of Wellbeing. Forthcoming. Debt growth rates from Statistics Canada, Summary Tables Online. Income, Pensions, Spending and Wealth: Assets and Debts Held by Family Units, Total Amounts, by Net Worth Quintile. Available from http://www40.statcan.ca/l01/cst01/famil115a.htm. Accessed May 8, 2007.

Notes: Growth in after-tax median income is for the period 1999–2004. After-tax income is total income, which includes employment earnings, investment income, and government transfers, minus income tax. It may also be called income after tax or personal disposable income (PDI).

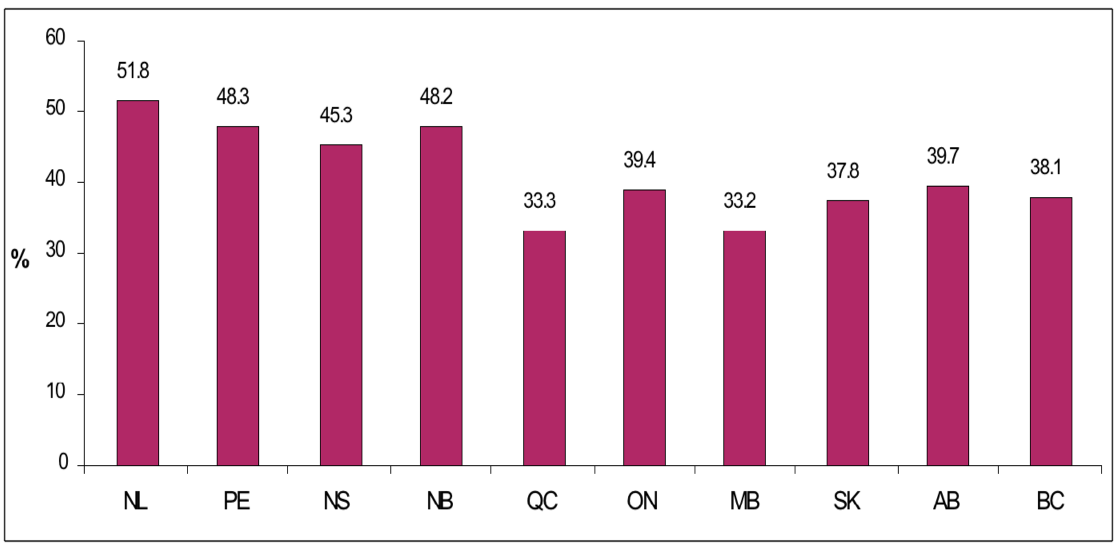
One other key factor determining households' capacity to make regular debt payments, and to service and manage debt effectively, is the interest rate charged on debt. In that regard, the GPI financial security and debt report also found that poorer households are increasingly relying on high-cost debt sources, like credit cards and payday loans, just to make ends meet. However, they frequently plunge them even deeper into debt. By contrast, wealthier households have the equity and financial means to access low-interest credit, which they can leverage to build assets and increase their wealth. For example, over 71% of line of credit debt is held by the wealthiest 40% of households, while less than 11% is held by the poorest 40%.[32]

On this particular sub-indicator of debt servicing capacity—concerning type of debt and interest rate charged—particular regional patterns are also apparent, with Atlantic Canada's lower income and lower wealth profile not surprisingly making it more vulnerable than other regions of the country to reliance on higher interest debt. Thus, in terms of credit card debt, households in Atlantic Canada have a substantially larger share of their overall debt tied up in credit card balances than the national average. In 1999, the most recent year for which regional breakdowns by debt component are available, 5% of total household debt in the Atlantic region was owed on credit cards, compared to just 3.2% nationally.

Extrapolating from the 1999 SFS, in which credit card debt accounted for 5% of the region's total household debt level, the outstanding balance on credit card debt in Atlantic Canada may be estimated to exceed $2 billion in 2005, compared to $1.3 billion in 1999 ($2005). This estimate conservatively assumes that the ratio of credit card debt to the total Atlantic region debt (which amounted to $41 billion in 2005) has remained constant at 5% between 1999 and 2005. It does not account for the reality that credit card debt has been the second fastest growing source of household debt load in Canada, and, therefore, quite likely now exceeds 5% of the total debt burden in Atlantic Canada.

Atlantic Canada accounted for 8% of the total Canadian credit card balance in 1999, roughly on par with the region's share of the national population. The median credit card balance in 1999 in the Atlantic region ($1,700 in 2005 constant dollars) was lower than the national average ($2,074). However, a larger proportion of Atlantic Canadian households have outstanding credit card balances than the national share. In 1999, 48% of Atlantic Canadian households had credit card debt (outstanding balances on their credit cards)—far exceeding the 38% national average in that year (see Figure 7-10 below).

Figure 7-10. Proportion of households with credit card debt (percent), by province, 1999



Source: Statistics Canada, Income Statistics Division. *Survey of Financial Security*. 1999.

In sum, all the indicators of capacity to service and manage debt examined here—debt to income ratios, debt growth versus asset growth, and reliance on high interest debt—point to potential vulnerabilities that may particularly compromise financial security among poorer Canadians. Such reduced capacity to service debt among substantial segments of the population reinforces and deepens the financial insecurity engendered by growing indebtedness among poorer Canadians, as documented in the initial indicators presented.

8. Economic Security

For the original GPI Atlantic report on economic security, please see the following:

Economic Security in Nova Scotia (2008)
http://gpiatlantic.org/pdf/livstand/econsec.pdf

Headline Indicators[1]

1. Index of Economic Security
2. Minimum wage
3. Social assistance benefits
4. Child benefits

Economic security means that individuals have a sense of confidence, protection, and even certainty about their economic safety both in the short term and for the foreseeable future. The economically secure do not worry about finding adequate economic resources to support themselves and their families, especially when encountering the economic losses that may result from being unemployed, ill, separating from an income-earning partner, or growing old. Thus, they do not feel overly anxious about potentially adverse circumstances that they may encounter in the future, and they have confidence that existing social mechanisms will provide adequate protection against such circumstances and conditions.

However, public opinion polling reveals that many Canadians do not have that confidence, feel economically insecure and experience such insecurity that their subjective state of wellbeing is diminished.[2] Lars Osberg has argued that economic insecurity is, in a general sense, "the anxiety produced by a lack of economic safety—i.e., by an inability to obtain protection against subjectively significant potential economic losses."[3] Since individuals' perceptions of economic insecurity in the future affect their present feelings of wellbeing, economic security can be considered to be an important component in the measurement of individuals' wellbeing. As such, it is a key indicator in the Index of Economic Wellbeing (IEW) developed by Dr. Lars Osberg and Dr. Andrew Sharpe, the Genuine Progress Index (GPI), and other measures that go beyond the narrower GDP-based growth measures.

While the definition of economic security above is essentially subjective—based on individuals' perceptions and feelings of confidence, security, anxiety, and wellbeing—these subjective experiences are difficult to quantify and measure directly and consistently over time. The indicators in this chapter therefore use available objective data on a select number of known risk factors for economic insecurity, and on the social mechanisms in place to provide protection against those risks, as proxies for the assessment of economic security. The underlying assumption here is that changes in the subjective level of anxiety about a lack of economic safety are proportionate to changes in objective risk.

What follows is a summary of key results from GPI Atlantic's 2008 *Economic Security in Nova Scotia* report, which adopted the approach to measuring economic security developed by the Centre for the Study of Living Standards (CSLS). This uses an aggregate index, the Index of Economic Security, which is comprised of assessments of security from the economic risks imposed by four key factors—unemployment, illness, old age, and single parenthood—to examine trends in economic security in both Nova Scotia and Canada from 1981 to 2007.

Separately, this 2008 report also examined provincial and national trends in four additional indicators that are designed to assess the adequacy of Nova Scotia's social safety net. These four indicators—social assistance levels, child benefits, minimum wage levels, and the adequacy of the minimum wage in relation to the low-income cut-off—can also be considered basic conditions of economic security, and are therefore also reported in this summary chapter.

8.1. The Index of Economic Security

Data sources: See sources accompanying each of the four index components below.

Result: Economic security in Nova Scotia declined during the 1981–2007 period, as it did nationwide. In 2007, the overall index of economic security in Nova Scotia was 0.581, a decline of 12.9% from its level of 0.667 in 1981. Nationwide, the economic security index declined from 0.666 to 0.555, a drop of 16.7%.

As previously noted, the Centre for the Study of Living Standards (CSLS) index of economic security is an aggregate index, based on security from the economic risks imposed by four key factors—unemployment, illness, old age, and single parenthood. These trends are summarized below for both Nova Scotia and Canada from 1981 to 2007.[4]

Overall, Nova Scotians (like other Canadians) were considerably less economically secure in 2007 than they were in 1981. In 2007, the overall index of economic security in Nova Scotia was 0.581, a decline of 12.9 % from 0.667 in 1981 (Table 8-1 below).

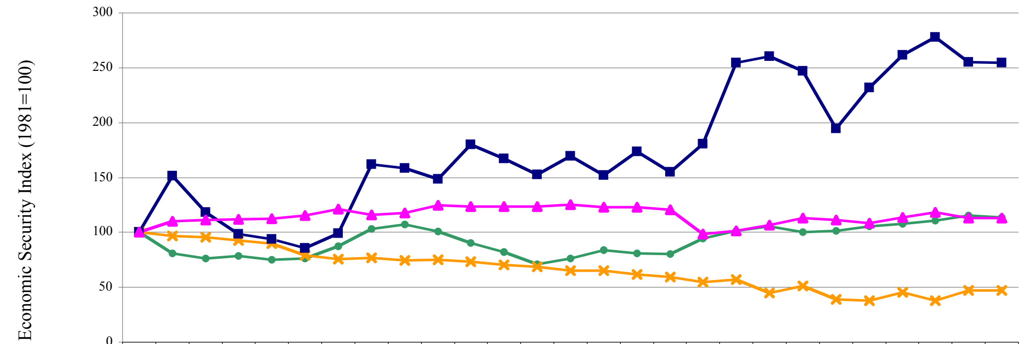
Table 8-1. Trends in the Index of Economic Security, Nova Scotia and Canada, 1981 and 2007

<table>
<tr><th rowspan="3"></th><th colspan="4">NOVA SCOTIA</th><th colspan="2">CANADA</th><th colspan="2" rowspan="2">Nova Scotia's Index of Economic Security as a Proportion of National Average</th></tr>
<tr><th colspan="2">Index of Economic Security</th><th colspan="2">Provincial Ranking of Index of Economic Security</th><th colspan="2">Index of Economic Security</th></tr>
<tr><th>1981</th><th>2007</th><th>1981</th><th>2007</th><th>1981</th><th>2007</th><th>1981</th><th>2007</th></tr>
<tr><td>Overall Index</td><td>0.667</td><td>0.581</td><td>3</td><td>4</td><td>0.666</td><td>0.555</td><td>100.2</td><td>104.7</td></tr>
<tr><td colspan="9">Index of security from risks imposed by:</td></tr>
<tr><td>Unemployment</td><td>0.551</td><td>0.627</td><td>6</td><td>8</td><td>0.625</td><td>0.669</td><td>88.2</td><td>93.7</td></tr>
<tr><td>Illness</td><td>0.915</td><td>0.431</td><td>2</td><td>2</td><td>0.813</td><td>0.331</td><td>112.5</td><td>130.2</td></tr>
<tr><td>Single parent poverty</td><td>0.286</td><td>0.728</td><td>10</td><td>8</td><td>0.431</td><td>0.739</td><td>66.4</td><td>98.5</td></tr>
<tr><td>Elderly poverty</td><td>0.719</td><td>0.812</td><td>2</td><td>6</td><td>0.600</td><td>0.847</td><td>119.8</td><td>95.9</td></tr>
</table>

As Table 8-1 above and Figure 8-1 below indicate, increased economic risks due to illness were the driving force behind the overall decline in economic security, both in Nova Scotia and nationwide. Thus, the index of security from risk imposed by illness in Nova Scotia declined by 52.9% from 0.915 in 1981 to 0.431 in 2007. At the same time, the economic risks attributable to single-parent poverty, unemployment, and elderly poverty decreased. The sub-indexes of economic security associated with these three risks increased by 154.5%, 13.8% and 12.9% respectively over the same period.

Economic security trends nationwide were similar to those in Nova Scotia, with a 16.7% decline in overall economic security in Canada between 1981 and 2007 driven by a 59.3% decline in the index of security from risk imposed by illness, while economic security for the other three constituents of the index improved. Among the provinces, Nova Scotia ranked fourth in 2007 in overall economic security, after Alberta, Newfoundland and Labrador, and Ontario. Economic security levels are lowest in Prince Edward Island, followed by Quebec and British Columbia.

Figure 8-1. Trends in the four components of the Economic Security Index (1981=100), Nova Scotia, 1981–2007



	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Unemployment	100.0	80.7	76.3	78.9	75.2	76.5	87.4	103.1	107.2	100.7	90.3	82.0	71.2	76.2	83.6	80.8	80.1	94.1	101.3	105.7	100.3	101.5	105.4	107.5	110.5	115.5	113.9
Illness	100.0	96.7	95.6	92.7	89.8	79.1	75.9	76.9	74.7	75.1	73.5	70.4	68.8	65.2	65.4	61.6	59.2	55.0	56.9	44.8	51.4	39.2	37.7	45.2	37.7	47.5	47.1
Single Parent Poverty	100.0	151.5	118.3	98.6	93.8	85.9	99.1	162.1	158.6	148.7	179.7	167.2	152.6	169.8	152.2	173.4	155.1	180.5	254.5	260.5	247.2	194.8	232.1	261.3	277.6	255.1	254.5
Elderly Poverty	100.0	109.9	111.0	112.1	112.4	115.5	121.3	116.0	117.9	124.5	123.7	123.4	123.7	125.0	122.6	122.9	120.4	98.7	101.6	106.4	112.8	111.4	108.3	113.5	118.0	112.9	112.9

It should be noted that the four components of the index illustrated in Figure 8-1 above are themselves weighted before being aggregated into the overall (scaled) Index of Economic Security. This is done using the relative proportions of the four groups facing the risk in the population as objective aggregation weights, as follows:

- For unemployment, the proportion of the 15–64 population in the total population (for example, 69.7 % in Nova Scotia in 2007).
- For illness, the proportion of the population at risk from illness, which is 100 %.
- For single-parent poverty, the proportion of the population comprised of married women with children under 18 years and of children under 18 (for example, 34.1 % in Nova Scotia in 2007).
- For elderly poverty, the proportion of the population in immediate risk of poverty in old age, defined as the proportion of the 45–64 population in the total population (for example, 29.3% in Nova Scotia in 2007).

For the purposes of aggregation, the above proportions are then normalized for all years to sum to unity. For example, in Nova Scotia, the weights for the four groups at risk in 2007 then became 0.299 (unemployment), 0.429 (illness), 0.146 (single-parent poverty), and 0.126 (elderly poverty).

In other words, considerably greater weight is given in the aggregate Index of Economic Security to the risks attributable to illness than to the other three risk factors, since the risk of illness affects the entire population. This helps explain, for example, why—in the aggregate index—the 52.9% decline in security from the economic risks imposed by illness outweighs the 154.5% improvement in security from the economic risks associated with single-parent poverty.

The internal variations in each of the four components that comprise the overall index of economic security are examined in detail in the 2008 economic security report and are briefly summarized below.

8.1.1. Security from risk imposed by unemployment

Data sources: Statistics Canada Labour Force Survey; Employment Insurance Statistics; Survey of Employment, Payroll and Hours

Result: Economic security from the risk imposed by unemployment in Nova Scotia improved between 1981 and 2007, although there have been considerable internal variations in this trend corresponding largely to business cycles.

The economic risk associated with unemployment is modelled here as a weighted average of the risk of unemployment (80% weight) and the extent to which people are protected from the income losses of unemployment (20% weight). Changes in the unemployment rate are taken as a proxy for freedom from the risk of unemployment. The extent to which people have been protected by Employment Insurance (EI) from the financial impacts of unemployment is modelled as the product of: 1) the percentage of the unemployed who claim regular EI benefits, and 2) the percentage of average weekly wages replaced by EI.

As seen in Figure 8-1 above, security from unemployment risks largely followed the business cycle, dropping particularly dramatically during the recessions of the early 1980s and early 1990s, and not recovering to 1990 levels until 1999. The registered improvement of 13.8% in the sub-index of security from the risk imposed by unemployment between 1981 and 2007, and the responsiveness of the sub-index to changes in unemployment rates, indicates how sensitive the trends are to the relative weights given to the different components of that sub-index.

Thus, both the decreased unemployment rate, particularly since the late 1990s, and the increased proportion of earnings replaced by Employment Insurance (EI) benefits have both contributed to the overall rise in the index of security from the risk imposed by unemployment. On the other hand, the proportion of the unemployed receiving EI benefits decreased nationally by 33.4% between 1981 and 2007 and fell by 47% from its high point in 1989. However, the strong decline in the unemployment rate still drove the sub-index of economic security from the risks imposed by unemployment up slightly, because of the much greater weight given to the unemployment rate indicator compared to the EI protection indicator (4 to 1).

The 2007 unemployment rate of 8% in Nova Scotia was the second lowest recorded in a quarter century (the lowest was in 2006, at 7.9%), and has shown steady improvement (i.e., a decline in unemployment) since the recession of the early 1990s and since its 1993 high point of 14.3%. However, there was still a two percentage point gap between the unemployment rate in Nova Scotia and the national average of 6%, and the Nova Scotia unemployment rate remained the third highest in the country.

It is important to distinguish economic security from affluence. In the same way that somebody with a small insured house may be more secure (but less affluent) than a neighbour who lives in an uninsured mansion, Nova Scotia in 2007 had a relatively higher coverage of financial protection for those unemployed than the Canadian average, but lower average wages. The ratio of regular EI beneficiaries to total unemployed individuals in Nova Scotia in 2007 was 71.3%—ranking fourth out of ten provinces in Canada—a roughly two thirds higher rate of coverage than the national average of 44.4%. Moreover, the percentage of average weekly wages replaced by the EI benefit was 45.3% in Nova Scotia, the second highest level in Canada—lower only than Prince Edward Island at 50.4%, and equal to Saskatchewan.

When these two factors (percentage receiving benefits and percentage of earnings covered by EI) are multiplied according to this measure, the relative level of financial protection afforded by EI for those unemployed in Nova Scotia is seen to be well above the average for Canada (0.323 versus 0.183) (see third row of Table 8-2 below).

Table 8-2. Trends in the indicators of economic security from risk imposed by unemployment, Nova Scotia and Canada, 1981 and 2007

	NOVA SCOTIA			CANADA		
	Indicator Values		Absolute Change (percentage points)	Indicator Values		Absolute Change (percentage points)
	1981	2007	1981–2007	1981	2007	1981–2007
Index of Security from risk imposed by unemployment	0.551	0.627	13.8	0.625	0.669	7.0
Unemployment rate (%)	10.0	8.0	-2.0	7.6	6.0	-1.6
Financial protection for unemployed (next two proportions multiplied together)	0.334	0.323	-0.011	0.256	0.183	-0.073
Proportion of unemployed receiving benefits (%)	90.0	71.3	-18.7	66.6	44.4	-22.2
Proportion of earnings replaced by benefits (%)	37.1	45.3	8.2	38.4	41.2	2.8

Sources: Statistics Canada Labour Force Survey. Employment Insurance Statistics, and Survey of Employment, Payroll and Hours.

Yes, despite the fact that Nova Scotians have better EI financial protection than most other Canadians, the overall sub-index of security from unemployment in Nova Scotia (0.627) remains 6.3% less than the national average (0.669), putting Nova Scotia in the eighth position in this component of the economic security index in 2007. This eighth place ranking is due mostly to the province's higher than average unemployment rate. At the same time, the improvement in the overall sub-index of security from the risk imposed by unemployment in both Canada and Nova Scotia is also driven mostly by the drop in unemployment—again because this factor is given much greater weight than changes in the proportion of the unemployed receiving EI benefits, which dropped during this period both nationwide and in Nova Scotia.

8.1.2. Security from risk imposed by illness

Data sources: Statistics Canada, Provincial Economic Accounts and Survey of Household Spending; Canadian Institute for Health Information (National Health Care Expenditures Database)

Result: Economic security from the financial risk imposed by illness in Nova Scotia decreased dramatically from 1981 to 2007. This change was driven by the increased share of out-of-pocket expenditures on health care in personal disposable income.

Economic security from the financial risk imposed by illness decreased dramatically from 1981 to 2007 both in Nova Scotia and nationwide. This change was driven by the increased share of personal disposable income devoted to private out-of-pocket expenditures on health care, which more than doubled in Nova Scotia from 0.79% of disposable income in 1981 to 1.69% in 2007—a 0.9 percentage point increase. Nationwide, the share of private expenditure on health care in disposable income almost doubled nationwide, increasing by 0.89 percentage points (Table 8-3 below).

Table 8-3. Trends in the indicators of economic security from risk imposed by illness, Nova Scotia and Canada, 1981 and 2007

	NOVA SCOTIA			CANADA		
	Indicator Values		% Change	Indicator Values		% Change
	1981	2007	1981–2007	1981	2007	1981–2007
Index of Security from risk imposed by illness	0.915	0.431	52.9	0.813	0.331	59.3
Private expenditure on health care, (millions of current dollars)	55	380	590.9	2,342	16,514	605.1
Personal disposable income (millions of current dollars)	6,920	22,513	225.3	238,606	881,964	269.6
Proportion of private expenditure on health care in personal disposable income	0.79	1.69	113.9	0.98	1.87	90.8

Source: Statistics Canada. *Provincial Economic Accounts and Survey of Household Spending*. Canadian Institute for Health Information. National Health Care Expenditures Database.

The Canadian Institute for Health Information (CIHI) provides a breakdown of out-of-pocket health care expenditures by type for Canada.[5] Although these out-of-pocket expenditures are increasing, they are concentrated mainly in spending on drugs and health supplies, dental and eye-care professionals, and health care institutions other than hospitals. These categories together accounted for 87.4% of private out-of-pocket expenditures in 2004. The largest major increases between 1987 and 2004 were in prescribed drugs and health care practitioners other than dentists and eye-care professionals, which grew by 325% and 348% respectively (in current dollars). A third category, "other health care services," increased by more than 500% from 1987 to 2004, but from a relatively small base of $37.9 million in 1987, so these expenditures still represented only 1.2% of total out-of-pocket health care expenditures in 2004.

A recent report from the Health Council of Canada (HCC) highlighted the need for a national drug strategy to protect Canadians from financial hardship due to the growing cost of prescription drugs.[6] The report evaluates results from the Accord on Health Care Renewal signed in 2003, and concludes that governments have failed to fulfill their promises: "Significant gaps in coverage are still evident across Canada and too many Canadians are vulnerable to personal hardship from needed drugs that cost more than they can afford."[7]

In 2007, direct private expenditures on health care in Nova Scotia averaged $407 per capita, which accounted for 1.69% of personal disposable income in the province—slightly less than the national average of 1.87%. Because of this smaller share of private health care spending in disposable income, the sub-index of security from the risks imposed by illness in Nova Scotia was 30.2% higher than the national average, and second highest nationwide, with only Newfoundland performing better. However, since the sub-index of security from the risks imposed by illness declined by 52.9% in Nova Scotia between 1981 and 2007, this relative ranking is small comfort.

8.1.3. Security from risk imposed by single-parent poverty[8]

Data sources: Statistics Canada, Survey of Labour and Income Dynamics; and Vital Statistics, Divorce Database.

Result: During the 1981–2007 period, Nova Scotian single female parents saw a considerable improvement in their economic security from the risks imposed by single-parent poverty, with low-income rates in that group declining from 67.3% in the 1981–1983 time period to 43% in the 2003–2005 time period.

Improvement in security from the risks of poverty associated with single parenthood in Nova Scotia is primarily attributable to two factors—a decline in Nova Scotia's divorce rate (thus reducing the incidence of single parenthood) and a sharp increase in labour force participation by single mothers. However, the improvement in economic security for single mothers must be balanced both against their higher levels of time poverty (see Chapter 2 above on unpaid household work) and reduced time with their children, and against the hidden costs of employment (like higher childcare and other expenditures), which are not accounted for in the index of economic security.[9]

Although Canada also showed similar trends during this same period, the magnitude of the increase in security for Canadian single mothers nationwide was not as great as that in Nova Scotia, largely because the poverty gap ratio nationwide did not decline as dramatically as it did in Nova Scotia.

Table 8-4 below illustrates trends in the three factors used to assess the economic risks imposed by single parenthood—the divorce rate (which strongly influences the incidence of single parenthood), the low-income rate among single mothers (using Statistics Canada's low income measure or LIM), and the poverty gap (the percentage of difference between the actual income of low-income single mothers and the LIM).

Table 8-4 shows that Nova Scotia had a divorce rate in 2007 virtually identical to the national average. This indicator, defined as the ratio of the number of divorces over the number of married couples, stood at 0.865% in 2007, virtually equal to the national average of 0.866%. However, the low-income rate for lone female families, defined on a low income measure (LIM) basis, was 43% in Nova Scotia—a marked improvement over the 1997 rate of 77.9%, but still higher than the national average of 40.3%. The lowest single female family low-income rate was in Quebec at 34.3%.

Meanwhile, the poverty gap for lone female families in 2003–2005 was 0.274 in Nova Scotia, which was smaller than all other provinces except Prince Edward Island at 0.191 and Quebec at 0.256. However, the overall risk imposed by single-parent poverty, which is calculated by the product of the low-income rate and the poverty gap, was relatively higher in Nova Scotia than nationwide due to the province's higher low-income rate for female lone parents, and the sub-index of security from risk imposed by single-parent poverty hence was correspondingly lower in Nova Scotia than nationwide.

Table 8-4. Trends in the indicators of economic security from risk imposed by single-parent poverty, Nova Scotia and Canada, 1981 and 2007

	NOVA SCOTIA			CANADA		
	Indicator Values		Absolute Change	Indicator Values		Absolute Change
	1981	2007	1981–2007	1981	2007	1981–2007
Index of Security from risk imposed by single-parent poverty	0.286	0.728	154.5	0.431	0.739	71.5
Risk imposed by single-parent poverty	28.2	11.1	-17.1	22.6	10.6	-12.0
Divorce Rate (%)	1.127	0.865	-0.262	1.116	0.866	-0.250
Low-income rate for lone female families (%)	67.3	43.0	-24.3	62.9	40.3	-22.6
Poverty gap for lone female families	0.339	0.274	-0.065	0.301	0.294	-0.007

Source: Statistics Canada. Survey of Labour and Income Dynamics; Statistics Canada, Vital Statistics—Divorce Database

Notes: Low-income rate and poverty gap data were not available for 2006–2007 at the time of writing. Therefore, they are here assumed to be equal to the 2003–2005 average. As explained in the endnotes to this chapter, the poverty rate and poverty gap for 1981 are actually the average for 1981–1983, and for 2007, the average of 2005–2007. Also, the data in 2006 and 2007 are imputed from the average of 2003 to 2005.

The sub-index of security from risk imposed by single-parent poverty for Nova Scotia was 1.5% lower than the national average, with Nova Scotia ranking eighth out of ten provinces on this measure. Prince Edward Island had the greatest security from risk imposed by single-parent poverty in the country, followed by Quebec and Manitoba. Alberta had the least economic security for single mothers, and British Columbia had the second least, which is partly attributable to the fact that those two provinces had the highest divorce rates in the country.

8.1.4. Security from risk imposed by poverty in old age

Data source: Statistics Canada, Survey of Income and Labour Dynamics.

Result: The sub-index of security from the risk imposed by poverty in old age in Nova Scotia improved steadily through the 1980s and early 1990s, reaching its highest level in 1994. The index is now 12.9%—higher than in 1981 but 9.6% lower than its 1994 peak.

Nationwide improvements in the sub-index of security from the risk imposed by poverty in old age in the 1980s were due partly due to federally legislated improvements to Old Age Security and Guaranteed Income Supplement benefits, including higher payments, indexation of benefits, and provision of spousal allowances. In Nova Scotia, the sub-index is 12.9% higher than in 1981 but 9.6% lower than its 1994 peak.[10]

The elderly low-income rate defined on a LIM basis reached highs of 15.6% in Nova Scotia in 1999–2001 and 14.6% in 2002–2004—more than double the rates of the early 1990s—before falling to an average of 12% in 2005–2007. The poverty gap for elderly families has been less in recent years than in the early 1980s and late 1990s, but higher than in the late 1980s and early 1990s. Nationwide, the improvement in security from the risk imposed by elderly poverty was considerably more impressive than in Nova Scotia, due to the much lower current rate of elderly low-income nationally and the much sharper decline in that low-income rate over time (Table 8-5 below).

Table 8-5. Trends in the indicators of economic security from risk imposed by elderly poverty, Nova Scotia and Canada, 1981 and 2007

	NOVA SCOTIA			CANADA		
	Indicator Values		Absolute Change	Indicator Values		Absolute Change
	1981	2007	1981–2007	1981	2007	1981–2007
Index of Security from risk imposed by elderly poverty	0.719	0.812	12.9	0.600	0.847	41.2
Poverty intensity for elderly families	0.061	0.034	-0.027	0.095	0.024	-0.071
Low-income rate for elderly families (%)	13.8	12.0	-1.8	15.3	7.5	-7.8
Poverty gap ratio for elderly families	0.177	0.136	-0.041	0.236	0.169	-0.067

Source: Statistics Canada. Survey of Labour and Income Dynamics.

Note: For the reasons explained in the endnotes to this chapter, the numbers for 1981 are actually the average for 1981 to 1983, and for 2007, the average of 2005 to 2007; and low-income data for 2006 and 2007 are imputed from the average of 2003 to 2005.

8.2. Minimum wage

8.2.1. Trends in minimum wage

Data source: Human Resource and Social Development Canada (HRSDC), Database on Minimum Wages.

Result: There has been virtually no change in the real (inflation-adjusted) minimum wage in Nova Scotia over a 26-year period.

In Nova Scotia, the nominal hourly minimum wage was $3.30 in 1981, and it increased to $7.60 by 2007, an increase of $4.30, or 130.3% (Table 8-6 below). This represents the fourth largest increase in nominal minimum wages among Canadian provinces after Ontario, Manitoba, and British Columbia. The average for Canada in 1981 was $3.59, and by 2007 it had increased to $7.93, an increase of $4.34 or 120.9%.

Since inflation in prices was of a similar magnitude as the nominal increase in minimum wages, the two almost exactly counter-balanced each other. As such, there has been virtually no change in the real (inflation-adjusted) minimum wage. On average, real minimum wages in Canada were $8.09 in 1981 ($2007), and decreased to $7.93 by 2007, a decline of $0.16 (2%). Real minimum wages in most provinces were at about the same level in 2007 as in 1981. In Nova Scotia, they increased marginally by $0.29, or 4%, from $7.31 in 1981 to $7.60 in 2007 ($2007) (Table 8-6).

Table 8-6. Trends in the indicators of minimum wages ($/hour), Nova Scotia and Canada, 1981 and 2007

	NOVA SCOTIA			CANADA		
	Indicator Values ($/hour)		% Change	Indicator Values ($/hour)		% Change
	1981	2007	1981–2007	1981	2007	1981–2007
Nominal hourly minimum wage (current dollars)	3.30	7.60	130.3	3.59	7.93	120.9
Real hourly minimum wage ($2007)	7.31	7.60	4.0	8.09	7.93	-2.0

Source: Human Resource and Social Development Canada. Database on Minimum Wages.

Note: The minimum wage in Canada is the average of provinces weighted by the number of minimum wage workers in each province.

8.2.2. Minimum wage relative to the Low Income Cut-Off[11]

Data source: Human Resource and Social Development Canada (HRSDC), Database on Minimum Wages.

Result: In 2006, employable persons on minimum wage in Nova Scotia had to work more hours per week than they did in 1981 in order to reach the low income cut-off (LICO).

Another way to look at the adequacy of minimum wages in terms of economic security is by assessing the hours that have to be worked at minimum wage to reach Statistics Canada's before-tax Low Income Cut-Off (LICO).

The LICO is different for rural and urban areas. For Nova Scotia, this section will first look at the adequacy of minimum wages in Halifax (using the LICO for an urban area of population 100,000 to 499,999) and then at the adequacy of minimum wages in the rural areas of the province (with the rural LICO). It is noteworthy that the Market Basket Methodology (MBM) of HRSDC implies that the cost of living of poor people is actually 3% higher in rural Nova Scotia than in Halifax and not, as the LICO presumes, 29% lower. Hence, those who favour the MBM over the LICO as a potential indicator of income adequacy may wish to disregard the illustrative calculations for rural areas presented here based on the LICO.

Since the Canada Child Tax Benefit (CCTB) and HST Tax Credit only came into existence in the 1990s, while the Family Allowance benefit was in place in the 1980s, the following trend analysis is conducted assuming no receipts from any other transfer program. In a sense, this earnings-only calculation serves to illustrate just how important the CCTB and HST transfer systems are, since they are what make it remotely feasible for many working families to reach the Low Income Cut Off. To demonstrate this importance, earnings at the minimum wage in 2006 for Nova Scotia are then added to GST/HST credits and to the Canada Child Tax Benefit, and compared to the same poverty lines (before-tax LICO).

In Canada, single employable persons and those with a disability would have had to work 43.6 hours weekly for 52 weeks at minimum wage[12] to reach the urban LICO in 1981. This increased to 45.7 hours in 2006—up 4.8% from 1981 (Table 8-7 below). In other words, single persons working at minimum wage needed to work more than full-time to reach the LICO in 1981, and slightly more than that in 2006.

Urban Canadians with children experienced the same trends over the 25-year period for this indicator. Yet, the number of hours required at minimum wage to reach the urban LICO was even greater. Canadian single parents with one child would have had to work 54.3 hours per week at minimum wage in 1981, or 9 hours daily for 6 days a week, 52 weeks a year, just to reach the LICO. Couples with two children would have had to work 81 hours between them.

This means that both husband and wife would have to work full-time (and still care for their children) if earning minimum wage.

The number of hours that had to be worked at minimum wage by Canadian single parents with one child in order to reach the low income cut-off line increased to 56.9 hours in 2006. For couples with two children, it increased to 85 hours. The inordinate hours that have to be worked by low-income single parents in particular, just to make ends meet, help explain the very high levels of time poverty experienced by single parents, as indicated in Chapter 2 above on unpaid household work and in GPI Atlantic's 2008 report on the value of free time.[13]

Persons living in Halifax fared slightly worse in all four categories in this indicator than the average urban Canadian. This is largely due to the fact that minimum wages in Nova Scotia were slightly lower than those of the average Canadian. In 2006, single employable persons in Halifax and those with a disability would have had to work 49.1 hours per week at minimum wage every week for 52 weeks to reach the urban LICO—slightly more than in 1981 (48.3 hours).

Single parents with one child in Halifax experienced the same trend at even higher levels, with an increase of 1.7% in the number of hours that would have had to be worked at minimum wage to reach the urban LICO—from 60.1 hours in 1981 to 61.1 in 2006. Low-income couples with two children in Halifax also saw an increase of 1.7% in the number of weekly hours at minimum wage required to reach the urban LICO—from 89.7 hours in 1981 to 91.2 hours in 2006 (Table 8-7 below).

Statistics Canada's low income cut-offs (LICO)—used by many analysts as a proxy for the poverty line[14]—are calculated according to the share of total income spent on food, clothing, and shelter. The intention is to reflect costs of living in different sized urban and rural settings. The before-tax LICO for a family of four living in a city of 100,000 to half a million people in Canada was $33,216, while the LICO for the same family in a rural area was only $21,728. For this reason—and due to the fact that the minimum wage is the same in rural and urban areas—Canadians and Nova Scotians living in rural areas were better off, according to this particular indicator of minimum wage adequacy, than those living in urban centres.

As noted above, however, this is not the case when using HRSDC's Market Basket Methodology (MBM) for assessing income adequacy. According to the MBM, once one takes account of the greater cost of transportation in rural areas, the poverty line should actually be drawn at a higher income in rural areas than in mid-sized cities. Using the MBM, therefore, would produce very different results from those indicated in Table 8-7 below, with low-income rural Nova Scotians actually having to work longer hours at minimum wage to make ends meet than their urban counterparts.

Single persons and those with a disability in Nova Scotia living in rural areas would have had to work 39.2 hours at minimum wage to reach the rural LICO in 2006, which is somewhat higher than in 1981 (38.6 hours). Single parents with one child living in rural areas would have had to work more than full-time at minimum wage to reach the rural LICO—48.9 hours weekly in 2006—up 1.9% from 1981. Rural couples with two children in Nova Scotia were better off, having to work 72.9 hours of work at minimum wage to reach the rural LICO in 2006—up 1.7% from 1981 (Table 8-7).

As seen in Table 8-7 below, Nova Scotians in rural areas would have had to devote more hours at minimum wage to reach the rural LICO than rural Canadians in general, again because of the lower than average minimum wage in Nova Scotia. Single rural persons in Canada and those with a disability had to work 36.6 hours at minimum wage to reach the rural LICO in 2006 (almost three hours less than in Nova Scotia). For single-parent families with one child in rural Canada, 45.5 hours at minimum wage were needed to reach the rural LICO, and for couples with two children, 67.9 minimum wage hours were enough to reach the rural LICO.

Table 8-7. Trends in the indicators of minimum wages relative to the Low Income Cut-off, Nova Scotia and Canada: weekly hours of work needed at minimum wage to reach the urban and rural LICO, 1981 and 2006

	NOVA SCOTIA			CANADA		
	Indicator Values (hours/week)		% Change	Indicator Values (hours/week)		% Change
	1981	2006	1981–2006	1981	2006	1981–2006
Urban LICO (Population of 100,000 to 499,999)						
Single employable persons	48.3	49.1	1.7	43.6	45.7	4.8
Persons with a disability	48.3	49.1	1.7	43.6	45.7	4.8
Single parents with one child	60.1	61.1	1.7	54.3	56.9	4.8
Couples with two children	89.7	91.2	1.7	81.0	85.0	4.9
Rural LICO						
Single employable persons	38.6	39.2	1.6	34.9	36.6	4.9
Persons with a disability	38.6	39.2	1.6	34.9	36.6	4.9
Single parents with one child	48.0	48.9	1.9	43.4	45.5	4.8
Couples with two children	71.7	72.9	1.7	64.8	67.9	4.8

Source: Human Resource and Social Development Canada, Database on Minimum Wages.

Analyses of earnings-only income for persons working at minimum wage, as in Table 8-7 above, enables us to see how adequate the minimum wage is by itself. But in fact, minimum wage workers are eligible for two important income supplement programs—GST/HST credits and Canada Child Tax Benefits. The evidence indicates that these programs make a huge difference in enhancing the adequacy of incomes in rural and urban areas nationwide, and in assisting low-income Canadians to make ends meet. These benefits particularly enable low-income families with children to reach the LICO while working at minimum wage with considerably fewer hours of work than indicated in Table 8-7 above. This is because the Child Tax Benefit ensures that the greatest improvements are for single-parent families and couples with two children.

Because they are ineligible for the Child Tax Benefit, single employable persons and those with a disability are hardly affected by these benefit programs. Thus, in rural Nova Scotia, for example, GST/HST benefits reduced the number of hours at minimum wage needed by single workers and those with a disability to reach the rural LICO by a mere 0.6 hours to 38.7 hours in 2006. In Halifax, the reduction amounted to only 0.7 hours a week in 2006—48.4 hours instead of 49.1 hours a week.

However, single-parent families with one child benefit greatly from the Canada Child Tax Benefits program. Those working full time at minimum wage in Nova Scotia receive a total of $4,241 in 2006 from both federal and provincial sources, mainly from the Canada Child Tax Benefit. As a direct result, the number of hours per week they need to work at minimum wage to reach the LICO is 37.1 hours in rural areas and 46.4 hours in urban areas—down from 48.9 and 61.1 hours respectively based on earnings alone.

These reductions of 11.8 and 14.8 hours compared to the basic minimum wage salaries make for workweeks that are at least conceivable, even if they still produce high rates of time poverty due to the fact that single parents also shoulder the entire burden of unpaid household work alone. It must also be borne in mind that these calculations of hours at minimum wage required to reach the LICO are based on 52 weeks of work each year—which may not be either possible or desirable for single parents who wish to spend some dedicated time with their children. In sum, the benefits significantly relieve the potential work and income stress of low-income single parents, but by no means signify income or time adequacy.

Couples with two children in Nova Scotia—who would receive $7,018 from Child Tax Benefit programs if working full time at minimum wage—also experience similar reductions, with the number of hours of minimum wage work needed to reach the LICO when accounting for benefits standing at 58.1 hours in rural areas and 72.7 hours in urban areas—down from 72.9 and 91.2 hours respectively without those benefits and based on the minimum wage alone.

8.3. Social assistance benefits[15]

Sources: National Council of Welfare, Welfare Incomes 2005 and Welfare Incomes 2006 (Web-Only Data)

Results: Welfare benefits decreased nationwide in real terms over the period 1986-2006, but Nova Scotia saw a substantially sharper decline in welfare benefits than the Canadian average.

In real terms, total social assistance benefits in Canada have decreased in general since 1986, despite the introduction of federal payments under the Canada Child Tax Benefit and GST tax credit program. With the exception of couples with two children, welfare recipients in Nova Scotia have seen a much sharper decline in their real benefits since 1986 than the average Canadian welfare recipient.

In 1986, single employable persons eligible for social assistance benefits in Canada received an average of $7,227 ($2007) in welfare income.[16] By 2006, this income had decreased by 5% in real terms to $6,868. The decrease for this group was more than four times larger in Nova Scotia, declining from $7,840 in 1986 to $6,119 in 2006—a drop of 21.9% over the period. It should be noted that Nova Scotia welfare benefits for single employable persons in 1986 were 8.5% above the Canadian average and that they had decreased to 10.9% below the Canadian average by 2006.

In 1989, persons with a disability eligible for social assistance benefits received $11,466 on average in Canada, whereas Nova Scotians with a disability received $11,615—1.3% higher than the national average. But again, there was a much larger decrease in benefits in Nova Scotia than in the rest of Canada. In 2006, welfare income for persons with a disability was $9,154 in Nova Scotia, a decrease of 21.2% from 1989—4.5 times the magnitude of decline in the rest of the country. In Canada, the decline in benefits during this period for persons with a disability was 4.5%, to a benefit amount of $10,950 in 2006—16.4% higher in absolute terms than in Nova Scotia.

In 1986, single parents with one child who were eligible for social assistance benefits received an average of $15,378 in welfare income in Nova Scotia and $16,238 in Canada ($2007). In Nova Scotia, this income had decreased to $14,308 by 2006, representing a decline of 7% from 1986, while in Canada it declined by 2.6% to $15,815 in 2006. Welfare income for Nova Scotian single parents with one child was 5.3% below the Canadian average in 1986, but 9.5% below the Canadian average in 2006.

Couples with two children eligible for social assistance benefits were the only group of the four to experience a less severe decline in their welfare incomes in Nova Scotia than in Canada as a whole. The welfare income for this group was $19,945 in Nova Scotia in 1986, and it remained relatively stable at $20,379 in 2006—a slight increase of 2.2% over the period. In Canada, welfare income for this group decreased by 6.6%—the largest relative decrease among the four groups from $22,556 in 1986 to $21,059 in 2006, which was still 3.3% higher than in Nova Scotia (Table 8-8 below).

Table 8-8. Trends in the indicators of social assistance benefits ($2007), Nova Scotia and Canada, 1986 and 2006

	NOVA SCOTIA			CANADA		
	Welfare Income		% Change	Welfare Income		% Change
	1986	2006	1986–2006	1986	2006	1986–2006
Single employable persons	7,840	6,119	-21.9	7,227	6,868	-5.0
Persons with a disability*	11,615	9,154	-21.2	11,466	10,950	-4.5
Single parents with one child	15,378	14,308	-7.0	16,238	15,815	-2.6
Couples with two children	19,945	20,379	2.2	22,556	21,059	-6.6

Source: Welfare Incomes 2005. Published by the National Council of Welfare and web-only data for Welfare Incomes 2006.

Note: *Data for persons with a disability are for the period 1989–2006, as comparable data are not available prior to 1989.

Due to the much larger declines in welfare income for most categories of social assistance recipients in Nova Scotia relative to their counterparts in Canada as a whole, it is not surprising that Nova Scotia's provincial ranking in this welfare income indicator was lower in 2006 than in 1986 (and lower than in 1989 for persons with disabilities):

- For single employable persons, Nova Scotia ranked fifth among the provinces in terms of adequacy of social assistance benefits in 1986, but seventh in 2006.
- For persons with disabilities, the province ranked fourth in 1986, but sixth in 2006.
- For single parents with a child, Nova Scotia fell from sixth place to last place.
- Only for couples with two children did Nova Scotia's ranking among Canadian provinces improve marginally—from second last place in 1986 to eighth place (third last) in 2006.

8.4. Child benefits

Data source: Canada Revenue Agency, National Child Benefits

Result: Total child benefit investments more than doubled in Nova Scotia from $11.1 million in 1998–99 to $27 million in 2006–07—an increase of 144%. This was somewhat below the national increase of 162%.

The National Child Benefit—a joint initiative of the federal, provincial, and territorial governments—is intended to help prevent child poverty and to reduce the depth of child poverty. In July 1998, the Government of Canada enhanced the Canada Child Tax Benefit (CCTB) by introducing the National Child Benefit Supplement (NCBS).[17]

Since 1998, child benefit expenditures are reported in two categories—"re-investments" and "total investments" (including new investment). "Re-investments" include spending by the provinces that is funded by the National Child Benefit Supplement, while investments are additional funds spent on child benefits by the provinces. "Total investments" represent the sum of these two figures.

Re-investments by all provinces except Quebec[18] increased from $264.3 million in 1998–1999 ($2007) to $660.1 million in 2006–2007. This represents a 149.8% increase in real terms, or an average compound increase of 10.7% per year. Total investments (including new investment) grew at about the same rate—162.4% over the period, or 11.3% annually. In 1998–1999, therefore, nationwide total investment in child benefits was $330.2 million ($2007), and this increased to $866.5 million in 2006–2007.

Child benefit re-investments in Nova Scotia grew at a slower rate than in the rest of Canada—at 103.7% or 8.2% annually. From a level of $10.3 million in 1998–1999 ($2007), re-investments reached $21 million in 2006–2007. Including new investments, the growth was 144.4% over the period, or 10.4% annually—slightly below the national average. Total investments in Nova Scotia reached $27 million in 2006–2007, up from $11.1 million in 1998–1999 (Table 8-9 below).

It is interesting to note that re-investments represented a much higher proportion of total child benefits investment in Nova Scotia in 1998 than they did in 2006. This indicates higher relative spending by the province itself on child benefits in 2006. Further investigation is required to understand the reasons for the changing balance between reinvestments and new investments in child benefits.

Table 8-9. Trends in the indicators of child benefits ($2007), Nova Scotia and Canada, 1998/1999 and 2006/2007

	NOVA SCOTIA			CANADA		
	Indicator Values ($2007)		% Change	Indicator Values ($2007)		% Change
	1998/1999	2006/2007		1998/1999	2006/2007	
Child benefits, re-investment in millions of $2007	10.3	21.0	103.7	264.3	660.1	149.8
Child benefits, total investment in millions of $2007	11.1	27.0	144.4	330.2	866.5	162.4

Source: National Child Benefits. 2001, 2008.

Note: The data are for fiscal years 1998/1999 and 2006/2007 (April 1 to March 31).

HUMAN AND SOCIAL CAPITAL

9. Population Health

For the original GPI Atlantic reports on population health, please see the following:

Health Disparities Indicators: Background Report for Developing Health Disparities Indicators in Canada (2008)
http://www.gpiatlantic.org/pdf/health/hdi08.pdf.
Health Disparities Indicators Appendices
http://www.gpiatlantic.org/pdf/health/hdiapp.pdf

The Health Costs of Poverty in Canada: A Literature Review of the Evidence and Methodologies Needed to Produce a Full Report (2008)
http://www.gpiatlantic.org/pdf/health/povcost.pdf.

Kings County and Glace Bay GPI Community Profiles (2008)
http://gpiatlantic.org/pdf/community/glace.pdf
http://gpiatlantic.org/pdf/community/kings.pdf
http://gpiatlantic.org/pdf/community/taletwo.pdf

Atlantic Health Database, Parts A–D (2003)
Part A: Determinants of Health http://gpiatlantic.org/pdf/healthdb/PartA.pdf
Appendix A http://gpiatlantic.org/pdf/healthdb/AppendixA.pdf
Part B: Health Outcomes http://gpiatlantic.org/pdf/healthdb/PartB.pdf
Appendix B http://gpiatlantic.org/pdf/healthdb/AppendixB.pdf
Part C: Death & Disease http://gpiatlantic.org/pdf/healthdb/PartC.pdf
Appendix C http://gpiatlantic.org/pdf/healthdb/AppendixC.pdf
Part D: Health Service Utilization http://gpiatlantic.org/pdf/healthdb/PartD.pdf
Appendix D http://gpiatlantic.org/pdf/healthdb/AppendixD.pdf

A Profile of Women's Health Indicators in Canada (2003)
http://gpiatlantic.org/pdf/health/womens/whbreport.pdf

Women's Health in Atlantic Canada Volume 1 (2003)
http://www.gpiatlantic.org/pdf/health/womens/womensvol1.pdf

Women's Health in Atlantic Canada Volume 2 (2003)
http://www.gpiatlantic.org/pdf/health/womens/womensvol2.pdf

Cost of Chronic Disease in Canada (2004)
http://www.gpiatlantic.org/pdf/health/chroniccanada.pdf

Inequity and Chronic Disease in Atlantic Canada (2003)
http://gpiatlantic.org/pdf/health/inequity.pdf
Annotated Bibliography http://gpiatlantic.org/pdf/health/inequitybibliography.pdf

Cost of Chronic Disease in Nova Scotia (2002)
http://www.gpiatlantic.org/pdf/health/chronic.pdf

The Cost of Physical Inactivity in Halifax Regional Municipality (2004)
http://www.gpiatlantic.org/pdf/health/inactivity-hrm.pdf

Cost of Physical Inactivity in Nova Scotia (2002)
http://www.gpiatlantic.org/pdf/health/inactivity.pdf

Physical Exercise Trends in Atlantic Canada (2000)
http://www.gpiatlantic.org/pdf/health/exercise.pdf

Cost of Physical Inactivity in British Columbia (2003)
http://www.gpiatlantic.org/pdf/health/inactivity-bc.pdf

Cost of Tobacco in Nova Scotia (2007 & 2000)
www.gpiatlantic.org/pdf/health/tobacco/costoftobacco-ns-2007.pdf
http://www.gpiatlantic.org/pdf/health/tobacco/costoftobacco-ns.pdf

The Cost of Smoking in British Columbia and the Economics of Tobacco Control (2004)
http://www.gpiatlantic.org/pdf/health/tobacco/costoftobacco-bc.pdf

The Cost of Smoking in New Brunswick and the Economics of Tobacco Control (2003)
http://www.gpiatlantic.org/pdf/health/tobacco/costoftobacco-nb.pdf

The Cost of Smoking in Newfoundland and Labrador and the Economics of Tobacco Control (2003)
http://www.gpiatlantic.org/pdf/health/tobacco/costoftobacco-nf.pdf

The Economic Impact of Smoke-Free Workplaces: An Assessment for Newfoundland and Labrador (2003)
http://www.gpiatlantic.org/pdf/health/tobacco/smoke-free-nf.pdf

The Socio-Economic Gradient in Health in Atlantic Canada: Evidence from Newfoundland and Nova Scotia 1985-2001 (2005)
http://www.gpiatlantic.org/pdf/health/hiec121605.pdf

Costs and Benefits of Gaming—A Literature Review with Emphasis on Nova Scotia (2004)
http://gpiatlantic.org/pdf/gambling/gambling.pdf

Income, Health and Disease in Canada: Current State of Knowledge, Information Gaps, and Areas of Needed Inquiry (2003)
http://www.gpiatlantic.org/pdf/health/cihr.pdf

Cost of HIV/AIDS in Canada (2001)
http://www.gpiatlantic.org/pdf/health/costofaids.pdf

Cost of Obesity in Nova Scotia (2000)
http://www.gpiatlantic.org/pdf/health/obesity/ns-obesity.pdf

Headline Indicators

1. Self-rated health
2. Mortality due to selected causes
3. Prevalence of selected health conditions and diseases
4. Mental health
5. Behavioural (lifestyle) risk factors
6. Economic costs of tobacco use, obesity, physical inactivity, and chronic disease

9.1. Social, economic, and environmental determinants of health

Health is the outcome of a wide range of social, economic, and environmental factors. In a very real sense, the entire Genuine Progress Index, and all the chapters of this summary GPI report can therefore be seen as constituting, in effect, the social, economic, and environmental determinants of health.

Thus, while we do not break down the health data in this particular chapter according to their social, economic, and environmental determinants such as education, income, pollution, etc., this chapter must be seen in the context of all the other chapters in this report and all the other components of the GPI. In other words, this particular chapter should by no means be regarded as *the* health chapter. Rather, the entire volume is quite literally about health, since the other sections of the GPI and of this summary report—on income and its distribution, employment, financial security, education, crime, free time, air quality, greenhouse gas emissions, and more—*all* constitute determinants of health. This statement is not rhetorical, but is entirely based in hard evidence.

According to Statistics Canada, "The relationship between socioeconomic status and health is one of the most pervasive in the epidemiologic literature and has held up over time and in countries throughout the world."[1] Socioeconomic status has been identified as a precursor of cancer, cardiovascular disease, arthritis and musculoskeletal disorders, diabetes mellitus, dental diseases, drug dependence and abuse, and infant mortality and morbidity.[2]

Poverty and inequality, in particular, are among the most reliable predictors of poor health—more so in fact than a wide range of standard medical factors like cholesterol levels and blood pressure. The World Health Organization (WHO) states that people who are poor run at least twice the risk of serious illness and premature death when compared to those with higher incomes.[3]

Child poverty has been linked to a wide array of physical, psychological, emotional, and behavioural problems among children, including higher rates of respiratory illnesses and infections, sudden infant death syndrome, obesity, high blood lead levels, iron deficiency anaemia, chronic ear infections, mental retardation, fetal alcohol syndrome, and dental problems.[4] Low-income children are more likely to have low birth weights, poor health, less nutritious foods, higher rates of hyperactivity, delayed vocabulary development, and poorer employment prospects.[5]

Although they engage in less organized sports, poor children have higher injury rates, and twice the risk of death due to injury than children who are not poor.[6] And a study published in *Psychological Science* found that the longer children spent in poverty, the worse their bodies were at handling the stressors in their environment—increasing their risk for long-term health problems.[7]

A Canadian analysis of the impacts of income on child wellbeing concluded that: "as family incomes fall, the risks of poor developmental outcomes in children's health, behaviour, learning and socialization rise."[8] A detailed analysis of both the National Longitudinal Survey on Children and Youth and the National Population Health Survey found that some 31 different indicators all showed that as family income falls, children are more likely to experience problems.[9]

However, a growing body of evidence indicates that, not only poverty, but also the *distribution* of income—the gap between rich and poor and the extent of income inequality—has important consequences for health. For example, higher income inequality has been correlated with higher rates of mortality,[10] lower self-rated health,[11] and greater prevalence of obesity.[12] According to the *British Medical Journal*:

> What matters in determining mortality and health in a society is less the overall wealth of the society and more how evenly wealth is distributed. The more evenly wealth is distributed, the better the health of that society.[13]

A November, 2007, analysis in the *British Medical Journal*, concluded that: "Improvements in child wellbeing in rich societies may depend more on reductions in inequality than on further economic growth."[14]

According to Statistics Canada, there are two key reasons why income distribution may affect health. Socio-psychological research suggests that individuals at the bottom of the income ladder may feel greater "anxiety and shame" about their lot in comparison with those better off. Over time, this negative emotion can lead to chronic stress, which in turn can lead to adverse physical health outcomes. The second key reason, based on what is called the neo-material approach, suggests that the poor suffer adverse health effects from not having access to the same resources or living conditions, such as health care, nutritious food, housing, secure employment, and a sense of social belonging.[15, 16]

The association between inequality and mortality is particularly strong in the U.S., where access to health care and high-quality education is very limited for many of the poor. In Canada, by contrast, basic health care services remain publicly funded and universally available. Examining the comparative U.S. and Canadian data, Statistics Canada finds that: "As a consequence, in the United States, an individual's income, in both a relative and absolute sense, is a much stronger determinant of one's life chances, and, in turn, their 'health chances,' than in Canada."[17]

Health Canada has also recognized environmental factors as key determinants of health:

> The physical environment is an important determinant of health in its own right. At certain levels of exposure, contaminants in our air, water, food and soil can cause a variety of adverse health effects, including cancer, birth defects, respiratory illness and gastrointestinal ailments. In the built environment, factors relating to housing, indoor air quality, and the design of communities and transportation systems can significantly influence our physical and psychological well-being.
>
> The physical environment is also linked to other determinants of health. Active living requires green spaces, clean water and protection from exposure to excessive ultraviolet rays. Healthy eating depends on the availability of safe, nutritious foods. Healthy working conditions require safe workplaces that maximize comfort, productivity and well-being. Healthy child development can be dramatically affected by the physical environment because children are particularly vulnerable to environmental contaminants.[18]

Health Canada has also recognized the links between poverty and likelihood of exposure to environmental hazards. It notes that the prevalence of childhood asthma, which is highly sensitive to airborne contaminants, has increased sharply in the last two decades. And it cites the World Health Organization's acknowledgement that unsustainable development pose serious threats to health—including climate change, stratospheric ozone depletion, and natural resource depletion.[19] Health Canada states:

> [T]here is a growing realization that Canada also has a global responsibility to protect and strengthen the world's environmental resource base. Air pollution and other environmental problems aren't restricted by national boundaries. Sustaining the health of the planet for future generations is our ultimate challenge.[20]

Environmental determinants of health may be particularly important indicators for women's health, because women constitute the majority of those afflicted with the category of illnesses commonly known as "environmental illness." These include Multiple Chemical Sensitivity (MCS), Chronic Fatigue Syndrome (CFS), and Fibromyalgia (FM). It is estimated that there are about 4.5 million Canadians (15% of the population) currently suffering from some degree of MCS, with young women most likely to be affected.[21]

Health is also directly linked to the other components of the GPI—including employment, education, crime, and various aspects of time use, including the social supports that result from high levels of voluntary work and the stresses that stem from lack of free time and the incapacity to juggle the competing demands of paid and unpaid work. To give just a few examples:

Abundant evidence indicates that the unemployed suffer higher rates of physical and mental illness than those with jobs. One Canadian meta-analysis by Jin, Shah, and Svoboda reviewed 46 studies, including aggregate level assessments of entire populations and studies of individuals, and found a "strong, positive association between unemployment and many adverse health outcomes." They found evidence that linked high unemployment rates with higher rates of overall mortality and of deaths due to heart disease and suicide in particular. The study concluded that the unemployed were more likely than either the employed or the general population to get sick and to die prematurely.[22] Studies have also indicated that those who experience longer spells of unemployment are at even greater risk of illness and premature death.[23]

The Canadian Mental Health Association found that the unemployed tend to develop irregular sleeping habits, eat less nutritious food, increase smoking and drinking, are less physically active, and "experience symptoms of diseases that are exacerbated by emotional distress."[24] The World Health Organization concluded that chronic stress due to unemployment was a major contributor to cardiovascular disease, ulcers, and asthma, as well as other mental and physical disorders.[25]

In fact, both unemployment and overwork have been shown to carry health problems and hidden costs, and one Japanese study found that the underemployed and overworked had equally elevated risks of heart attack.[26] A Statistics Canada analytical study based on data from the National Population Health Survey found that a substantially longer workweek increased the chances of unhealthy weight gain in men, of alcohol consumption and depression in women, and of smoking in both men and women.[27]

Statistics Canada found that women who worked long hours were 2.2 times more likely to report a depressive episode than women working standard hours. Men working long hours were 2.2 times more likely to have excess body weight. Changes from standard to long hours were also associated with a two-fold increase in smoking among men and a four-fold increase in smoking among women. The Statistics Canada report concluded that "there is currently sufficient evidence to raise concerns about the health and safety risks of working long hours."

The effect of time use variables and work-life balance on health is further illustrated by evidence pointing to the significant value of free time in buffering life's stressful events and assisting individuals in coping with stress.[28] Indeed, sufficient leisure time has been found to have positive value and benefit for both physical and mental health.[29]

Also of relevance to health from a time use perspective is the role of voluntary work. According to Health Canada, social support networks, which extend from close family and friends to the broader community, are a major determinant of health, and are "reflected in the institutions, organizations and informal giving practices that people create to share resources and build attachments with others."[30] For this reason Health Canada uses volunteerism as a key indicator of a "supportive social environment" that can improve health.[31]

In fact, Mustard and Frank found that social networks may play as important a role in protecting health, buffering against disease, and aiding recovery from illness as behavioural and lifestyle choices such as quitting smoking, losing weight, and exercising.[32] It has been suggested that strong communities and social networks in Newfoundland may help explain why Newfoundlanders consistently record the highest rates of self-reported excellent and very good health in the country, the highest rates of psychological wellbeing, the lowest stress and depression rates, and the lowest rates of several chronic ailments in the country.[33]

Educational attainment—another core GPI component—has also been demonstrated to be positively associated both with health status and with healthy lifestyles. For example, in the 1996–97 National Population Health Survey, only 19% of respondents with less than high school education rated their health as "excellent," compared with almost 30% of university graduates.[34]

Educational attainment has also been reliably linked both to health behaviours and health care utilization. For example, those with only a high school education are 64% more likely to be overweight than those with a university degree.[35] One Canadian study found that those with no high school degree use 49% more physician services than do those with a B.A., and those with just a high school diploma use 12% more than those with a university degree.[36] From a health determinants perspective, education is clearly a good investment that can reduce long-term health care costs.

Statistics Canada's Health Indicators also include crime rates as a "non-medical determinant of health." Both crime rates in general, and youth crime rates in particular, were also confirmed as key non-medical determinants of health at the Canadian Institute for Health Information's National Consensus Conference on Population Health Indicators.[37] Some categories of crime, like domestic violence, affect women disproportionately and have very serious adverse impacts on health and wellbeing.

In sum, this very brief review of the economic, social, and environmental determinants of health serves simply to indicate that health is quite literally the outcome of all components of the Genuine Progress Index. Indeed, one of the key purposes of the GPI altogether is to demonstrate the close linkages and relationships among the social, economic, and environmental determinants of health and wellbeing.

To that end, several other chapters in this report quite specifically assess health impacts—with the chapters on work hours, crime, air quality, water quality, energy, greenhouse gas emissions, and transportation, for example, all including economic cost estimates for health care, hospitalization, productivity loss and other costs associated with illness or injury related to unemployment, work stress, crime, accidents, air and water pollution, fossil fuel combustion, and other health determinants.

As well, the chapter on income describes the health impacts of poverty and inequality, the chapter on debt and financial security notes that inability to manage debt has been associated with illness and even suicide, the chapter on economic security assesses the economic risks associated with illness, the education chapter references health literacy as a key attribute of an educated populace, and—in reporting the asthma results below—this chapter notes that exposure to second-hand smoke and air pollution have been found to contribute to asthma incidence and severity.

While it would be naïve to draw simplistic cause-effect inferences between particular health determinants and particular health outcomes, the overwhelming weight of evidence clearly indicates that wise investments in natural, human, economic, and social capital, and concomitant improvements in economic and financial security, environmental quality, education, safety, community wellbeing, and work-life balance can all improve population health outcomes.

In short, it is quite clear that this chapter, as noted in our opening remarks, cannot be taken in isolation from the results presented in this report as a whole, and the health-specific results outlined below can be seen as outcomes of the full range of GPI evidence. Since space constraints do not allow a detailed analytical exploration, based on the epidemiological literature, of the health determinants most closely associated with each set of results below, this general introductory section on the social, economic, and environmental determinants of health must here suffice to provide the essential context for the results presented below. More detailed analyses of these associations are contained in the detailed GPI population health reports listed at the start of this chapter.

One final introductory remark on health determinants is necessary. Because women and men have distinct health profiles and needs, gender has been widely acknowledged as a key determinant of health. As Health Canada notes, "in questions of health, it matters whether you are a woman or a man." The differences manifest in:

> patterns of illness, disease, and mortality; the way women and men experience illness, their interactions with the health system; the effects of risk factors on

women's and men's wellbeing and the social, cultural, economic and personal determinants of health, which are significantly affected by gender differences.[38]

Thus, former federal Health Minister Allan Rock spoke of "the need to enhance the sensitivity of the health system to women's health issues" and "the need for more research, particularly on the links between women's health and their social and economic circumstances."[39] Similarly, the National Forum on Health recommended that the health system pay more attention to the factors which influence women's health and be more responsive to the distinct needs of women.[40]

Health Canada notes that gender-based analysis "makes for good science and sound evidence by ensuring that biological and social differences between women and men are brought into the foreground." That basis in evidence makes a gender perspective essential to health policy, as it "ensures that both women and men identify their health needs and priorities, and acknowledges that certain health problems are unique to, or have more serious implications, for men or women."[41]

For this reason, and to the extent possible, some results below are broken down by gender. Again, space constraints here prevent a full gender-based analysis of population health results. For more detailed analyses related to this vitally important health determinant, please see GPI Atlantic's extensive reports of women's health indicators in both Canada and Atlantic Canada, as listed at the start of this chapter.

9.2. Self-rated health

Data sources: Statistics Canada, National Population Health Surveys, 1994–95, 1996–97, and 1998–99; Canadian Community Health Surveys, 2000–01, 2003, 2005, and 2007.

Results: Between 1994/1995 and 2007, the percentage of men rating their health as excellent or very good declined in both Canada and Nova Scotia. Canadian women saw a smaller decline in self-rated excellent or very good health, while Nova Scotian women saw an improvement to 1998/99 and a decline thereafter. Further investigation is required to assess trends in self-rated health among Canadian and Nova Scotian youth.

Self-rated health has been found to be a reliable predictor of health problems, health care utilization, and longevity.[42] Statistics Canada assesses self-rated health according to the percentage of the population, aged 12 and over, who rate their own health status as excellent, very good, good, fair, or poor. Data are from the National Population Health Surveys and Canadian Community Health Surveys.

In 2007, women in Canada were slightly less likely than men to rate their health as excellent or very good—59.0% of Canadian women compared to 60.2% of Canadian men. By contrast, Nova Scotian women were significantly more likely than men to rate their health as excellent or very good (58.7% versus 55.3%).

Between 1994/1995 and 2007, the percentage of men rating their health as excellent or very good declined in both Canada and Nova Scotia—from 65.4% to 60.2% for Canadian men and from 61.2% to 55.3% for Nova Scotian men. It should be noted that all the Statistics Canada results presented here are age-standardized, indicating that this decline in self-rated health among males cannot be attributed to demographic changes like the aging of the population.

Canadian women saw a much smaller decline in self-rated excellent or very good health—from 60.8% in 1994/95 to 59% in 2007, while Nova Scotian women saw an improvement from 58.2% in 1994/95 to 64.5% in 1998/99 and then a decline to 58.7% in 2007 (see Tables 9-1 and 9-2 below).[43]

Preliminary investigation just before this report went to press appeared to indicate that there may have been a sharp decline in excellent and very good self-rated health among young Canadians in particular. However, it appears that special provincial data runs from Statistics Canada would be required in order to confirm this and to assess whether this is true for Nova Scotia. Though time and resources did not permit that investigation for this chapter, it is strongly recommended that this important question be investigated with some urgency, and that results be publicly reported.

Table 9-1. Age-standardized self-rated health by gender (%), Canada and Nova Scotia, 1994/1995, 1996/1997, 1998/1999, 2000/2001, and 2003

	1994/1995		1996/1997		1998/1999		2000/2001		2003	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
CANADA										
Very good or Excellent	65.4	60.8	65.3	61.6	67.3	63.2	62.9	59.9	59.5	57.3
Excellent	26.8	24.2	26.5	23.6	28.3	23.1	27.3	24.0	23.2	21.5
Very good	38.6	36.5	38.8	38.1	39.0	40.1	35.7	35.9	36.3	35.8
Good	25.6	27.6	25.9	28.0	24.3	26.9	25.8	27.4	30.2	30.3
Fair to poor	9.0	11.7	8.8	10.3	8.5	10.0	11.2	12.7	10.3	12.4
NOVA SCOTIA										
Very good or excellent	61.2	58.2	62.2	62.7	61.0	64.5	58.6	60.3	55.9	60.2
Excellent	24.7	22.0	23.2	16.4	22.2	19.5	20.5	20.0	18.4	18.5
Very good	36.5	36.2	38.9	46.2	38.8	45.0	38.1	40.3	37.5	41.7
Good	23.9	23.1	23.5	27.2	25.7	23.4	26.5	25.7	30.7	25.5
Fair to poor	14.9	18.7	14.3	10.2	13.3	12.1	14.9	13.9	13.4	14.2

Sources: Statistics Canada, Canadian Community Health Surveys 2003, and 2000/01; and National Population Health Surveys 1994/95, 1996/97, and 1998/99.

Note: At the time data were retrieved for this chapter, there had been a change in the Statistics Canada's public reporting format for CCHS results starting in 2005, with results for "very good" and "excellent" health combined. So data for 2005 and 2007 are summarized separately in Table 9-2 below. Just as this report went to press, it was found that Statistics Canada had in fact adjusted its reporting to make the 1994/95–2007 data fully comparable, as now reflected in Statistics Canada, CANSIM Table 105-4022. Available at http://cansim2.statcan.gc.ca/cgi-win/cnsmcgi.pgm. Accessed 7 December, 2008. However, time did not allow a reformatting of Tables 9-1 and 9-2 into a single comparable table before publication.

Table 9-2. Age-standardized self-rated health ("perceived health") by gender (%), Canada and Nova Scotia, 2005 and 2007

	2005		2007	
	Male	**Female**	**Male**	**Female**
CANADA				
Very good or excellent	60.6	59.6	60.2	59.0
Good	28.7	28.7	28.8	29.2
Fair or poor	10.7	11.7	10.8	11.8
NOVA SCOTIA				
Very good or excellent	56.2	59.1	55.3	58.7
Good	28.9	27	29.6	28.0
Fair or poor	15.0	13.8	15.0	13.2

Source: Statistics Canada, Canadian Community Health Surveys, 2005 and 2007.

Note: As of 2007, this indicator is now referred to by Statistics Canada as "Perceived Health" rather than "Self-Rated Health."

9.3. Mortality due to selected causes

Data sources: Statistics Canada, Vital Statistics—Death Database

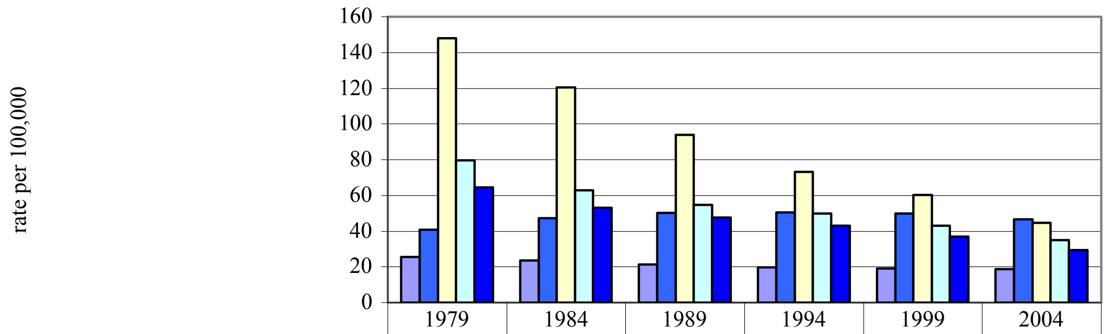
Results: Rates of mortality for the selected diseases declined substantially in both Canada and Nova Scotia between 1979 and 2004, except for lung cancer mortality among women, which increased in that time period.

Mortality rate declines lead to an increase in life expectancy, which, in turn, is a widely used indicator of population health. Mortality rate declines can occur as a result of improved medical, surgical, and drug interventions, and of improved screening and detection. Though mortality and life expectancy measure quantity rather than quality of life, they still reflect pressing human concerns. We therefore present here Canada and Nova Scotia data for mortality rates (age-standardized rate of death per 100,000 population) for the following representative diseases: colorectal cancer, lung cancer, acute myocardial infarction (AMI), cerebrovascular diseases, and all stroke.[44]

Figures 9-1 and 9-2 below indicate that—except for lung cancer—mortality rates due to the selected diseases declined significantly from 1979 to 2004 in both Canada and Nova Scotia. In particular, mortality due to acute myocardial infarction (AMI) decreased very substantially nationwide—by 70% in Canada from 148.1 to 44.7 per 100,000 in the 25-year period, and by 73% in Nova Scotia from 175.2 to 46.8 per 100,000. Mortality due to stroke and cerebrovascular disease dropped by more than half nationwide during that period, and colorectal cancer mortality by 27% nationwide and by 39% in Nova Scotia.

However, lung cancer mortality increased nationwide from 40.9 per 100,000 in 1979 to 50 per 100,000 in the 1990s, before dropping back to 46.6 per 100,000 in 2004. In Nova Scotia, lung cancer mortality increased from 46.9 per 100,000 in 1979 to 63.4 per 100,000 in 1999, before dropping back to 56.3 per 100,000 in 2004 (Figures 9-1 and 9-2).

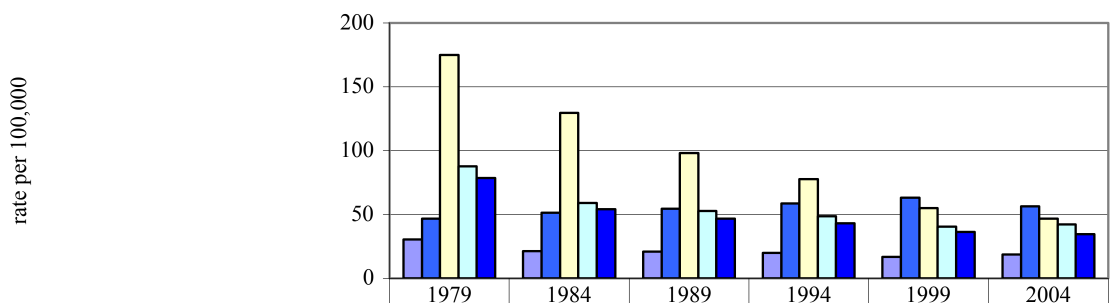
Figure 9-1. Mortality for selected causes, age standardized rate per 100,000 population (both sexes), Canada, 1979–2004



	1979	1984	1989	1994	1999	2004
Colorectal cancer	25.6	23.6	21.5	19.9	19.1	18.7
Lung cancer	40.9	47.4	50.2	50.5	50	46.6
Acute myocardial infarction (AMI)	148.1	120.5	93.9	73.2	60.2	44.7
Cerebrovascular diseases	79.7	62.7	54.8	49.8	43.2	34.9
All stroke	64.5	53	47.5	43.1	37	29.4

Source: Statistics Canada, Vital Statistics—Death Database. Available from http://www.statcan.ca/english/freepub/82-221 XIE/2008001/tblstructure/1hlthstat/1de/de1mbs-en.htm. Accessed October 14, 2008.

Figure 9-2. Mortality for selected causes, age standardized rate per 100,000 population (both sexes), Nova Scotia, 1979–2004



	1979	1984	1989	1994	1999	2004
Colorectal cancer	30.4	21.2	21	20.1	16.7	18.6
Lung cancer	46.9	51.3	54.4	58.5	63.4	56.3
Acute myocardial infarction (AMI)	175.2	129.6	98.1	77.7	55.2	46.8
Cerebrovascular diseases	87.5	59.2	52.5	48.8	40.5	42.1
All stroke	78.8	54.2	46.6	43.1	36.4	34.5

Source: Statistics Canada, Vital Statistics—Death Database. Available from http://www.statcan.ca/english/freepub/82-221 XIE/2008001/tblstructure/1hlthstat/1de/de1mbs-en.htm. Accessed October 14, 2008.

Table 9-3 below presents age-standardized mortality rates for Nova Scotian men and women for the time period 1979–2004 for the above diseases plus prostate and breast cancer. The overall decline in mortality rates during this time period is partly attributable to improved screening and early detection. In line with the data for both sexes above, Table 9-3 shows very significant mortality declines for both men and women in Nova Scotia due to acute myocardial infarction, cerebrovascular diseases, and strokes.

There is a striking gender difference in relation to lung cancer mortality, which increased sharply among Nova Scotian women from the early 1980s to the late 1990s before levelling off at rates that are almost five times as high as in 1970.[45] By contrast, lung cancer mortality among Nova Scotian men rose in the 1970s, peaked in 1992, and has declined steadily since then, with rates in recent years at their lowest level in 25 years.

The sharp contrast between male and female lung cancer mortality points to the importance of gender-based analysis. When rates for men and women are combined, it appears that lung cancer mortality rates are increasing overall—obscuring the significant decline for men and the fact that the overall increase is now entirely attributable to higher lung cancer mortality rates among women. Since 90% of lung cancers are attributable to smoking, the different patterns for men and women largely reflect the drop in tobacco consumption that began for males in the mid-1960s and much later (mid-1980s) for females.[46] However, a gender-based analysis also reveals that female smokers are twice as susceptible to lung cancer as male smokers, that smoking rates for women dropped less rapidly than for men, and that smoking among teenage girls persisted for longer than among teenage boys and for different reasons (e.g., stress relief and weight loss).[47]

Table 9-3. Mortality for selected causes by gender, age standardized rate per 100,000 population, Nova Scotia, 1979–2004

YEAR	MALE					
	Colorectal Cancer	Lung Cancer	Prostate Cancer	Acute Myocardial Infarction (AMI)	Cerebro-vascular Diseases	All Stroke
1979	32.5	78.2	28.8	256.9	101.2	90.3
1980	31.4	78.7	23.9	224.7	92.6	84.0
1981	27.1	80.7	29.0	230.0	81.3	73.8
1982	26.8	79.5	23.1	213.6	77.3	71.2
1983	24.3	83.2	26.1	198.5	75.9	67.5
1984	25.1	86.2	30.5	178.4	70.3	63.6
1985	22.6	83.2	33.2	182.4	71.6	64.3
1986	26.0	87.5	30.6	167.2	64.0	58.0
1987	23.3	79.6	29.3	148.4	62.4	56.2
1988	27.2	87.8	31.8	148.4	59.0	53.9
1989	22.6	84.3	33.5	137.9	57.6	48.9
1990	21.0	90.1	32.2	127.8	46.6	42.6
1991	24.0	88.3	34.0	116.7	50.1	46.1
1992	23.4	97.7	37.2	110.5	54.0	48.6
1993	20.7	92.4	32.0	107.9	50.8	43.1
1994	22.1	91.9	36.2	109.2	56.2	47.7
1995	22.5	91.8	33.0	101.8	46.8	43.7
1996	23.9	83.3	34.6	92.9	44.2	39.8
1997	19.5	78.0	31.7	100.1	48.4	42.2
1998	19.5	81.3	33.1	95.3	47.8	42.8
1999	21.0	90.4	30.2	74.4	44.0	38.5
2000	21.2	81.9	32.2	76.2	45.1	39.4
2001	19.8	76.2	28.2	73.0	43.3	37.3
2002	24.2	73.0	26.2	73.6	46.3	37.6
2003	25.9	77.5	21.0	75.4	45.2	38.1
2004	25.2	75.7	24.1	65.9	41.9	33.9

YEAR	FEMALE					
	Colorectal Cancer	Lung Cancer	Female Breast Cancer	Acute Myocardial Infarction (AMI)	Cerebrovascular Diseases	All Stroke
1979	28.7	21.2	28.1	107.8	77.6	70.5
1980	28.2	19.4	31.4	112.6	74.9	66.7
1981	21.5	18.3	26.8	99.9	64.3	58.9
1982	20.7	19.8	33.1	92.5	56.6	50.6
1983	19.9	17.1	35.3	90.6	57.1	49.5
1984	18.2	24.5	30.3	89.5	51.3	47.4
1985	22.7	25.9	42.0	81.8	54.2	47.4
1986	17.0	27.6	32.0	79.5	47.5	40.7
1987	14.8	28.8	35.9	79.4	42.9	39.1
1988	16.8	29.0	34.5	68.1	49.4	43.5
1989	19.5	31.0	29.8	66.4	48.7	44.2
1990	16.0	34.4	36.2	60.9	45.9	41.9
1991	14.6	32.6	32.0	59.1	43.4	39.3
1992	12.9	36.4	34.0	57.5	44.3	40.6
1993	16.1	34.1	32.6	48.4	41.2	37.7
1994	18.3	33.8	28.8	53.0	43.5	39.6
1995	13.0	34.2	33.0	52.5	45.3	41.6
1996	16.4	40.3	29.8	42.8	41.1	37.2
1997	14.6	42.2	30.1	50.8	43.3	39.2
1998	17.0	40.9	31	42.2	42.0	37.8
1999	13.9	43.2	30.7	39.8	39.0	35.7
2000	14.3	36.4	27.7	35.1	46.4	40.7
2001	12.7	43.0	25.7	37.5	39.2	34.5
2002	15.0	40.9	25.4	31.9	36.5	31.2
2003	15.7	41.9	32.0	32.4	34.9	29.7
2004	13.7	41.8	21.0	31.6	40.7	33.5

Source: Statistics Canada, Vital Statistics—Death Database. Available from http://www.statcan.ca/english/freepub/82-221 XIE/2008001/tblstructure/1hlthstat/1de/de1mbs-en.htm. Accessed October 14, 2008.

The 2008 *Canadian Cancer Statistics* report found substantial mortality rate declines for most cancer types between 1995–2004, but a 2.2% average annual increase in liver cancer mortality among males over that 10-year period. Decreases of at least 2% per year for the 1995–2004 period occurred for the following cancers (with average annual rates of decline noted in parentheses): For males there were declines in stomach cancer mortality (-3.6%/year), larynx cancer (-3.2%), prostate cancer (-2.9%), oral cancer (-2.5%), and lung cancer (-2.1%), as well as

Hodgkin lymphoma (-4.2%) and non-Hodgkin lymphoma (-2.3%). For females there were mortality declines due to Hodgkin lymphoma (-3.7%/ year), cervical cancer (-3.3%), and stomach cancer (-3.1%). The mortality rate for breast cancer in women declined by an average of 1.6% per year from 1995–2004. [48]

In 2004, Nova Scotia's cancer mortality rates were higher than for any other province in the country—246 per 100,000 for men and 163 per 100,000 for women, compared to national averages of 212 and 147 respectively. When the territories are included, cancer mortality rates are highest in Nunavut (Table 9-4 below).

Table 9-4. Mortality for most common cancers by gender, age standardized rate per 100,000, Canada, provinces and territories, 2004

	CAN	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC	YT	NT	NU
MALES														
All cancers	**212**	**230**	**231**	**246**	**228**	**239**	**203**	**218**	**206**	**194**	**185**	**268**	**238**	**326**
Lung	61	62	70	75	76	82	53	56	49	50	49	104	71	180
Colorectal	27	46	29	35	27	30	26	31	26	25	21	38	55	--
Prostate	23	30	38	24	22	20	23	28	34	26	22	--	--	--
Pancreas	10	9	9	12	14	11	10	11	10	9	10	--	--	--
Non-Hodgkin Lymphoma	8	5	5	11	6	8	9	9	9	7	8	--	--	--
Leukemia	8	6	9	9	5	8	8	8	10	7	8	--	--	--
Stomach	7	10	6	7	9	8	7	6	7	6	6	--	--	--
Bladder	7	5	6	7	7	7	7	8	6	6	7	--	--	--
Esophagus	7	4	8	9	7	5	7	7	5	6	7	--	--	--
Kidney	6	8	5	7	6	6	5	6	6	6	5	--	--	--
Brain	5	4	6	6	6	6	5	4	5	5	5	--	--	--
Oral	4	3	4	4	3	5	4	5	3	2	4	--	--	--
Multiple myeloma	4	3	6	4	3	4	4	3	4	4	4	--	--	--
Melanoma	3	2	4	3	3	2	3	3	2	3	3	--	--	--
Liver	3	2	2	2	1	3	3	2	1	3	3	--	--	--

FEMALES														
All cancers	**147**	**146**	**158**	**163**	**138**	**154**	**145**	**159**	**138**	**143**	**138**	**180**	**196**	**437**
Lung	36	31	36	42	36	41	33	39	34	34	36	45	52	249
Breast	23	19	24	21	20	24	24	28	22	20	21	29	30	--
Colorectal	17	29	23	20	13	18	17	16	17	16	14	--	31	--
Pancreas	8	6	4	10	9	9	8	9	6	10	8	--	--	--
Ovary	7	6	6	9	7	7	7	11	8	9	8	--	--	--
Non-Hodgkin Lymphoma	6	4	7	6	6	6	6	7	6	5	5	--	--	--
Leukemia	4	2	4	6	4	4	5	4	5	5	4	--	--	--
Brain	3	2	11	4	3	4	3	3	2	4	3	--	--	--
Body of uterus	3	2	2	4	4	3	4	4	3	3	3	--	--	--
Stomach	3	8	3	4	3	3	3	4	3	3	3	--	--	--
Kidney	3	4	3	2	3	3	2	3	2	3	2	--	--	--
Bladder	2	1	3	2	2	2	2	1	1	2	2	--	--	--
Cervix	2	4	4	4	2	1	2	2	2	2	2	--	--	--

Source: Canadian Cancer Society and National Cancer Institute. 2008. Canadian Cancer Statistics, p. 24. Available from http://www.cancer.ca/Canada-wide/About%20cancer/Cancer%20statistics/Canadian%20Cancer%20Statistics.aspx?sc_lang=en. Accessed October 14, 2008.

Note: 2000–2004 averages used for Yukon, Northwest Territories, and Nunavut.

9.4. Health conditions / diseases

The disability, pain, and discomfort of chronic diseases can severely compromise wellbeing and quality of life over long periods of time. It has been estimated that 40% of chronic disease incidence is attributable to socio-economic, behavioural, and lifestyle factors, and is therefore preventable. Epidemiological studies indicate that 25% of all medical costs are attributable to a small number of excess risk factors like smoking, obesity, physical inactivity, and poor nutrition.[49]

A previous GPI Atlantic report, *The Cost of Chronic Disease in Nova Scotia* (2002), investigated the socioeconomic causes of chronic disease and estimated that the province could avoid 200 deaths and save $243 million ($2007) a year in avoided direct and indirect poverty-related heart disease costs if all Nova Scotians were as heart healthy as those with higher incomes.

The report further cited a Dalhousie University study by Kephart et al., which estimated excess physician costs attributable to educational inequality in Nova Scotia at 17.4% of total physician expenditures, or $42.2 million per year out of a total of $242.4 million ($2001). Excess physician use associated with income inequality was estimated at 11.3% of all physician costs, or $27.5 million annually. In other words, these are amounts that would be saved in avoided physician services alone if all Nova Scotians were as healthy as those with university degrees and higher incomes.[50]

In short, in addition to potential improvements in health and wellbeing, there is also an economic case for investments in health promotion that reduce the incidence of chronic disease. In addition to reducing taxpayer-funded health care costs, health promotion efforts can also improve labour productivity by reducing the incidence of premature death, disability, and sick days among employees.

Such health promotion efforts in any province or community must begin with a clear profile of the most prevalent chronic diseases. Space does not permit such a full profile in this short summary chapter, but a few examples of particular concern are briefly presented here for illustrative purposes, updating results presented in earlier GPI reports. Please see GPI Atlantic's 2002 report, *The Cost of Chronic Disease in Nova Scotia,* for a more complete inventory and description of prevalent chronic diseases in the Province, and their respective mortality rates, costs and cost breakdowns by category.

9.4.1. Asthma

Data sources: Statistics Canada, Canadian Community Health Surveys, 2000/01, 2003, 2005, and 2007; Statistics Canada, National Population Health Surveys, 1994/95, 1996/97, and 1998/99

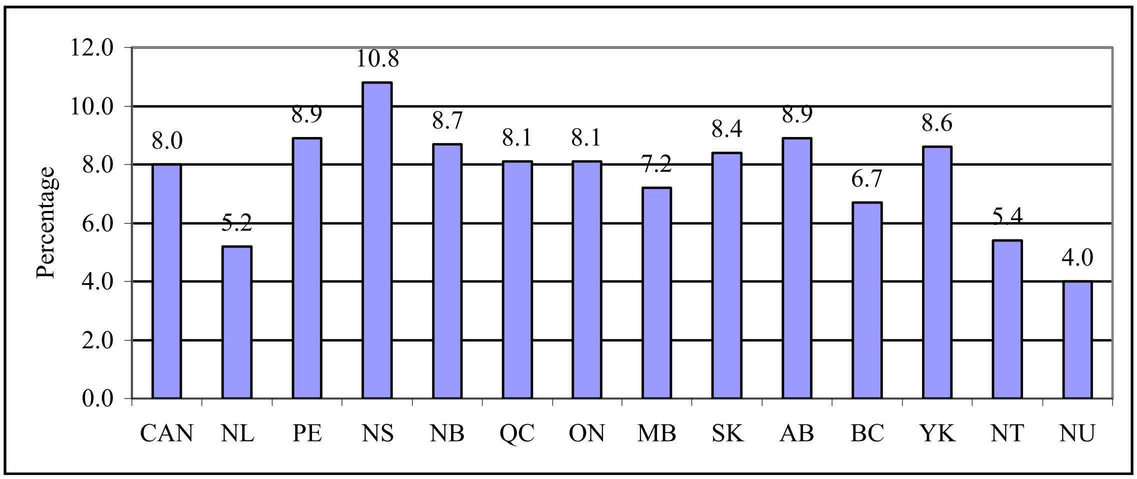
Results: There was no improvement in asthma rates among Nova Scotians or Canadians 12 and older between 1994–95 and 2007, and female asthma rates in Nova Scotia now stand at record levels—nearly twice as high as in 1994/95. In 2007, Nova Scotia had the highest prevalence of asthma in the country among all provinces and territories. Asthma prevalence is highest among children, with childhood asthma on the rise nationwide since 1994.

A chronic inflammatory disorder of the airways, asthma can cause wheezing, difficulty in breathing, and chest pain, and is the most common chronic disease among children in North America.[51] It is a major cause of hospitalization for young children in Canada, contributing to 12% of all hospital admissions in the birth to 4 years age group.[52]

A British study also found asthma to be the leading cause of absenteeism from school in the U.K.[53] A 2006 report by the Commission for Environmental Co-operation found that asthma rates among children in some parts of North America are four times higher than they were 20 years ago, and that poor urban children are at greater risk.[54] Exposure to second-hand smoke and air pollution has been found to contribute to asthma incidence and severity.[55]

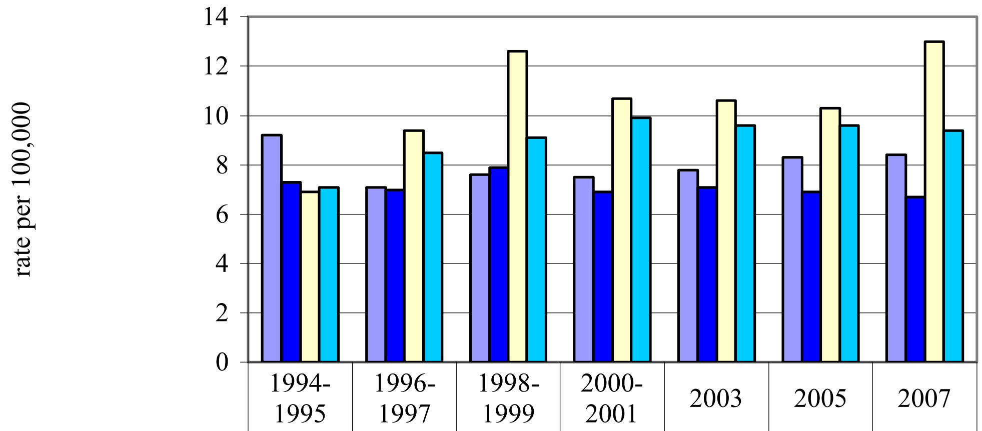
In 2007, Nova Scotians aged 12 and older had the highest rates of asthma in the country—10.8% compared to the Canadian average of 8% (Figure 9-3 below). Figure 9-4 below indicates that, since 2000, asthma rates for both males and females in Nova Scotia have been consistently higher than the Canadian average, and that asthma rates among females have been consistently higher than among males in both Canada and Nova Scotia. Most disturbingly, females asthma rates in Nova Scotia are now at their highest ever recorded level—13 per 100,000—nearly twice as high as in 1994/95 and well above the 9.7 per 100,000 rate for Canadian females. In 2007, the asthma rate among Nova Scotian males was 8.4 per 100,000, compared with 6.7 in Canada.

Figure 9-3. Percentage of population aged 12 and over (both sexes), Canada and provinces, 2007



Source: Statistics Canada. Canadian Community Health Survey, 2007.

Figure 9-4. Asthma rates, population aged 12 and over (%), Canada and Nova Scotia, 1994/1995–2007



	1994-1995	1996-1997	1998-1999	2000-2001	2003	2005	2007
NS (males)	9.2	7.1	7.6	7.5	7.8	8.3	8.4
CAN (males)	7.3	7	7.9	6.9	7.1	6.9	6.7
NS (females)	6.9	9.4	12.6	10.7	10.6	10.3	13.0
CAN (females)	7.1	8.5	9.1	9.9	9.6	9.6	9.4

Source: Statistics Canada, Canadian Community Health Surveys, 2000/01, 2003, 2005, and 2007; Statistics Canada, National Population Health Surveys, 1994/95, 1996/97, and 1998/99.

While the data presented above are for the population aged 12 and over, it is noteworthy that children and youth have the highest prevalence of asthma in Canada and the highest hospitalization rates due to asthma. The report by the Commission for Environmental Cooperation found that:

- Since 1994, asthma prevalence has been increasing among children (except for boys aged 4–7 years)
- Boys of all ages have a higher prevalence of asthma than girls—in contrast to the data above, which indicate that females *over 12* have higher asthma rates than males.
- Currently, approximately 20% of boys aged 8–11 have been diagnosed with asthma, the highest prevalence group among children.[56]

According to the National Longitudinal Survey on Children and Youth (NLSCY), in 2000–01, 16% of children 0–15 years in Nova Scotia were diagnosed with asthma (18.9% among boys and 12.9% among girls), compared to 15.5% in the Atlantic provinces—the region with the highest rates in the country—and 13% in Canada overall (16% for boys and 11% for girls). British Columbia and the Prairie provinces had the lowest childhood asthma rates in the country at 11.4% and 11.1% respectively.[57]

9.4.2. Diabetes

Data sources: Statistics Canada, Canadian Community Health Surveys, 2000/01, 2003, 2005, and 2007; Statistics Canada, National Population Health Surveys, 1994/95, 1996/97, and 1998/99

Results: In both Canada and Nova Scotia, the prevalence of diabetes nearly doubled between 1994–95 and 2007—from 3.6% to 6.8% in Nova Scotia (the third highest rate in the country), and from 3% to 5.8% in Canada. In 2005, the prevalence of diabetes in Nova Scotia peaked at 9.3%.

Diabetes is a serious, lifelong condition that can result in limb amputation, heart disease, kidney failure, and blindness, and often leads to disability and death. In 2007, more than one 1.6 million Canadians (over the age of 12) had non-insulin-dependent diabetes mellitus (often called adult-onset diabetes, or type 2 diabetes), which accounts for 92.5% of all cases of diabetes. This amounts to 5.8% of the total population of Canada. In Nova Scotia in the same year, more than 54,000 over the age of 12 had diabetes—or 6.8% of the population. In 2007, Newfoundland had the highest prevalence of diabetes in the country (8.8%), followed by New Brunswick (7.4%) and Nova Scotia (6.8%). The lowest prevalence was found in the Northwest Territories (4.2%) and Alberta (4.5%) (see Figure 9-5 below).

Diabetes is estimated to be responsible for the total disability of about 3,300 Nova Scotians, including 40 who become blind each year because of diabetic eye disease, more than 200 who receive treatment for kidney failure, and another 200 who undergo diabetes-related lower-extremity amputations. Diabetes is estimated to be the underlying cause of 150 deaths each year in Nova Scotia, and a contributing cause to at least 300 more, for a total of at least 450 deaths attributable to diabetes (5.7% of all deaths). These premature deaths represent an estimated loss of 5,000 years of life every year in Nova Scotia.[58]

Because it leads to other serious illnesses, diabetes is under-reported on death certificates. Thus, conventional estimates of mortality, disease-specific disability, and health expenditures attributable to diabetes are almost certainly underestimates, because of the convention of classifying illnesses by principal diagnosis.

According to Health Canada:

> There were 5,447 deaths in 1996 for which diabetes was certified as the underlying cause. This ranks diabetes as the seventh leading cause of death in Canada. However, the actual number of deaths for which diabetes was a contributing factor is probably five times this number.[59]

The U.S. Centers for Disease Control similarly report:

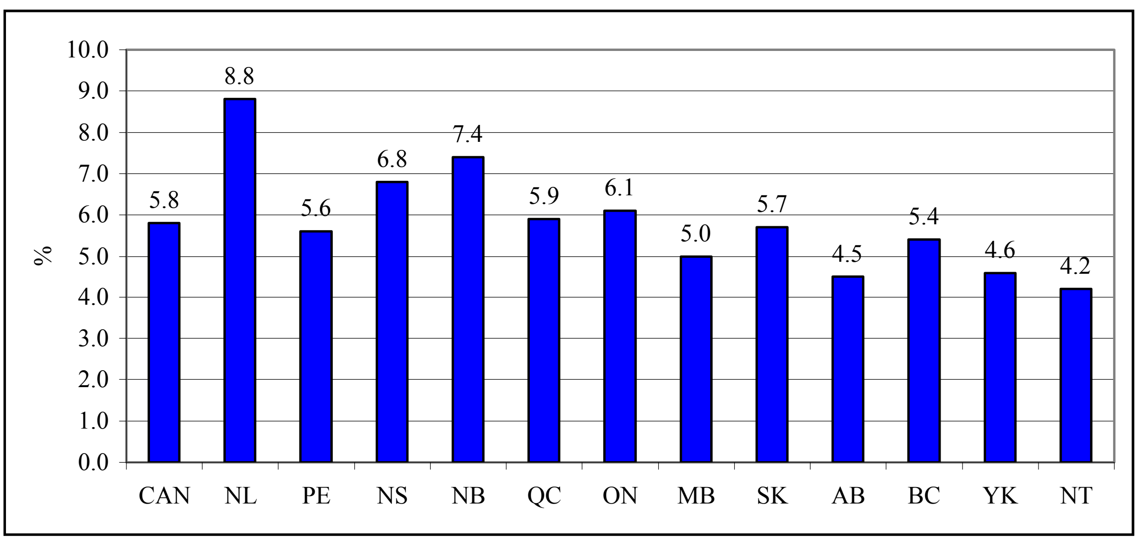
> Actually diabetes contributes to a much larger proportion of mortality, since it is reported on only about half of the death certificates for persons who die with the disease and is listed as the underlying cause on only one-quarter of the certificates on which it appears. The most frequent causes of death among persons with diabetes are ischemic and other forms of heart disease, cerebrovascular disease, and other forms of atherosclerosis; renal disease, including nephritis/nephrosis and uremia; respiratory disease; and infection.[60]

Diabetes is closely associated with obesity, with more than 50% of diabetes cases attributable to overweight.[61] Given the epidemic increase in obesity, it is not surprising that the global population with diabetes jumped nearly five-fold between 1985 and 1998 alone—from 30 million to 143 million. The average age of diabetics is getting younger, and the global incidence of the disease is expected to double to 300 million by the year 2025.[62] Statistics Canada reports that Canadians with a body mass index (BMI) greater than 30 are four times as likely to have diabetes as those with normal weights.[63]

A substantial portion of diabetes incidence, mortality, and costs could therefore be avoided through improved nutrition, physical activity, and weight reduction. One study found that the achievable reduction in the risk of non-insulin-dependent diabetes mellitus by favourably altering modifiable risk factors was 50–75% for obesity and 30–50% for physical activity.[64]

However, chronic disease incidence can be reduced not only by lifestyle and behavioural interventions, but also by improving socio-economic conditions. A detailed review of the burden of unnecessary illness by Emory University's Carter Center in the United States found socio-economic level to be a more consistent precursor of diabetes mellitus than any other cause.[65]

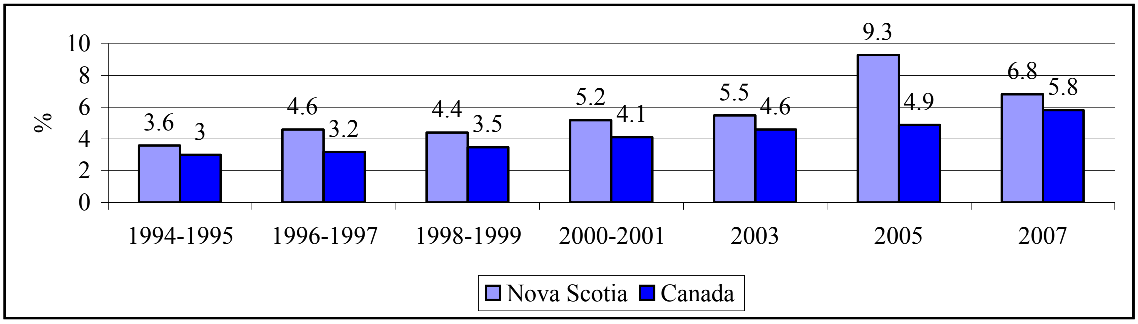
Figure 9-5. Prevalence of diabetes, population aged 12 and older (%), Canada, provinces and territories, 2007



Source: Statistics Canada. Canadian Community Health Survey, 2007.

In both Canada and Nova Scotia, the prevalence of diabetes nearly doubled between 1994–95 and 2007 from 3% to 5.8% in Canada and from 3.6% to 6.8% in Nova Scotia. In 2005 the prevalence of diabetes peaked in Nova Scotia at 9.3% (Figure 9-6 below). The prevalence of diabetes is higher among males than females—8.2% versus 5.6% in Nova Scotia and 6.4% versus 5.2% in Canada in 2007.

Figure 9-6. Prevalence of diabetes, population aged 12 and older (%), Canada and Nova Scotia, 1994–95 to 2007



Source: Statistics Canada, Canadian Community Health Surveys, 2000/01, 2003, 2005, and 2007; Statistics Canada, National Population Health Surveys, 1994/95, 1996/97, and 1998/99.

When 2007 diabetes prevalence is analysed by health region in Nova Scotia, it is discovered that prevalence ranges from 6% in the Halifax region and Cumberland, Colchester, and East Hants to a high of 10.2% in Cape Breton where 12% of males and 8.7% of females have been diagnosed with diabetes—among the highest rates in the country. The prevalence of diabetes is 6.9% in south and southwest Nova Scotia, 7.2% in the Annapolis Valley, and 6.7% in the Pictou-Antigonish-Guysborough area.[66]

9.4.3. High blood pressure

Data sources: Statistics Canada, Canadian Community Health Surveys, 2000/01, 2003, 2005, and 2007; Statistics Canada, National Population Health Surveys, 1994/95, 1996/97, and 1998/99

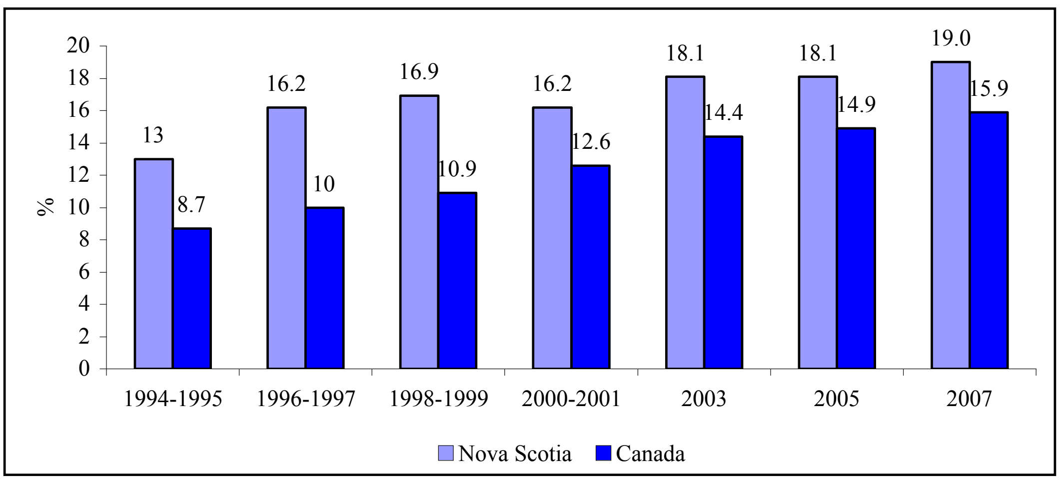
Results: The prevalence of high blood pressure increased in both Canada and Nova Scotia between 1994–95 and 2007. Nova Scotia has the third highest rate of high blood pressure in the country—19% compared to the national average of 15.9%.

High blood pressure is a principal risk factor for coronary heart disease and stroke, and in the U.S. has been estimated to account for 15% of all deaths and 24% of premature deaths.[67] Fortunately, it can be detected with a simple test, successfully controlled when diagnosed, and reduced through weight loss, increased physical activity, reduced salt and alcohol intake, and relaxation.[68]

Blood pressure checkups are recommended at least once a year, yet nearly 30% of Canadians do not heed that advice, and survey evidence indicates that a significant number of Canadians may have undetected high blood pressure. Thus, only 71% of Canadians 15 and older indicated in 2000/01 that they had their blood pressure checked within the past year—a percentage that has actually declined since 1985. British Columbia had the lowest proportion with a blood pressure checkup in the last year (66%) while Ontario and Nova Scotia had the highest (75%).[69]

Figure 9-7 below shows that the prevalence of high blood pressure increased in both Canada and Nova Scotia between 1994–95 and 2007—from 13% to 19% in Nova Scotia and from 8.7% to nearly 16% in Canada. The prevalence of high blood pressure has consistently been higher in Nova Scotia, but the gap has narrowed in recent years.

Figure 9-7. Prevalence of high blood pressure, population 12 and older (%), Canada and Nova Scotia, 1994–1995 to 2007

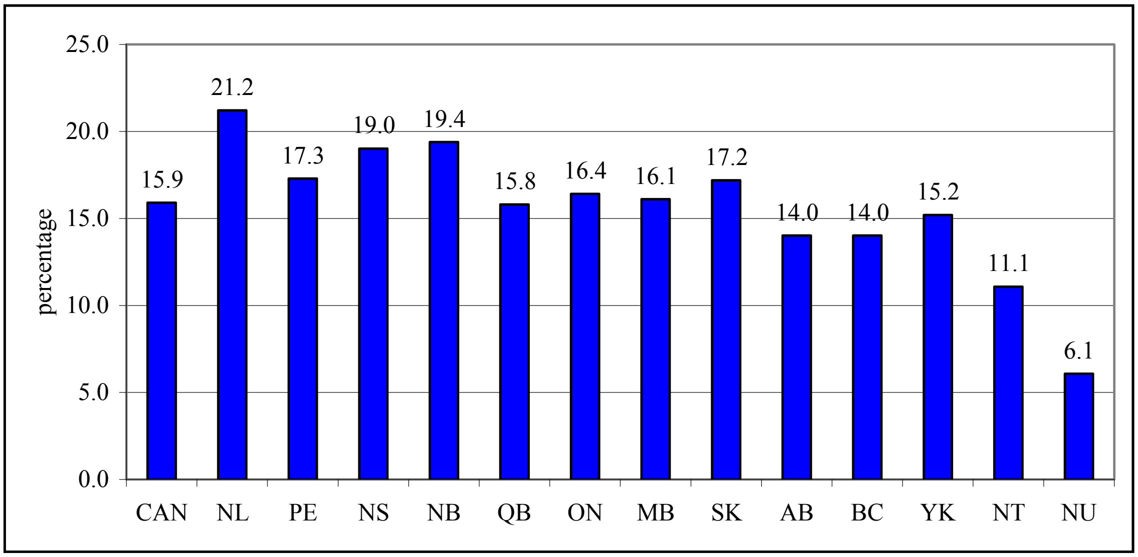


Source: Statistics Canada, Canadian Community Health Surveys, 2000/01, 2003, 2005, and 2007; Statistics Canada, National Population Health Surveys, 1994/95, 1996/97, and 1998/99.

In both Canada and Nova Scotia, women have a higher prevalence of high blood pressure than men, but rates are increasing much faster for men, substantially narrowing the female-male gap. Thus, between 1994–95 and 2007, the prevalence of high blood pressure more than doubled among Canadian males—from 7.3% to 15.1%, while it increased from 10.4% to 18.4% among Nova Scotian males. Among Canadian females, prevalence increased from 10% to 16.7% and among Nova Scotian females from 15.5% to 19.6% in this time period.

Among the provinces and territories, Nova Scotia had the third highest prevalence of high blood pressure (19%) in 2007, after Newfoundland (21.2%) and New Brunswick (19.4%). Prevalence was lowest in the north and in the west (Figure 9-8).

Figure 9-8. Prevalence of high blood pressure, population 12 and older (%), Canada, provinces, and territories, 2007



Source: Statistics Canada, Canadian Community Health Survey 2007.

When the prevalence of high blood pressure in 2007 is analysed by health region in Nova Scotia, we find that it ranges from a low of 15.8% in the Halifax region (similar to the national average) to highs of 23% in south and southwest Nova Scotia and in the Cumberland, Colchester, East Hants region, and 22.2% in Cape Breton. High blood pressure rates were 17.5% in the Pictou, Antigonish, Guysborough area, and 19.6% in the Annapolis Valley.

9.4.4. Cancer

Data sources: Statistics Canada, Canadian Cancer Registry (CCR) Database, the National Cancer Incidence Reporting System and Demography Division (population estimates)

Results: Between 1976 and 2004 cancer rates in Nova Scotia increased by 39% for Nova Scotian men and by 24% for Nova Scotian women. Nova Scotia has the second highest cancer rate in the country—12.4% higher than the Canadian average.

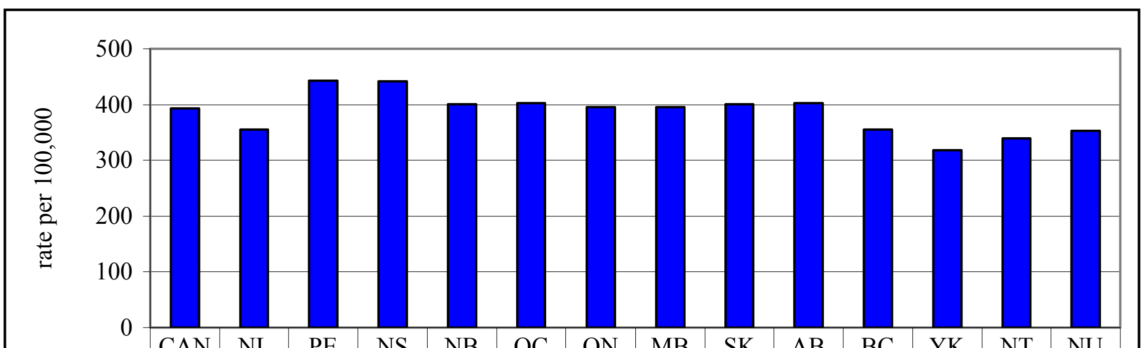
Cancer is the second leading cause of death in Canada, and accounts for 29% of all deaths in the country. Since 1979 the proportion of deaths due to cancer has increased from 22.9% to 29.2% in 2003.[70] Thus, it is estimated that at least one in four of all Canadians will die of cancer. The National Cancer Institute estimated that in 2008 there would be 166,400 new cases of cancer and 73,800 deaths from cancer. The number of new cases of cancer points to the burden and cost of cancer that will be borne in the future.

Nova Scotia's cancer incidence in 2004—the most recent year for which data were available at time of publication—was 441.8 per 100,000. This was the second highest cancer incidence in the country after PEI (443.1) and 12.4% higher than the Canadian cancer incidence of 393.2 per 100,000. If current trends continue, this means that 45% of Nova Scotian men and 40% of Nova Scotian women will develop cancer during their lifetimes.[71] The north had the lowest cancer rates in the country, followed by British Columbia (354.9) and Newfoundland and Labrador (355.3) (Figure 9-9 below).

After excluding prostate cancer, which shows large provincial differences due to diversity in Prostate Specific Antigen (PSA) screening, and discounting the effects of undercounting in Newfoundland and Labrador, the Canadian Cancer Society and National Cancer Institute report that cancer incidence and mortality rates are both generally higher in Atlantic Canada and Quebec and lower in British Columbia.[72]

Many risk factors for heart disease—including smoking, poor nutrition, physical inactivity, obesity, and exposure to second-hand smoke—are also key risk factors for cancer, and are preventable. According to the American Cancer Society, one-third of all cancer deaths are related to poor nutrition.[73]

Figure 9-9. Cancer incidence, age-standardized rate per 100,000, Canada, provinces and territories, 2004



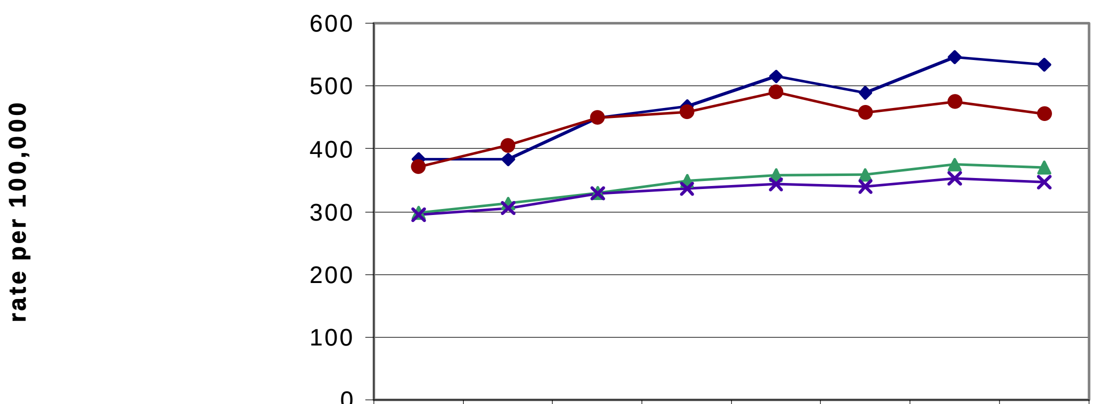
	CAN	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC	YK	NT	NU
2004	393.2	355.3	443.1	441.8	400.5	402.4	394.9	395	400.3	402.4	354.9	318.4	339	352.7

Source: Statistics Canada, Canadian Cancer Registry (CCR) Database, the National Cancer Incidence Reporting System and Demography Division.

Cancer incidence in both Canada and Nova Scotia increased significantly between 1976 and 2004—by 23% for Canadian men (from 371.9 to 456.2 per 100,000), by 18% for Canadian women (from 294.9 to 347.2), by 39% for Nova Scotian men (from 384.3 to 534.2), and by 24% for Nova Scotian women (from 299.1 to 370.4).

Thus, the rate of increase in cancer incidence is seen to be considerably sharper in Nova Scotia than in Canada for both men and women, but particularly for men—where relative parity with Canadian rates through the mid-1980s has now turned into a 17% higher incidence rate (Figure 9-10 below). This growing gap may be partly due to an earlier and more rapid decline in smoking rates nationwide than in Nova Scotia.

Figure 9-10. Cancer incidence, age-standardized rate per 100,000 population, by gender, Canada and Nova Scotia, 1976–2004



	1976	1980	1984	1988	1992	1996	2000	2004
Nova Scotia (men)	384.3	383.2	449.8	467.7	515.6	489.3	546	534.2
Canada (men)	371.9	406.1	450	458.4	490	457.8	475.4	456.2
Nova Scotia (women)	299.1	313.1	330.4	349	357.7	358.5	374.8	370.4
Canada (women)	294.9	305.5	329.5	336	343.8	339.6	353.6	347.2

Source: Statistics Canada, Canadian Cancer Registry (CCR) Database, the National Cancer Incidence Reporting System and Demography Division (population estimates). CANSIM Table 103-0204.

According to the Canadian Cancer Society, three types of cancer account for the majority of new cases: prostate, lung, and colorectal cancer in men, and breast, lung, and colorectal cancer in women. The increased number of new cases of cancer is primarily due to an aging population—42% of new cancer cases and 60% of deaths due to cancer occur among those who are at least 70 years of age.[74]

9.5. Mental Health

In health promotion efforts, mental illness and its associated costs generally receive far less attention than physical illnesses and lifestyle factors. Yet mental illness accounts for some of the highest disease costs. Of seven modifiable risk factors examined in a major study of 46,000 U.S. employees, depression and stress accounted for higher medical costs than any other risk factors. Depressed workers had 70% higher medical costs and highly stressed workers had 46% higher costs than those who did not suffer from depression and high stress.[75] In addition, mental health problems can lead to a range of causes of premature death, including violence, substance abuse, and suicide.[76]

Substantial research has found that stress negatively affects health, weakens the immune system, and increases susceptibility to a wide range of illnesses.[77] According to Richard Surwit of Duke University Medical Centre:

> Experiencing stress is associated with the release of hormones that lead to energy mobilization—known as the 'fight or flight' response. Key to this energy mobilization is the transport of glucose into the bloodstream, resulting in elevated glucose levels, which is a health threat for people with diabetes.[78]

A study in Detroit, Michigan, found that those living in dangerous and high-stress neighbourhoods had higher hypertension levels than those living in low-stress neighbourhoods.[79] In a wide-ranging review of the literature, the American Journal of Health Promotion found stress to be the most costly of all modifiable risk factors.[80]

In addition to depression and stress, certain emotional states and personality types have been identified as risk factors for hypertension, heart disease, and other chronic illnesses. In particular, hostility, aggression, cynicism, and isolation have been related to heart disease risk; suppressed anger has been linked to cancer and high blood pressure; and repressed emotions have been found to predict both cancer and heart disease. Conversely, studies have found that confidence, optimism, self-efficacy, and a sense of coherence and control can buffer and moderate the effects of stress, and protect against illness. Reviewing the evidence, Jon Kabat-Zinn hypothesizes that:

> [P]articular patterns of emotional expression (or suppression) can contribute to the development of chronic disease[. . .]. Coping effectively with the full range of emotions we feel as human beings may be of great importance for our health [. . . . A] middle path in the self-regulation of emotional expression, at least regarding anger and hostility, may be the avenue of choice in terms of improving health.[81]

Just as mental distress is frequently the precursor of physical illness, a healthy state of mind is also recognized as the most important element in healing and restoring health after illness or injury. There is also strong evidence that mental health is important in coping successfully with stressors in general, and the stress of illness in particular, and for maintaining good physical health and healthy life practices.[82] The World Health Organization's definition of health as "a state of complete physical, mental, spiritual, and social well-being, and not merely the absence of disease," clearly recognizes the centrality of mental health.

Given the importance of mental wellbeing, it is perhaps surprising how few data have been available on the subject until relatively recently, and how hidden the evidence has remained compared to measures of physical health. Fortunately, Statistics Canada's first dedicated Canadian Community Health Survey focussing on mental health now provides important new data. Here we report briefly on three illustrative measures of mental health on which relatively recent data are now available.

9.5.1. Life stress

Data sources: Statistics Canada, Canadian Community Health Surveys, 2000–2001, 2003, 2005, and 2007

Result: Fewer Canadians and Nova Scotians reported high levels of life stress in 2007 than seven years earlier. Fewer Nova Scotians report high life stress than the Canadian average.

Stress is described here as a separate social-psychological determinant of health, but it can clearly flow from any of the economic, social, and environmental determinants of health and from several major risk conditions—poverty, unemployment, job insecurity, overwork, lack of control at work, family violence, lack of social support, environmental stressors, and so on. As with all determinants of health, the issue is not to identify a separate causal link to health or illness for any one determinant, but to indicate the dynamic interplay and synergy of multiple health determinants, and to identify intervening processes that may exacerbate or ameliorate particular health outcomes.

Stress is both an outcome of other health determinants and a key influence on mental and physical health in its own right. To give one example—gender has long been recognized by Health Canada as a key determinant of health, since women's health outcomes differ from those of men in several important ways. In this case, stress is a particularly important indicator of women's health, since women report higher levels than men of both chronic stress in general and time stress in particular.

Stress has been shown to have adverse physical outcomes for both men and women, but in many cases key stressors have particular origins in women's social-structural roles. For example, stress can be occasioned by the financial pressures of both gender pay inequity and single parenthood, and by the double burden of paid and unpaid work that is generally borne more intensely by women.

Time stress, or the intense struggle to juggle domestic and work schedules, and to balance work, family, and life responsibilities, may also lead to adverse health outcomes by fostering unhealthy lifestyle behaviours. One Statistics Canada study found that women working longer hours had higher rates of smoking, physical inactivity, depression, and unhealthy weight gain.[83]

Indeed, Statistics Canada's time use survey data indicate that time stress rates are rising across the country, with full-time working mothers consistently recording significantly higher rates than men of life stress in general and time stress in particular. In fact, full-time working mothers are the most highly time-stressed demographic group in Canada, when both paid and unpaid work are counted, with full-time working lone mothers experiencing the most time stress of all demographic groups.[84] Please see the free time chapter of this summary report for new data pointing to sharp increases in time stress for Nova Scotian women in the last decade.

Ground-breaking research in the last ten years has identified several of the biological mechanisms by which stress has an impact on health. Abundant evidence has existed for some time that stress is an independent risk factor for several chronic illnesses. However, more recent research has uncovered evidence on the physiological pathways between psychosocial stress, emotional arousal, and disease. Thus, it has been found that two stress-related neuro-endocrine pathways can adversely affect the heart—the pituitary adrenal system, activated when there is depression, withdrawal, or loss of control, and the sympathetic adrenal medullary system, activated in response to the "fight or flight" syndrome.[85]

Work is also a significant source of stress for many Canadians. Statistics Canada's 1994/1995 Population Health Survey found that key factors which played a significant role in producing and exacerbating work stress were job strain—defined as the "measure of the balance between the psychological demands of a job and the amount of control or decision-making power it affords"; job insecurity; high physical demands; and lack of supervisor support and co-worker support.[86]

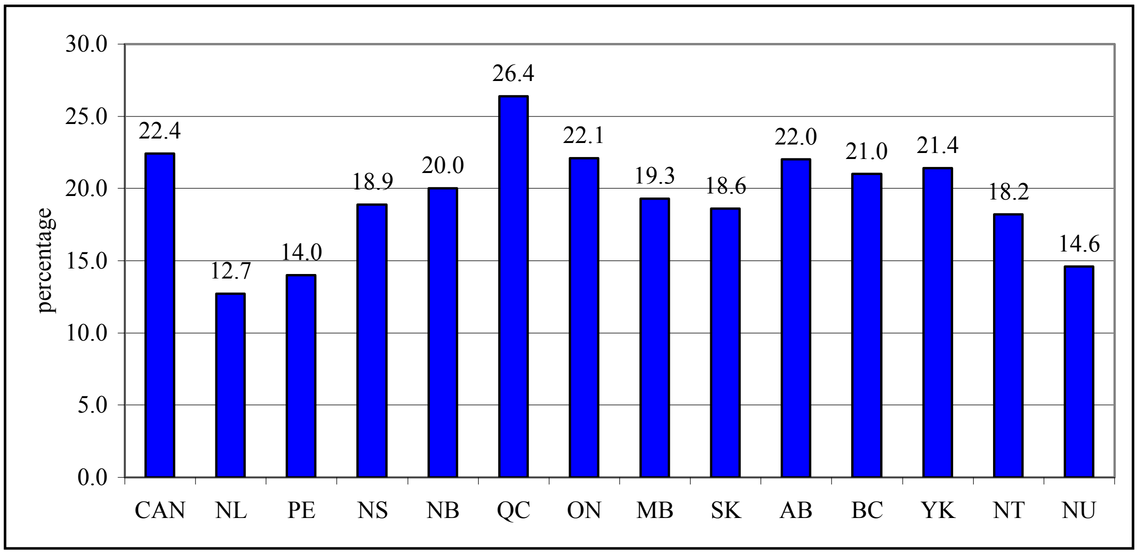
While long work hours, increased time pressure, and even burnout are the experience of a growing number of workers today, they are clearly not the only cause of work stress. Work '"underload," and lack of stimulus, challenge, and variety of work, are also causes for concern that have been related to job stress. Inadequate work, demand, and hours may be associated with a perceived threat of layoff, with income loss, and with the economic stress of not being able to make ends meet.[87]

According to the 2007 CCHS, 22.4% of Canadians experienced "quite a lot" of life stress in that year, compared with nearly 19% of Nova Scotians, 26.4% of Quebecers (the highest rate in the country), and just 12.7% of Newfoundlanders and 14% of Prince Edward Islanders (the lowest rates) (Figure 9-11 below). In fact, residents of Newfoundland and Labrador and PEI consistently report the lowest rates of life stress in the country, and all four Atlantic provinces were below the Canadian average for 2007.

Between 2000–01 and 2007, the proportion of Canadians and Nova Scotians experiencing high levels of life stress declined— from 26.1% to 22.4% in Canada, and from 22.5% to 18.9% in Nova Scotia. All four population health surveys since 2000–01 showed Canadian women to be more likely than men to experience "quite a lot" of life stress—23.4% versus 21.4% in 2007, for example. This was true in Nova Scotia in all surveys except 2007, when 18.3% of Nova Scotian women and 19.5% of men reported high stress (Table 9-5 below).

When life stress data are analysed by health region, the highest levels of life stress were found in south and southwest Nova Scotia (where 25.3% of respondents reported experience "quite a lot" of life stress) followed by the Halifax region (20.8%), and the Annapolis Valley (18.7%). The lowest levels of high stress were in the Pictou, Antigonish, and Guysborough area (13%), Cape Breton (14%), and the Cumberland, Colchester, East Hants region (14.8%).

Figure 9-11. Percentage who experience "quite a lot" of life stress, Canada, provinces, and territories, 2007



Source: Statistics Canada, Canadian Community Health Survey, 2007.

Table 9-5. Percentage who experience "quite a lot" of life stress by gender (%), Canada and Nova Scotia, 2000–2001 to 2007

	NOVA SCOTIA			CANADA		
	Total	**Men**	**Women**	**Total**	**Men**	**Women**
2000-2001	22.5	21.4	23.6	26.1	25.3	26.8
2003	19.1	18.7	19.5	24.4	23.9	25.0
2005	20.9	18.0	23.5	23.2	22.4	24.0
2007	18.9	19.5	18.3	22.4	21.4	23.4

Source: Statistics Canada, Canadian Community Health Survey, 2000–2001, 2003, 2005, and 2007.

9.5.2. Perceived mental health

Data sources: Statistics Canada, Canadian Community Health Surveys, 2003, 2005, 2007

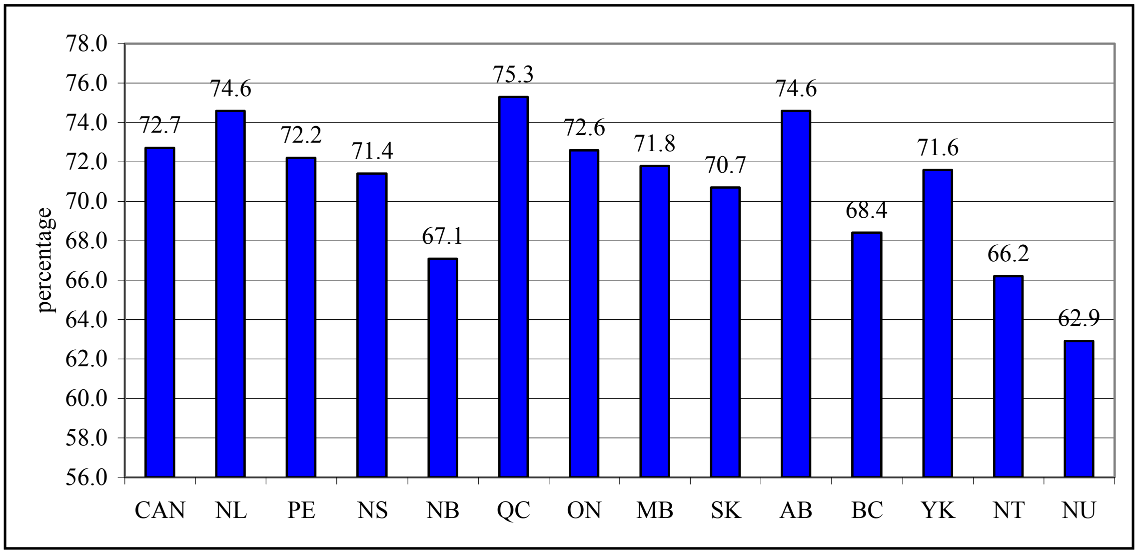
Result: 71% of Nova Scotians rate their mental health as very good or excellent in 2007, slightly fewer than the national average. There was little change in the self-rated mental health of Nova Scotians between 2003 and 2007.

According to the 2007 Canadian Community Health Survey, 71.4% of Nova Scotians rated their mental health very good or excellent, compared with 72.7% of Canadians (see Figure 9-12 below). The highest ranking province was Quebec (75.3%) followed by both Newfoundland and Labrador (74.6%) and Alberta (74.6%). The lowest ranking jurisdictions were Nunavut (62.9%), New Brunswick (67.1%) and British Columbia (68.4%).

Between 2003 and 2007, the percentage of Nova Scotians rating their mental health as very good or excellent remained stable at 71.8% and 71.4% respectively. In Canada, there was a slight increase in the percentage of Canadians rating their mental health as very good or excellent—from 71.6% in 2003 to 72.7% in 2007.

When data are analysed by Health Region with Nova Scotia, a higher percentage of respondents in Cape Breton (73.3%) and the Halifax region (73.2%) rated their mental health as very good or excellent than in Pictou-Antigonish-Guysborough (70%), the Annapolis Valley (69.6%), Cumberland-Colchester-East Hants (69.2%) and south and southwest Nova Scotia (67.8%).

Figure 9-12. Perceived mental health, percentage rated "very good" or "excellent", Canada, provinces, and territories, 2007



Source: Statistics Canada, Canadian Community Health Survey, 2007.

9.5.3. Self-esteem

Data sources: Statistics Canada, National Population Health Survey (NPHS), 1994–1995; Canadian Community Health Survey (CCHS), 2003

Results: There was a significant decline (and therefore improvement) between 1994–95 and 2003 in the proportion of Nova Scotian men and women reporting low levels of self-esteem. However, considerably fewer Nova Scotians (37%) than Canadians (49%) reported high self-esteem in 1994–95 (the only year for which pan-Canadian data are available.)

Self-esteem, an indicator of mental health and wellbeing, is the level of perceived self-worth reported by persons aged 12 and over, as assessed by their responses to six questions in Statistics Canada's population health surveys. The National Association for Self-Esteem defines self-esteem as "the experience of being capable of meeting life's challenges and being worthy of happiness."[88] The concept therefore consists of a psychological component—worthiness—and a behavioural component—competence.

Based on data from the 1994–95 National Population Health Survey, as reported in GPI Atlantic's 2003 report titled *A Profile of Women's Health Indicators in Canada*, similar proportions of Canadian women and men reported high self-esteem in 1994–95 (48.6% and 48.7% respectively), but women were considerably more likely than men to report low self-esteem (14.1% compared to 9.9%). In Nova Scotia, women were also considerably more likely than men to report low self-esteem (20.4% versus 14.1%) in 1994–95. The male-female gap in 1994–95 was widest among young Canadians, with 22% of 15–19 year-old women reporting low self-esteem, compared to 13% of men in that age group.

Self-esteem was also linked to income, education, and region. In 1994–95, 18% of those with the lowest income levels reported low self-esteem, compared to 13% of middle-income earners, and 10% of high-income earners. The highest rates of self-esteem in the country were in Quebec, where 62% were assessed as having high self-esteem, based on their answers to the six survey questions. The lowest rates were in Manitoba and Saskatchewan, where only 34% reported high self-esteem, and in the Atlantic provinces (Newfoundland—35%, Nova Scotia—37%, PEI—40%, and New Brunswick—41%).

Unfortunately, 2003 is the only other year when CCHS data are available for Nova Scotia. According to the 2003 Canadian Community Health Survey, roughly 11% of Nova Scotians had low self-esteem (9.3% of men versus 12.3% women) and nearly 38% reported having high self-esteem. Because not all provinces participated in this section of the survey, pan-Canadian data for 2003 are not available, and it is therefore not possible to compare Nova Scotian results with a Canadian average, or to assess changes in Canadian self-esteem ratings.

If we compare the 2003 CCHS data on Nova Scotia with the 1994–95 NPHS Nova Scotia data, we find a very slight increase in the proportion of those with high self-esteem (38% in 2003 compared to 37% in 1994–95. However, we find a significant decline (and therefore improvement) in the proportion categorized as having low self-esteem—9.3% of men in 2003, compared with 14.1% in 1994-95, and 12.3% of women in 2003 compared to 20.5% in 1994–95 (Table 9-6 below).

Table 9-6. Self-esteem by gender, Nova Scotia Health Regions,[89] 2003

2003	Low self esteem	High self esteem	Not stated
Nova Scotia	10.8	37.9	4.3
Male	9.3	37.2	5.7
Female	12.3	38.6	3.0
Zone 1	12.5	31.9	5.3
Male	11.7 E	26.5	5.4 E
Female	13.2 E	37.1	5.1 E
Zone 2	12.8	40.3	2.8 E
Male	13.6	41.1	F
Female	12.0	39.6	F
Zone 3	10.7	33.3	4.2 E
Male	9.6 E	31.0	7.0 E
Female	11.9	35.5	F
Zone 4	10.0	33.9	3.4 E
Male	8.9 E	32.2	4.3 E
Female	10.9	35.5	2.4 E
Zone 5	11.9	41.2	6.0 E
Male	11.2 E	41.2	9.7 E
Female	12.4 E	41.2	2.6 E
Zone 6	9.8	40.5	3.9 E
Male	7.0 E	41.5	4.6 E
Female	12.4	39.6	3.4 E

Source: Statistics Canada. Canadian Community Health Survey, 2003.

Notes: E indicates that data have a coefficient of variation (CV) from 16.6% to 33.3% and should be interpreted with caution. F indicates that data have a coefficient of variation (CV) greater than 33.3% and are therefore suppressed by Statistics Canada due to extreme sampling variability.

9.6. Behavioural (lifestyle) risk factors

9.6.1. Smoking

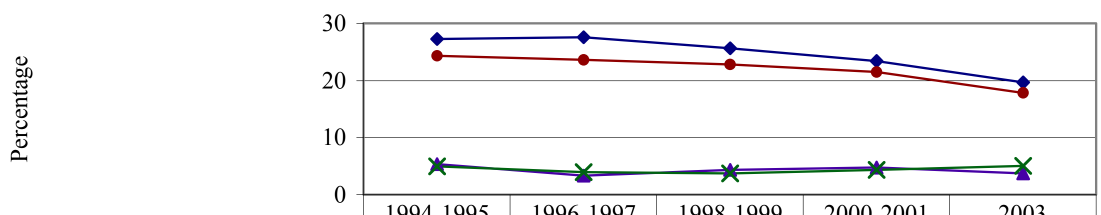
Data sources: Statistics Canada, Canadian Community Health Surveys (CCHS) 2000–01, 2003, 2005, and 2007; Statistics Canada, National Population Health Surveys (NPHS) 1994–95, 1996–97, 1998–99; Canadian Tobacco Use Monitoring Surveys, 1999–2005

Results: Rates of smoking decreased in both Canada and Nova Scotia between 1994–95 and 2007—from 29.3% to 21.9% in Canada and from 32.7% to 24.4% in Nova Scotia.

Health Canada reports that 21% of all deaths in Canada are attributable to smoking— 45,000 preventable deaths a year—and that smoking is the leading preventable cause of sickness and death in Canada.[90] Ninety per cent of lung cancers are attributable to smoking, and tobacco is also a significant risk factor for other cancers, coronary heart disease, and respiratory illnesses.[91]

Between 1994–95 and 2003, the percentages of daily smokers in both Canada and Nova Scotia declined considerably—from 24.3% to 17.8% in Canada and from 27.3% to 19.7% in Nova Scotia. The percentages of occasional smokers declined in Nova Scotia from 5.4% to 3.8% and increased marginally in Canada from 5% to 5.1% (Figure 9-13 below).[92]

Figure 9-13. Daily or occasional smoker, population 12 and older (%), Canada and Nova Scotia, 1994–1995 to 2003



	1994-1995	1996-1997	1998-1999	2000-2001	2003
Nova Scotia (daily)	27.3	27.6	25.6	23.4	19.7
Canada (daily)	24.3	23.6	22.8	21.5	17.8
Nova Scotia (occasional)	5.4	3.3	4.4	4.8	3.8
Canada (occasional)	5	4	3.7	4.4	5.1

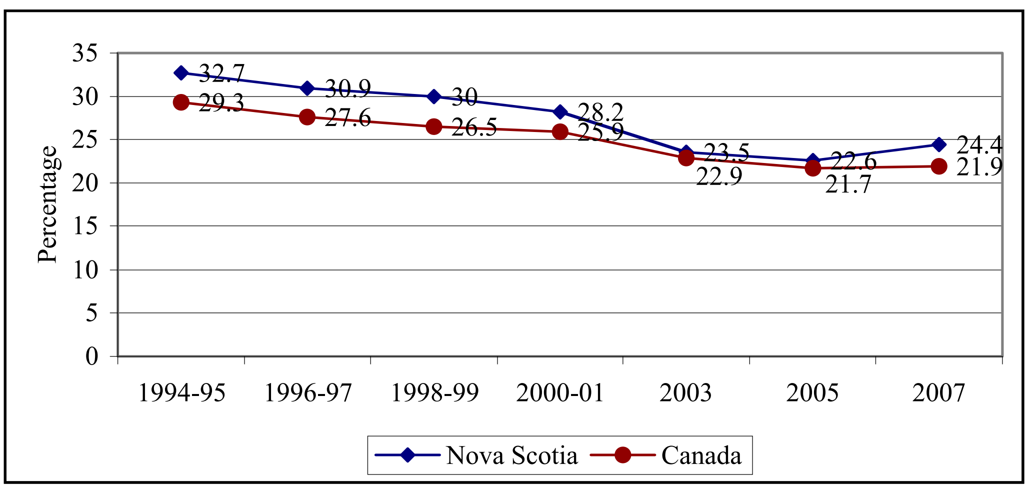
Source: Statistics Canada, Canadian Community Health Survey, 2000-01 and 2003; Statistics Canada, National Population Health Survey, 1994-95, 1996-97, 1998-99.

However, in the 2005 and 2007 CCHS, the daily and occasional smoker categories were combined, and so it was no longer possible to ascertain the separate proportions of smokers that smoked daily or occasionally. In 2005, 21.7% of Canadians (23.6% of males and 19.8% of females) and 22.6% of Nova Scotians (23.7% of males and 21.6% of females) were daily or occasional smokers. By 2007, however, overall smoking rates had crept up somewhat—more substantially among Nova Scotians, where smoking rates increased among both males and females, than nationwide, where the increase was entirely attributable to more male smoking. Thus, in 2007, 21.9% of Canadians (24.6% of males and 19.4% of females) and 24.4% of Nova Scotians (25.9% of males and 22.9% of females) smoked either daily or occasionally. As noted, it was not possible to ascertain whether the increase was due to increases in daily smoking or occasional smoking.

Between 1994–95 and 2007, overall rates of smoking decreased significantly in both Canada and Nova Scotia—from 29.3% to 21.9% in Canada and from 32.7% to 24.4% in Nova Scotia (Figure 9-14 below).

Data from the Canadian Tobacco Use Monitoring Surveys show that rates of smoking among youth have declined more sharply in Nova Scotia than in any other province—from one in three (33%) Nova Scotians aged 15–24 in 1999 to one in five (20%) in 2005—a drop of 39% compared to the 31% Canadian average decline for youth. This success, and the substantial overall decline in smoking in Nova Scotia, is attributable in large part to the Province's comprehensive tobacco control strategy, which included sharp increases in tobacco taxes, smoke bans in public places, and media campaigns.

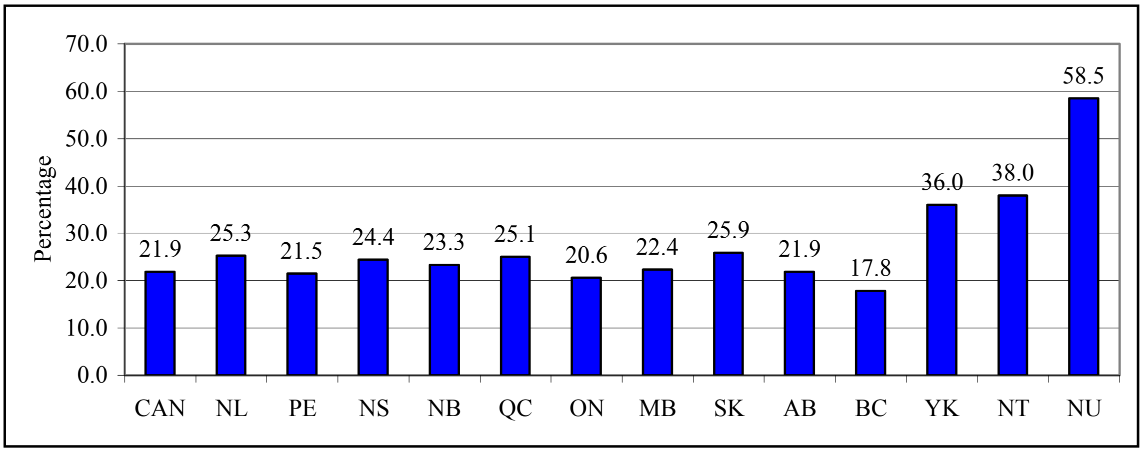
Figure 9-14. Smokers (daily and occasional combined), population aged 12 and older (%), Canada and Nova Scotia, 1994–1995 to 2007



Source: Statistics Canada, Canadian Community Health Surveys, 2000–01, 2003, 2005, and 2007; Statistics Canada, National Population Health Surveys, 1994–95, 1996–97, 1998–99

The highest rates of smoking (daily or occasional) were in Canada's north, where 58.5% of Nunavut residents 12 and older, 38% of those in the Northwest Territories, and 36% of those in the Yukon, smoked. The lowest smoking rate was in British Columbia (17.8%), and the highest rates among the provinces were in Saskatchewan (25.9%), Newfoundland and Labrador (25.3%), Quebec (25.1%), and Nova Scotia (24.4%) (Figure 9-15 below).

Figure 9-15. Smokers (daily or occasional combined), population aged 12 and older (%), Canada, provinces, and territories, 2007



Source: Statistics Canada. Canadian Community Health Survey, 2007.

9.6.2. Obesity

Data sources: Statistics Canada, National Population Health Surveys (NPHS), 1994–95, 1996–97, 1998–99; Canadian Community Health Surveys (CCHS), 2000–01, 2003, 2005, 2007

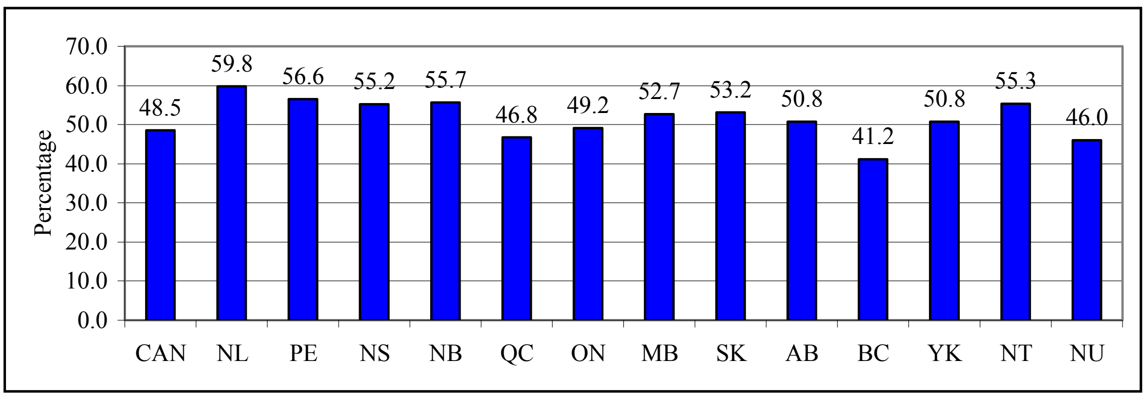
Results: Between 1994–95 and 2007, rates of adult obesity increased in Canada from 12.7% to 16% and in Nova Scotia from 16.7% to 20.1%. Nova Scotia has consistently had higher rates of obesity than the national average.

It is noteworthy that Statistics Canada lists obesity—defined as having a Body Mass Index (BMI) of 30 or above[93]—as an actual health condition rather than as a behavioural risk factor. While GPI Atlantic fully appreciates and accepts the logic if that classification, obesity is placed here after smoking as a risk factor, because obesity is also acknowledged as the second most preventable and costly cause of illness and premature death after smoking. Obesity has been linked to a wide range of chronic diseases including type 2 diabetes, heart disease, hypertension, and gallbladder disease. Rates of overweight and obesity have more than doubled in Nova

Scotia, in Canada, and globally in the last two decades.

The 2007 CCHS indicate that nearly half (48.5%) of Canadians 18 and older self-reported a weight and height[94] that classified them as either overweight (BMI = 25–29.99) or obese (BMI = 30+). Among the provinces, the highest rates in the country of overweight or obesity were in the four Atlantic provinces—led by Newfoundland and Labrador (59.8%), PEI (56.6%), New Brunswick (55.7%) and Nova Scotia (55.2%). The lowest rate was in British Columbia (41.2%) (Figure 9-16 below). In 2007, 16% of Canadians and 20.1% of Nova Scotians had a BMI of 30 or more, classifying them as "obese."

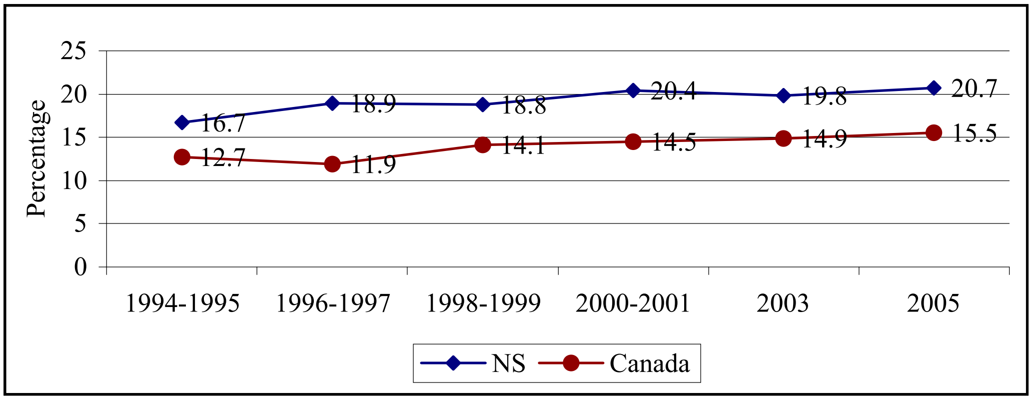
Figure 9-16. Self-reported adult BMI of 25+, percentage of population 18 and older that is overweight or obese, Canada, provinces, and territories, 2007



Source: Statistics Canada. Canadian Community Health Survey, 2007.

As Figure 9-17 below illustrates, rates of obesity increased in both Canada and Nova Scotia between 1994–95 and 2005—from 12.7% to 15.5% in Canada and from 16.7% to 20.7% in Nova Scotia, with Nova Scotia rates consistently higher than the national average over the ten-year period. Just as this report went to press, 2007 CCHS data were released showing that 16% of Canadians and 20.1% of Nova Scotians were obese in 2007 (not included in Figure 9-17 below).

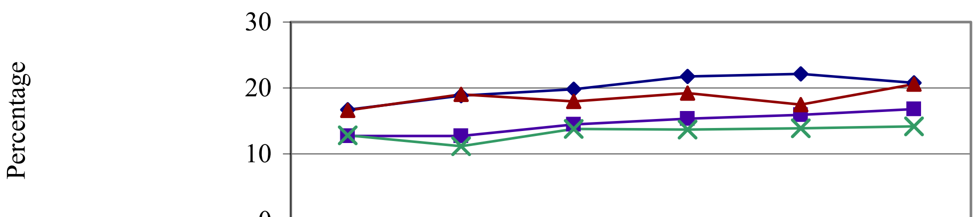
Figure 9-17. Self-reported adult BMI, percentage of population 18 and older that is obese, Canada and Nova Scotia, 1994–1995 to 2005



Source: Statistics Canada. National Population Health Survey, 1994–95, 1996–97, 1998–99; Canadian Community Health Survey, 2003, 2005.

As Figure 9-18 below indicates, the rate of obesity among Canadian and Nova Scotian males generally tends to be somewhat higher than among females. That is again confirmed by 2007 CCHS data released just as this report went to press, indicating that, in 2007, 17.1% of Canadian males and 15% of Canadian females 18 and older were obese, and that 21.5% of Nova Scotian males and 18.9% of Nova Scotian females were obese (not included in Figure 9-18 below).

Figure 9-18. Self-reported adult BMI, percentage of population 18 and older that is obese, by gender, Canada and Nova Scotia, 1994–1995 to 2005



	1994-1995	1996-1997	1998-1999	2000-2001	2003	2005
NS (males)	16.7	18.8	19.8	21.7	22.1	20.8
CAN (males)	12.7	12.7	14.5	15.3	15.9	16.8
NS (females)	16.6	19	18	19.2	17.5	20.6
CAN (females)	12.8	11.2	13.8	13.7	13.9	14.2

Source: Statistics Canada. National Population Health Survey, 1994–95, 1996–97, 1998–99; Canadian Community Health Survey, 2003, 2005.

When obesity rates are analysed by Health Region, we find that in 2005 they were highest in Zone 1—south and southwest Nova Scotia (24.8%) followed by Zone 3—Cumberland-Colchester-East Hants (22.8%), Zone 5—Cape Breton (22.6%), and Zone 4—Pictou-Antigonish-Guysborough (21.7%). The lowest rates of obesity were found in Zone 2—the Annapolis Valley (18%), Zone 6—the Halifax region (18.6%). Interestingly, the Cumberland-Colchester-East Hants region had the highest rate of male obesity in the Province (29.2%)—indicating that nearly three out of every ten males in that region is obese, with a BMI of 30 or more—but the lowest rate of female obesity (16.7%) (Table 9-7 below).

Table 9-7. Self-reported adult BMI, percentage of population 18 and older that is obese, by gender, Nova Scotia Health Regions[95], 2000–01, 2003, and 2005

	2000–2001 (%)			2003 (%)			2005 (%)		
	Total	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**
Zone 1	25.1	24.2	26.0	21.8	24.4	19.2	24.8	22.0	27.5
Zone 2	19.5	18.1	20.7	17.8	18.7E	17.0E	18.0	18.2	17.8
Zone 3	19.9	19.9	20.0	22.8	24.8	21.0	22.8	29.2	16.7
Zone 4	21.3	24.6	18.2	21.3	24.9	17.9	21.7	22.4	21.0
Zone 5	23.1	28.2	18.4	21.1	24.7	17.7	22.6	20.2	24.9
Zone 6	18.0	19.1	17.0	17.9	19.8	16.1	18.6	18.5	18.6

Source: Statistics Canada. Canadian Community Health Survey, 2000–01, 2003, and 2005.

Notes: E indicates that data have a coefficient of variation (CV) from 16.6% to 33.3% and should be interpreted with caution.

According to a 2005 Statistics Canada study using longitudinal data from the National Population Health Survey (NPHS) between 1994–95 and 2002–03, it appears to be easier not to put on weight in the first place than it is to take it off, and therefore, interventions that focus on prevention may be more effective than efforts to lose weight.

The study also found that men were more likely than women to make the transition from normal weight to being overweight (38% versus 28%). However, women were more likely to go from being overweight to being obese: by 2002–03, 28% of women who had previously been overweight had become obese, compared to 20% of previously overweight men. While the study did not include children, it did note that parental obesity significantly increased the risk of obesity among children.

The study also found that income was inversely correlated with obesity: For both men and women, members of high-income households were 40% less likely to become obese than members of the lowest-income households.[96]

Time, space, and resource constraints simply did not allow an examination of all important health indicators in this chapter. In this section, which presently deals only with adult obesity, it would clearly be highly desirable to include a section on childhood obesity. Childhood obesity will be addressed directly in GPI Atlantic's forthcoming (2009) study on the Cost of Obesity in Alberta, undertaken for the Alberta Cancer Board.

9.6.3. Physical inactivity

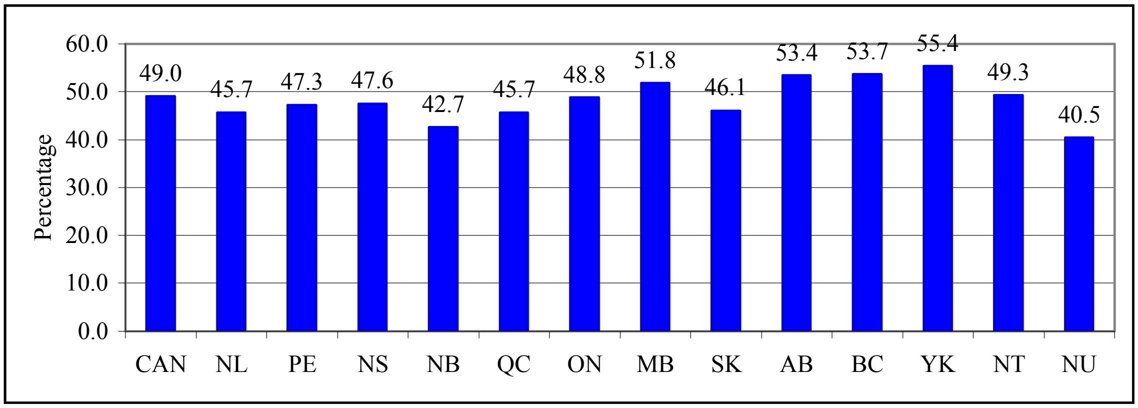
> *Data sources*: Statistics Canada, National Population Health Surveys, 1994–95, 1996–97, and 1998–99; Canadian Community Health Surveys, 2000–01, 2003, 2005, and 2007
>
> *Result*: Between 1994–95 and 2007, there was a decrease in the percentages of Canadians and Nova Scotians who were physically inactive—from 54.6% to 48.2% in Canada, and from 62.5% to 50% in Nova Scotia. However, the improvements have stalled since 2003, with about half of all Canadians and Nova Scotians still living a sedentary or physically inactive lifestyle.

Physical activity has proven benefits in preventing disease, improving health, and promoting independence and quality of life in old age.[97] The most substantial body of evidence for achieving healthy active aging relates to the beneficial effects of *regular* exercise.[98] Physical activity has been called "the most obvious of variables which might reduce overall lifetime morbidity" and the "cornerstone" of any strategy aimed at prolonging disability-free life expectancy.[99]

Abundant evidence shows that physical activity protects against heart disease, stroke, hypertension, type 2 diabetes, colon cancer, breast cancer, osteoporosis, obesity, depression, anxiety, and stress.[100] Conversely, physical inactivity is linked to a wide range of chronic illnesses, including diabetes 2, heart disease, hypertension, and colon cancer.

According to the 2007 CCHS data, nearly 48% of Nova Scotians 12 and older are physically active or moderately active, compared to 49% of Canadians overall. The highest rates of physical activity in the country were found in the Yukon (55.4%), British Columbia (53.7%), and Alberta (53.4%). The lowest rates were in Nunavut (40.5%) and New Brunswick (42.7%) (Figure 9-19 below).

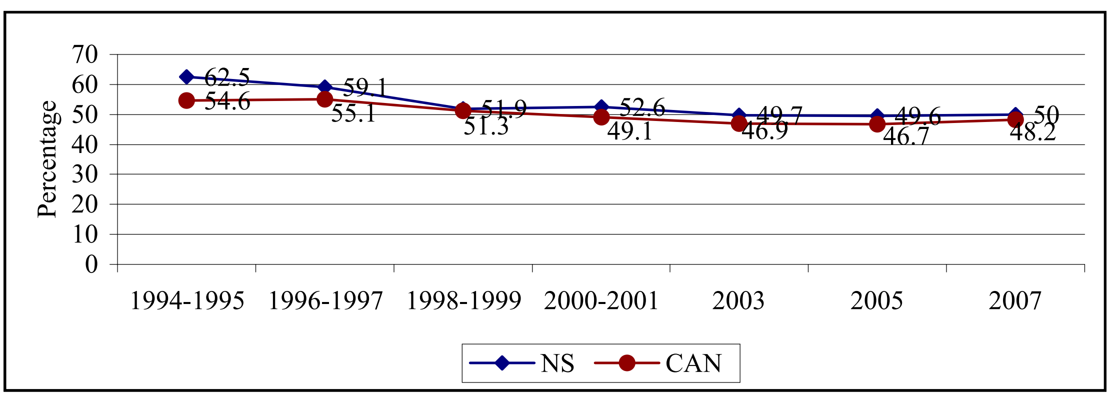
Figure 9-19. Leisure time physical activity, physically active or moderately active, population aged 12 and older (both sexes) (%), Canada, provinces, and territories, 2007



Source: Statistics Canada. Canadian Community Health Survey, 2007.

Between 1994–95 and 2007, there was a decrease in the percentages of Canadians and Nova Scotians who were physically inactive—from 54.6% to 48.2% in Canada and from 62.5% to 50% in Nova Scotia—reflecting a 6.4 percentage point improvement in Canada, and a 12.5 percentage point improvement in Nova Scotia. Despite this positive trend, it is noteworthy that all the gains happened between 1994–95 and 2003, with the improvement stalling since that time and no further gains recorded either nationwide or in Nova Scotia since 2003 (Figure 9-20 below). As about half of Canadians and Nova Scotians still remain sedentary (or "physically inactive"), there is clearly no room for complacency in this field in light of the serious proven health consequences of inactivity.

Figure 9-20. Leisure time physical activity, percentage reporting physical inactivity, Canada and Nova Scotia, 1994–1995 to 2007



Source: Statistics Canada. National Population Health Survey, 1994–95, 1996–97, and 1998–99. Canadian Community Health Survey, 2000–01, 2003, 2005, and 2007.

When the 2005 CCHS data are analysed by Health Region, we find the highest rates of physical inactivity in the Province in Zone 4—Pictou-Antigonish-Guysborough (55.2%) followed by Zone 1—south and southwest Nova Scotia (54.1%), and Zone 3—Cumberland-Colchester-East Hants (53.8%). The lowest rates of physical inactivity were found in Zone 6—Halifax (46.2%), Zone 2—Annapolis Valley (47.7%), and Zone 5—Cape Breton (49.5%). (Table 9-8 below).

Table 9-8. Leisure time physical activity, % reporting physical inactivity, Nova Scotia Health Regions, 2000–2001 to 2005

	2000-2001 (%)			2003 (%)			2005 (%)		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
Zone 1	59.4	52.6	65.9	54.4	52.6	56.1	54.1	53.7	54.5
Zone 2	48.8	43.9	53.3	48.7	45.2	52.0	47.7	43.0	52.0
Zone 3	54.3	52.9	55.5	50.0	47.1	52.7	53.8	52.3	55.3
Zone 4	51.4	46.9	55.8	53.7	52.8	54.5	55.2	51.9	58.4
Zone 5	54.5	51.4	57.3	49.1	38.9	58.4	49.5	47.2	51.5
Zone 6	50.3	45.9	54.4	47.5	42.9	51.9	46.2	44.4	47.8

Source: Statistics Canada. Canadian Community Health Surveys, 2000–01, 2003, and 2005.

9.7. Health costs

Since GPI Atlantic's initial work on the costs of chronic disease, tobacco, obesity, and physical inactivity in Nova Scotia in 1999–2002, a number of new developments have occurred. These include new definitions for obesity and physical inactivity, expanded risk factor / disease associations based on new epidemiological evidence, new directly measured obesity data from the Canadian Community Health Survey (CCHS), new Environmental Burden of Illness in Canada (EBIC) costing data, and new directly measured data for children and youth. As well, significant policy shifts—including the creation of a new provincial Department of Health Promotion and Protection under its own Minister, and a new comprehensive tobacco control strategy that includes sharply increased tobacco taxes and smoke-free places legislation—have helped sharply reduce smoking rates for example and will significantly impact costing projections.

Updating these chronic disease and risk factor cost estimates would be a major undertaking and involve quite challenging and complex new costing studies using the newly available data and methodologies, and accounting for changes in trends and the impact and cost implications of new policy developments. Therefore, with the exception of tobacco cost estimates, which GPI Atlantic did update in 2007 for the Canadian Cancer Society, GPI Atlantic is not able to undertake a comprehensive update of the overall chronic disease and other risk factor cost estimates at this time, and for this summary report has simply updated those original cost estimates to 2007 dollars.

However, GPI Atlantic is continuing its cost of illness research in several areas, with a major new study on the Cost of Obesity in Alberta (forthcoming 2009) currently under way, a study on the Cost of Tobacco in Saskatchewan just beginning (also scheduled for release in 2009), and the possibility of an update of GPI Atlantic's original Cost of Physical Inactivity in Nova Scotia currently under consideration. To illustrate the challenges and complexities involved—and thus the reasons a comprehensive update of chronic disease and risk factor cost estimates was not possible for this present report—a few specific examples of new developments in the field are provided here for illustrative purposes. These examples are drawn largely from GPI Atlantic's current cost of obesity research (to be released in 2009):

- *New epidemiological literature*—The knowledge base in the areas of obesity and physical inactivity, in particular, has expanded tremendously since GPI Atlantic's original reports on both risk factors. Indeed, the vast majority of obesity and physical inactivity research in general—and costing work in particular—has all happened in the last few years since GPI Atlantic's original reports on the subjects were released. Unlike tobacco research that has a much longer history, these two risk factors were not studied nearly as extensively over such a long period (several decades), and the scientific understanding of their importance as health risk factors and of their actual economic costs is much more recent.

  Since 2000, obesity awareness has increased among both researchers and the general public. For example, there has been a substantial increase in new obesity-related literature—particularly in the field of epidemiology, investigating the association between obesity and various illnesses, and accounting for potential confounding factors. A search for obesity-related evidence in only one database, Medline, showed that during the 1970s, 10,197 obesity-related articles were indexed in Medline, and during the 1980s, 11,800 were indexed. During the 1990s, the number rose to 17,754, and between 2000 and 2008 alone—just since the publication of GPI Atlantic's original Cost of Obesity study—42,913 articles were published, reflecting a remarkable increase of more than 260% from two decades earlier. Other databases and literature searches reveal similar increases, all pointing to a massive, and very recent, expansion of the knowledge base in this important area.

  Proper costing updates for obesity and physical inactivity will require careful study of the new epidemiological literature, which provides new information on the relation between these two risk factors and particular health and illness outcomes. That, in turn, will require adjustments in the relative risk factors associated with particular diseases based on the most reliable evidence now available in meta-analyses of the epidemiological literature, and the addition of new illness categories now reliably associated with obesity and physical inactivity on which insufficient epidemiological evidence was available a decade ago to include in GPI Atlantic's original cost estimates.

  In addition the new cost updates will need to take into account new definitions, new data sources, and new methodologies, plus the new understanding that now exists of some of the problematic issues involved in using earlier, less refined costing methodologies. In short, cost of illness studies constitute a relatively new field, in which the most significant advances have been made in recent years—again since the time of GPI Atlantic's original studies. A few specific examples follow.

- *New definitions*—New definitions of physical inactivity and obesity have produced very different prevalence rates that are not comparable to those used in GPI Atlantic's original costing studies. At the time of GPI Atlantic's original cost of physical inactivity study, the Canadian Fitness and Lifestyle Research Institute (CFLRI) rates for physical inactivity—which had consistent annual trend data available—were used to define physical activity and inactivity. Those CFLRI rates and definitions were also used by Katzmarzyck et al. in the first systematic cost of physical inactivity study undertaken for Canada, published in 2000 in the *Canadian Medical Association Journal,* which served as the model for GPI Atlantic's study of physical inactivity costs for Nova Scotia.[101]

  However, the CFLRI definition of "physically active" was different from the definition—now more universally accepted—adopted in Statistics Canada's subsequent Canadian Community Health Surveys (CCHS), which were first administered in 2000–01. The CCHS now has results available biennially to 2007, with data comparable to earlier National Population Health Survey (NPHS) results, thus allowing for consistent 1994/95–2007 time series on physical activity and inactivity for Canada and the provinces (see previous section above).

  Specifically, in the definition now used by Statistics Canada, Canadians are considered physically inactive or "sedentary" if they report a usual daily leisure-time energy expenditure amounting to less than 1.5 kilocalories per kilogram of body weight per day (kcal/kg/day). Individuals are defined as moderately active if they expend 1.5-2.9 kcal/kg/day, and as "active" if they expend 3.0 or more kcal/kg/day. Calculations are made based on individuals' reporting of the frequency and duration of different types of physical activity, using independently established values for the energy demands of each activity. In that analysis, "regular" physical activity (at the levels indicated) is defined as at least 15 minutes of leisure time physical activity 12 or more times per month. The CCHS/NPHS results apply to Canadians 12 and older.

  By contrast, the CFLRI definitions of physical activity and inactivity used in the original *CMAJ* and GPI Atlantic cost of physical inactivity studies were more rigorous, and thus produced higher rates of physical inactivity and lower rates of physical activity. As well, the CFLRI Physical Activity Monitor surveys, on which the *CMAJ* and GPI trends and cost estimates were based, were administered to Canadians 18 and older, thus again producing different results than in CCHS surveys administered to Canadians 12 and older. Specifically, The CFLRI rated Canadians according to whether their physical activity levels were sufficient for "optimal health benefits." Physical inactivity, according to this measure, was defined as less than 12.6 kilojoules (kJ)/kg of body weight per day of physical activity—the minimum judged necessary to obtain health benefits from physical activity.[102] The CFLRI results apply to Canadians 18 and older. A key advantage of using the CFLRI data at the time was the availability of a consistent national time series dating back to the first Canada Fitness Survey conducted in 1981.

Aside from these two sets of definitions, there was also a wide range of other definitions of physical activity and inactivity that were current at the time of GPI Atlantic's original Cost of Physical Inactivity study. For example, Health Canada's 1998 publication, *Canada's Physical Activity Guide to Healthy Active Living*, called for an hour of low-intensity activity every day, or 30–60 minutes of moderate-intensity activity, or 20–30 minutes of vigorous-intensity activity 4–7 days a week.[103] And estimates of physical activity rates were produced based on these criteria, indicating that only 34% of Canadians aged 25–55 at the time met Health Canada recommendations for adequate physical activity.[104]

In addition, other Statistics Canada survey evidence, reported in Statistics Canada's CANSIM database with trendlines available from 1985 to 1996, assessed physical activity levels according to whether respondents reported exercising three or more times weekly, once or twice weekly, less than once weekly, or never.[105]

Because there were so many different definitions of physical activity and inactivity at the time—compromising comparability both over time and among jurisdictions—an "international consensus group" was formed in 1998 to develop an internationally agreed upon set of measures of physical activity participation. At the time that GPI Atlantic produced its original Cost of Physical Inactivity study for Nova Scotia, this international consensus group had developed and pilot-tested a set of International Physical Activity Questionnaires (IPAQ), with Canada one of 12 countries participating in the validation and reliability phase of the project.[106]

The significant differences between the different definitions of physical activity and inactivity, and between CCHS/NPHS and CFLRI definitions in particular, will clearly produce markedly different prevalence rates, which in turn will substantially affect cost estimates for 'physical inactivity', depending on how it is defined. Using comparable years, for example, the 1996–97 CFLRI Physical Activity Monitor found that 66% of Canadians were not sufficiently active to reap the benefits of physical activity, while the NPHS data for those years reported a physical inactivity rate of 57% for Canadians.[107]

Definitional differences will produce significant differences in cost of physical inactivity estimates in two important ways. First, it will affect use of epidemiological evidence to assess relative risk ratios associating physical inactivity with particular diseases, since relative risk estimates will differ according to amounts of physical activity expended by study subjects. Second, as noted above, it will affect estimates of physical inactivity prevalence rates. Reliable and consistent relative risk ratios and prevalence rates for physical inactivity, in turn, are both the necessary basis for any cost estimates.

In short, a new cost of physical inactivity study for Nova Scotia would now use the CCHS/NPHS definition and data on prevalence rates that have now become more universally accepted, rather than the CFLRI definition and prevalence data used at the time both by the *CMAJ* and by GPI Atlantic. In order for the new estimates for Nova Scotia to be comparable to earlier ones—to assess the degree to which costs have increased or declined in response to changes in physical inactivity rates—GPI Atlantic would also have to re-figure its earlier estimates according to the CCHS/NPHS definitions, relative risk evidence, and prevalence rates.

Similar definitional changes have occurred with regard to obesity estimates. GPI Atlantic's previous cost of obesity studies, undertaken for eight provinces—as well as a seminal 1999 *CMAJ* study on the cost of obesity in Canada,[108] which again served as the template for the 1999–2001 GPI provincial studies—used a different definition of obesity than that subsequently adopted by Health Canada and Statistics Canada. The new guidelines, which describe a body weight classification system that can be used to identify health risks associated with body weight in individuals and populations, are in accord with World Health Organization (WHO) recommendations that were released in 2000 and have now been widely adopted internationally.[109]

Between 1988 and 2003, for adults aged 20 to 64, Health Canada considered a BMI of 20–24.9 as "acceptable weight", 25–26.9 as "some excess weight", and 27 or higher as "overweight".[110] There was no "obesity" classification in these official Canadian standards, which were also used as the basis for Statistics Canada reporting, though the original 1999 *CMAJ* national cost of obesity study classified Canadians with a BMI of 27 or more as being obese. As the basis for the *CMAJ* and subsequent GPI Atlantic cost estimates, epidemiological evidence on relative risks for particular disease categories were again assessed for those with a BMI of 27+.

In 2003, based on the new WHO guidelines and on new research on the relationship between BMI and risks of morbidity and mortality, Health Canada updated and changed its guidelines for body weight classifications for (non-pregnant or lactating) adults. In the process, it also changed the age classification for overweight and obesity estimates to 18 years and over from the earlier 20–64 age group categorization previously used for overweight and obesity prevalence estimates.[111]

The new Health Canada guidelines—now also used by Statistics Canada for reporting purposes—identify "underweight" as having a BMI of under 18.5, "normal weight" as having a BMI of 18.5 to 24.9, "overweight" as having a BMI of 25.0 to 29.9, and "obese" as having a BMI of 30 or greater. The new guidelines further divide "obese" into three levels: BMI 30.0 to 34.9 (obese-Class I); 35.0 to 39.9 (obese-Class II); 40 or greater (obese-Class III).[112] Relative risk ratios have been found to differ substantially according to these different categories, thus also allowing for much finer cost estimates than were previously possible, and for breakdowns of aggregate obesity cost estimates according to the proportion of total obesity costs attributable to different categories of obesity.

In addition—as part of the new guidelines—a level of abdominal fat measurement, which is rarely used in surveys or studies, was changed from a waist to hip ratio to a waist circumference measure. Altogether, the new classifications substantially affect both the relative risk ratios and the prevalence rates that are both the essential basis for any cost estimates.

- *New and more precise data*—New directly-measured obesity data that did not exist at the time of GPI Atlantic's original March 2000 Cost of Obesity in Nova Scotia study have now become available through the CCHS. Between 1995 and 2003, there were no health surveys conducted in Canada that directly measured Canadians' height and weight—the basis for calculating Body Mass Index (BMI). In 2004, the CCHS, Cycle 2.2, which focused on nutrition, became the next survey to directly measure the height and weight of respondents, and in 2005 the CCHS directly measured a small sub-sample of the 2004 survey for comparison purposes.[113]

  Evidence has shown that directly measured BMI data are considerably more accurate than self-reported data, which tend to be biased.[114] This bias is not always gender-specific, though it has been found that men tend to overestimate their height, while women more often tend to underestimate their weight—perhaps, as S. Connor Gorber et al. of Statistics Canada note, because of social desirability and the stigma that can be associated with obesity.[115] As well, it was found that overweight and obese individuals tend to misrepresent their height and weight more often than do those with normal weight.

  In general, therefore, self-reported data on height and weight tend to underestimate BMI, which in turn results in fewer people being classified as obese than is actually the case. In addition, the association found between obesity and morbidity tends to differ depending on the data collection method.[116]

  For example, in a recent study, Margot Shields et al. of Statistics Canada found that the prevalence of obesity in Canada in 2005 was 22.6% when based on measured data, and 15.2% when based on self-reported data from the same individuals—a very substantial difference of 7.4 percentage points.[117] For males the obesity rate was 8.8 percentage points higher based on measured data (24.2% vs. 15.4%), and for females it was 6 percentage points higher (21.0% vs. 15.0%). The directly measured data showed significantly higher obesity rates for all age groups, with the 65 and older age group showing the greatest disparity—with the difference 15 points higher for men aged ≥65 (31% vs. 16%), and 13 points higher for women aged ≥65 (28% vs. 15%).

  These substantial differences are much more important in costing studies that depend upon accurate estimates on the relative risks of disease associated with particular BMI levels and on obesity prevalence at a particular point in time, than in assessing relative trends over time that are more concerned to assess whether rates are increasing or declining. Such trend estimates, which are only really possible in Canada and the provinces using the consistent self-reported NPHS/CCHS data collected biennially from 1994/95 to 2007, may reasonably assume that the BMI under-reporting bias has remained relatively consistent over time and will therefore not substantially affect trend reporting. Even that assumption, however, must be qualified by the evidence on the magnitude of disparity by age group noted in the previous paragraph, which indicates that BMI underestimates may become progressively greater as the population ages, since older people are more likely to overestimate their height based on the height they once had.

Certainly, Statistics Canada's new evidence on the magnitude of disparity between measured and self-reported BMI results indicates that the self-reported BMI results—used as the basis for the original 1999–2000 *CMAJ* and GPI obesity cost estimates based on data availability at the time—were significant underestimates that in turn underestimated associated economic costs.

In addition, the original obesity cost studies used 1998 EBIC costing data from Health Canada. Although not yet published, the Public Health Agency of Canada (PHAC) now has updated EBIC costing data for 2000. In sum, future updates for the cost of obesity in Nova Scotia should use both the new EBIC data as well as measured rather than self-reported BMI prevalence rates.

In response to the need for more accurate data, Statistics Canada, Health Canada, and the Public Health Agency of Canada (PHAC), have developed a new survey—the Canadian Health Measures Survey—that directly measures physical health, including BMI, blood pressure, heart rate, lung functioning, and cardiovascular fitness, among other factors.[118] Data collection is currently taking place between 2007 and 2009, and will sample approximately 5,000 Canadians aged 6–79 years. When the results are released in 2010, they should provide important new data concerning the health of Canadians, which in turn will allow far more accurate assessments of illness and risk factor costs than has hitherto been possible.

- *More advanced and precise methodologies*—As a result of important new work by the Centers for Disease Control and Prevention in the U.S., and by Beverly Rockhill and associates—who found that previous epidemiological and costing studies frequently had significant computation errors—new methodological understanding has been developed in the last few years.[119, 120]

Specifically, Rockhill et al. found that one of the most common errors has been the use in the epidemiological and costing literature of *adjusted* relative risk ratios in association with the wrong formula to estimate population attributable fractions for the proportions of particular chronic diseases attributable to obesity, physical inactivity, tobacco and other risks. That commonly used formula—also used in the *CMAJ* cost of obesity and physical inactivity studies and in the GPI Atlantic cost studies—is as follows: The population attributable fraction (PAF) for each disease is calculated as [P(RR – 1] / [1 + P(RR – 1)], where P is the prevalence of the risk factor (obesity, smoking, physical inactivity, etc.) in the population, and RR is the relative risk for the disease in an obese, smoking, or inactive person.

Rockhill and her associates argued that either a formula other than the one commonly used should be utilized in association with adjusted relative risk ratios, or that the relative risk ratios used with the common formula should *not* be adjusted for confounding factors since this method removes part of the population from the estimate. Rockhill et al. note: "The magnitude of bias resulting from this error will depend on the degree of confounding."[121]

Since the vast majority of epidemiological studies do report adjusted and summarized (rather than unadjusted) relative risk (RR) ratios, it will be very challenging to obtain unadjusted RR results for use in the common PAF formula without consulting the study authors and going back to original unadjusted data sets that are rarely provided in the peer-reviewed epidemiological and medical journals in which the study results were published. Despite these challenges, this new methodological understanding requires that future updates of Nova Scotia costing studies for any risk factor, including obesity, tobacco, and physical inactivity, should, to the extent possible, use unadjusted RRs.

Eventually, a full update of the costs of chronic disease in Nova Scotia and of a range of risk factors, should be undertaken using these new accepted definitions, new data sources, new methods, and new knowledge and understanding—all of which have become available in the last ten years, mostly since the original GPI cost studies were undertaken. However, since a costing study using new definitions, data, and methods is a major undertaking and project in its own right, time and resources did not permit GPI Atlantic to do so for this summary report. Therefore, as noted, this chapter only updates the original GPI cost estimates for Nova Scotia to 2007 constant dollars, so that the results presented below should by no means be taken as definitive estimates.

In order to move the costing work forward on all fronts, GPI Atlantic's current research on the cost of obesity in Alberta, undertaken for the Alberta Cancer Board, does attempt to use the new definitions, data sources, methods, and knowledge—including use of the new EBIC data (kindly provided to GPI Atlantic by PHAC prior to publication), use of the 2004 measured BMI data rather than self-reported data, and calculation of new unadjusted RR ratios based directly on CCHS data. This major year-long study, to be released in 2009, can potentially serve as useful template for future Nova Scotia costing studies.

9.7.1. Cost of tobacco use

Smoking is the leading preventable cause of sickness and premature death in Canada and in Nova Scotia. Worldwide, tobacco presently kills one in ten adults, and by 2030 the World Bank estimates that it will kill one in 6, or 10 million people a year—more than any other single cause of death.[122] Health Canada reports that 21% of all deaths in Canada are attributable to smoking—amounting to 45,000 preventable deaths a year.[123] Smoking and exposure to Environmental Tobacco Smoke (ETS) kill approximately 1,748 Nova Scotians every year, also accounting for 21% of all deaths in the province.

Ninety per cent of lung cancers are attributable to smoking, and tobacco is also a significant risk factor for a wide range of other cancers, for coronary heart disease, for respiratory illnesses, and for a range of other ailments.[124] In fact, tobacco is the only product sold legally that causes sickness and death when used exactly as intended.

The economic costs of tobacco use include direct hospital, physician, and drug expenditures on smoking-attributable illnesses; the cost of fires unintentionally started by cigarettes; and indirect costs such as productivity losses to the economy due to premature mortality, disability, excess sickness, absenteeism, and unauthorized smoke breaks. Tobacco use therefore adds a significant cost burden to the Nova Scotian economy, costing $171.3 million annually in direct health care costs and more than $500 million more in indirect costs resulting from productivity losses due to long and short-term disability and premature mortality.

In addition, based on Conference Board of Canada estimates, it costs Nova Scotian employers more than $250 million more each year to employ smokers instead of non-smokers, due largely to on-the-job productivity losses incurred in unauthorized smoke breaks. When additional costs such as prevention and research costs and losses due to fires are added, smoking cost the Nova Scotian economy an estimated $943.8 million in 2006, or about $1,000 for every person in the province. Some $538 million, or 57% of the total cost of tobacco use in Nova Scotia, is paid for by society at large, indicating that tobacco taxes paid by smokers cover only a fraction of the full costs of smoking.[125]

The overall rates of smoking in Nova Scotia fell from 29% in 1999 to 22% in 2006—representing a 24% decline in the number of smokers. Rates of tobacco use among young adults fell from 37% in 1999 to 33% in 2006. Most encouragingly, tobacco use among Nova Scotian teenagers aged 15 to 19 declined dramatically from 30% in 1999 to just 15% in 2006—the sharpest drop in teenage smoking in the country. In the longer term, this bodes very well for health improvements and declines in premature mortality in the province, and for future reductions in the cost burden of smoking.

The continued high costs of tobacco use in Nova Scotia—even higher in 2006 than at the time of GPI Atlantic's first Cost of Tobacco report in 2000 when smoking rates were significantly higher—reflect high smoking rates in the past that are now manifesting in high health care costs and premature death. Since smoking is the leading preventable cause of illness and death both in Canada and Nova Scotia, and since smoking-related illnesses like lung cancer, heart disease, and chronic obstructive pulmonary disorders generally only manifest many years later, the recent sharp decline in smoking prevalence in the province will produce significant cost reductions in the future.

In sum, the evidence quite clearly shows that investments in tobacco use prevention and reduction will produce a very substantial rate of return and long-term benefits to Nova Scotians in lives saved, better long-term health outcomes, and significant cost savings. Reducing Nova Scotia's smoking rate by a further 36% from 2006 levels (to reach the 14% rate achieved in California) is estimated to save Nova Scotians about $109 per capita, or a total of $101.8 million per year, above and beyond the savings that will be realized through the tobacco use reductions of recent years. For details on results and calculation methods, please see GPI Atlantic's 2007 Cost of Tobacco in Nova Scotia report, which updates the original 2000 study.

9.7.2. Cost of obesity

Obesity is the second most preventable and costly cause of illness and premature death after smoking, and has been linked to a wide range of chronic diseases including type 2 diabetes, heart disease, hypertension, and gallbladder disease. Rates of overweight and obesity have more than doubled in Nova Scotia, in Canada, and globally in the last two decades.[126] GPI Atlantic estimates that obesity costs Nova Scotia $148 million ($2007) a year in direct health care costs—or roughly 5% of the total health budget,[127] and an additional $173 million ($2007) a year in indirect productivity losses, for a total cost of more than $320 million.[128]

As noted above, GPI Atlantic is currently engaged in a major year-long study on obesity costs that is designed to improve the accuracy of obesity cost estimates substantially through use of new data sources and costing methodologies.

9.7.3. Cost of physical inactivity

Physical activity has proven benefits in preventing disease, improving health, and promoting independence and quality of life in old age.[129] The most substantial body of evidence for achieving healthy active aging relates to the beneficial effects of *regular* exercise.[130] Physical activity has been called "the most obvious of variables which might reduce overall lifetime morbidity" and the "cornerstone" of any strategy aimed at prolonging disability-free life expectancy.[131] The evidence indicates that regular physical activity also protects against obesity and assists weight control; fosters development of healthy muscles, bones and joints; increases strength and endurance; improves behavioural development in children and adolescents; and helps maintain function and preserve independence in older adults.

Studies have found that physically active adults have lower rates of lifetime illness than those who are inactive, and are more likely to remain independent into old age. Because regular exercisers have much less overall lifetime morbidity than those who are sedentary, medical costs avoided due to physical activity are not simply deferred to older ages.[132] Abundant evidence shows that physical activity protects against heart disease, stroke, hypertension, type 2 diabetes, colon cancer, breast cancer, osteoporosis, obesity, depression, anxiety, and stress.[133] Conversely, abundant epidemiological evidence shows that physical inactivity is linked to a wide range of chronic illnesses, including diabetes 2, heart disease, hypertension, and colon cancer.

GPI Atlantic estimates that physical inactivity costs Nova Scotia $122 million ($2007) a year in direct health care costs. Of this, $14.2 million is estimated to consist of mental health care costs attributed to physical inactivity, based on epidemiological evidence linking physical inactivity to higher rates of depression, anxiety, and stress. Estimates of indirect productivity losses due to premature mortality and disability for the seven diseases reliably related to physical inactivity in the epidemiological literature, is an additional $274 million ($2007) annually.[134] In other words, the Nova Scotia economy would be worth $274 million more each year than it currently is if it had the benefit of the productive services of the hundreds of Nova Scotians disabled or killed prematurely by a sedentary lifestyle.[135]

When direct medical costs and economic productivity losses are combined, the total economic burden of physical inactivity in Nova Scotia is estimated to exceed $395 million ($2007) annually. Again, as noted, updates of these costs should take into account the new epidemiological evidence, definitions, data sources, and costing methodologies referenced above.

9.7.4. Cost of chronic disease

The disability, pain, and discomfort of chronic diseases can severely compromise wellbeing and quality of life over long periods of time. It has been estimated that 40% of chronic disease incidence is attributable to socio-economic, behavioural, and lifestyle factors, and is therefore preventable. Epidemiological studies indicate that 25% of all medical costs are attributable to a small number of excess risk factors like smoking, obesity, physical inactivity, and poor nutrition.[136]

GPI Atlantic estimates that seven categories of chronic disease cost Nova Scotia roughly $3.4 billion in direct health care costs and indirect productivity losses in 2007—$1.4 billion in direct health costs and more than $2 billion in indirect costs including lost productivity due to premature death and disability (Table 9-9 below).

Table 9-9. Cost of chronic disease in Nova Scotia ($2007 million), 2007[137]

	HOSP	DOC	DRUGS	OTHER	TOTAL DIRECT	PRE-MATURE DEATH	DIS-ABILITY	TOTAL
Circulatory	183.4	30.2	72.2	156.4	442.2	371.0	277.4	1,090.6
Cancer	81.1	13.4	8.5	56.3	159.3	484.9	16.5	660.7
Respiratory	24.5	3.6	18.8	25.8	72.7	49.3	88.7	210.7
Musculo-skeletal	63.5	23.0	25.0	61.1	172.6	4.0	348.7	525.3
Endocrine	21.0	8.2	33.3	34.2	96.7	49.7	30.7	177.1
Nervous	62.8	31.7	21.8	63.6	179.9	34.1	180.0	394.0
Mental	118.3	20.1	44.5	100.1	283.0	18.2	82.1	383.3
TOTAL:	554.6	130.2	224.1	497.5	1,406.4	1,011.2	1,024.1	3,441.7

Source: Cost estimates are based on Health Canada, The Economic Burden of Illness in Canada, 1998, with adjustments as described in GPI Atlantic's 2002 *The Cost of Chronic Disease in Nova Scotia.*

Note: Cost estimates are from the original GPI report *The Cost of Chronic Disease in Nova Scotia,* based on 1998 data, and have been updated here to 2007 constant dollars using the Consumer Price Index (CPI). For that reason, they are described in the table caption as 2007 chronic disease costs, even though direct cost estimates for 2007 have not been made for this summary update.

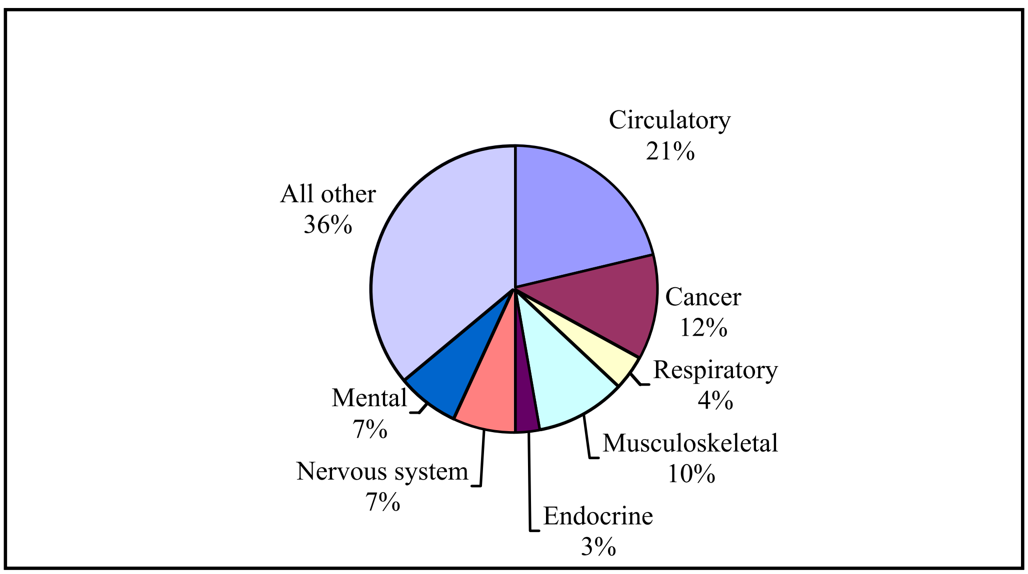
A Dalhousie University study by Kephart et al. estimated excess physician costs attributable to educational inequality at 17.4% of total physician expenditures, or $42.2 million per year out of a total of $242.4 million ($2001) spent on physician services in Nova Scotia. Excess physician use associated with income inequality was estimated at 11.3% of all physician costs, or $27.5 million annually. In other words, these are amounts that would be saved in avoided physician services if all Nova Scotians were as healthy as those with university degrees and higher incomes.[138]

In short, in addition to potential improvements in health and wellbeing, there is also an economic case for investments in health promotion that reduce the incidence of chronic disease. In addition to reducing taxpayer-funded health care costs, health promotion efforts can also improve labour productivity by reducing the incidence of premature death, disability, and sick days among employees. Such health promotion efforts must begin with a clear profile of the most prevalent chronic diseases in any province or community and their associated costs—which is the purpose of the chronic disease cost exercise.

In that regard, it is noteworthy that different kinds of chronic disease have very different cost distributions. Cardiovascular diseases and mental illnesses account for the highest direct health care costs in Nova Scotia (particularly hospital and drug costs), cancer produces the highest losses in premature death, and musculoskeletal disorders account for the highest disability costs in the province.

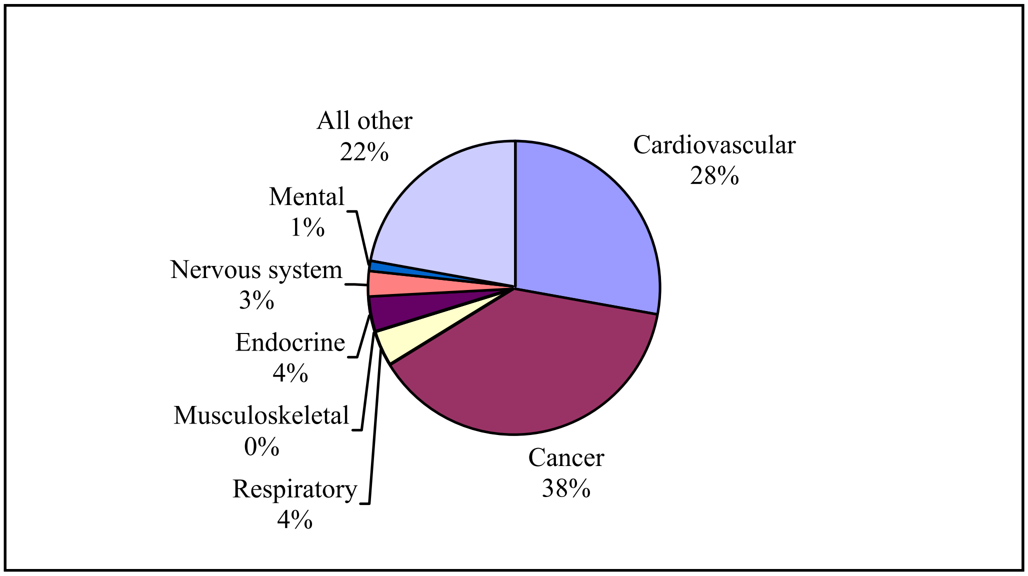
The seven categories of chronic disease considered here account for 78% of all productivity losses due to premature death in Nova Scotia, and 76% of all disability costs (see Figures 9-21, 9-22, and 9-23 below).

Figure 9-21. Distribution of illness costs in Nova Scotia, 1998



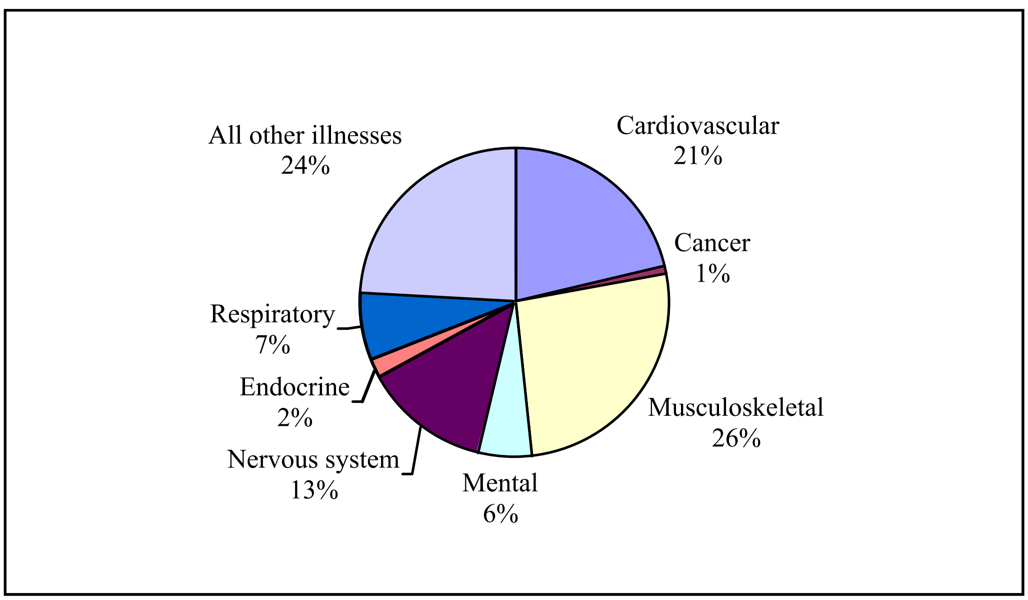
Source: Derived from Health Canada. Economic Burden of Illness in Canada, 1998.

Figure 9-22. Costs of premature death in Nova Scotia, by illness, 1998



Source: Derived from Health Canada. Economic Burden of Illness in Canada, 1998.

Figure 9-23. Costs of disability in Nova Scotia, by illness, 1998



Source: Derived from Health Canada. Economic Burden of Illness in Canada, 1998.

10. Safety and Security

For the original GPI Atlantic report on safety and security, please see the following:

The Cost of Crime in Nova Scotia (1999)
http://gpiatlantic.org/pdf/crime/crime.pdf

Headline Indicators

1. Total crime rates and rates of violent crime, homicide, and property crime
2. Perceptions of personal safety from crime
3. Rate of police-reported spousal violence
4. Economic costs of crime in Nova Scotia

10.1. Introduction

A peaceful, harmonious, and secure society is an important social asset and makes a vital contribution to our quality of life. Public opinion surveys, nationally and internationally, consistently report that physical security is a top priority for citizens.[1] In addition, the Canadian Institute for Health Information (CIHI) and Statistics Canada both acknowledge that physical safety and security are key non-medical determinants of health, and Statistics Canada now regularly reports crime rates among its health indicators.

In our conventional economic accounts, however, most crime costs are perversely counted as contributions to economic prosperity and wellbeing. The higher the crime rate, the more we spend on prisons, police, criminal trials, burglar alarms and security systems; the more we spend, the more our economy grows; therefore, crime costs are conventionally interpreted as a sign of progress.

By contrast, the GPI counts crime as a liability rather than an asset, and its costs as an economic loss rather than a gain. Lower crime rates are seen as a sign of progress and reduced crime costs are seen as savings that can be invested in more productive activities that build communities and enhance wellbeing.

As well, it is now widely recognized that safety and security are themselves outcomes of a wide range of social and economic conditions and circumstances, and are linked to income, employment, social supports, and other key variables. For example, regression analyses conducted by the Canadian Centre for Justice Statistics (CCJS) demonstrate a strong statistical link between crime and unemployment.[2] A CCJS survey of inmates in Nova Scotia prisons found that more than two-thirds of inmates were unemployed at the time of admission to the correctional facility.[3]

A recent Statistics Canada study that examined the characteristics and distribution of crime in three Canadian cities—Edmonton, Halifax, and Thunder Bay—found that crime appears to be higher in neighbourhoods whose residents have more limited access to socio-economic resources, and that "high-crime neighbourhoods are characterized by a population that is more disadvantaged in economic terms (higher unemployment rate[4] and proportion of low income and government transfers, and lower incomes), and they have a smaller proportion of highly educated people."[5] The study also found that a larger proportion of residents in high-crime neighbourhoods spend more than 30% of their income on shelter, do not own their homes, and live in neighbourhoods characterized by older dwellings or dwellings in need of major repairs.

From this perspective, money spent on crime prevention—decreasing poverty, income inequality, social exclusion, and unemployment, for instance—should be seen as investments in a peaceful and more secure society, rather than as a cost.

From the GPI full-cost accounting perspective, measuring the costs of crime also raises the very practical question of how much we have to spend as citizens for an acceptable level of security. If we need to spend less to maintain the same level of security, then our quality of life may be considered to have improved, and our standard of living to have increased in direct proportion to the drop in intermediate expenditures. If the cost of maintaining the same level of security goes up, our quality of life may be considered to be eroding and our standard of living to be declining.

By failing to identify and measure economic costs, and by misleadingly counting them as gains (as occurs when we mistakenly use GDP-based measures to assess progress and wellbeing), we lose sight of both the value and the potential deterioration of our social assets. That, in turn, can lead to serious policy failures when we fail to take action to remedy trends that undermine our quality of life and standard of living. No blame attaches to this failure because our economic accounting system has been sending misleading messages to policy makers and the general public alike. We have all been trapped in the materialist illusion that more output and spending necessarily produce greater wellbeing.

Conversely, the measurement and valuation of non-material human, social, and environmental assets not only draws attention to the true sources of genuine prosperity, but can allow us to focus clearly and unambiguously on the legacy we are leaving our children and on the society we want to create and inhabit in the future. Such a society clearly includes high levels of physical safety, security, and peace. Trends in crime rates and perceptions of crime and safety are among the most well accepted measures of such societal peace and security.

10.2. Crime rates

In Canada, there are two primary sources of statistical information on crime: police-reported surveys and victimization surveys. The police-reported survey used extensively in this update is the Uniform Crime Reporting Survey (UCR), and its results are referred to as the "official" crime statistics. The tables, charts, and ratios in this update are based almost entirely on these official statistics released by Statistics Canada, and the economic losses over time in the last section of this update are deduced from these official crime rates.

However, it is important to note that these official numbers only capture crimes that have been reported to the police. In 1996, the Solicitor-General of Canada found that 48% of victims failed to report crimes to police.[6] Statistics Canada's 2004 General Social Survey (GSS) on victimization found that 64% of crimes in that year were unreported.[7] Victimization surveys have found that sexual assaults are by far the least commonly reported crimes (only 8%) followed by assaults (39%), while property crimes such as break and enter and car theft are more commonly reported (54% and 49%, respectively), partly for insurance reasons.[8] It is also noteworthy, according to victimization surveys, that over half of unreported violent incidents do not come to the attention of police because the victim felt the incident was not important enough, "suggesting the crime may have been too minor to warrant police involvement."[9]

The evidence indicates that there has been a considerable change over time in reporting rates for particular categories of crime. In 1999, GPI Atlantic reported that a comparison of the ratio of reported crimes in the UCR statistics to the number of crimes reported in victim surveys conducted as part of Statistics Canada's 1988 and 1993 GSS found that reporting rates had gone up between these two surveys.

This indicates that increases in the official crime rate may not actually reflect higher levels of crime. Thus, GPI Atlantic reported that, between 1988 and 1993, victimization rates actually declined for personal theft, robbery, and assault according to the GSS victim surveys, while reported crimes in each of these categories increased during the same period.

This discrepancy in reporting rates versus the results of victimization surveys was particularly problematic in determining how to interpret the dramatic increase in reported crime between 1962 and 1997—the time period examined in the 1999 GPI Atlantic cost of crime study. At that time, based on official crime rates, it appeared that Nova Scotians were four times as likely to be victims of crime in 1997 as they were 35 years earlier, and 4.5 times as likely to be victims of violent crime. But a substantial portion of this increase appeared due to significantly higher reporting rates for common assaults in the mid-1990s compared to the 1960s and 1970s. Therefore, GPI Atlantic raised the possibility that the official statistics may be misleading.

To test the degree of likely distortion against actual rates of increase in crime, GPI Atlantic examined three categories of crime in which reporting rates were not likely to have changed substantially over a long period. These are homicides, which are always reported; robbery, where limited data from victimization surveys do not provide evidence of major changes in reporting rates over time; and motor vehicle theft, where reporting is required for theft insurance claims and is, therefore, likely to remain at a fairly constant rate over time.

Based on this analysis and other evidence from victimization surveys, GPI Atlantic concluded that crime rates had still substantially increased overall since 1962 but not at the rate suggested by the official crime statistics. While the official crime statistics suggested a four-fold increase in crime in Nova Scotia from 1962 to 1997, the real increase—adjusting for changes in reporting rates—was more likely to be three-fold.[10]

In addition, it should be noted that, while higher crime rates may signify the erosion of a social asset, higher reporting rates may actually indicate a more civil society. Thus, increased reporting might signify that violent crime that was once socially "acceptable" is no longer accepted. This is particularly true of crimes like spousal and child abuse, other forms of domestic violence, and sexual assault, as well as drunken driving, where reporting rates in all these cases appear to have increased substantially. In these cases, higher reporting rates can be taken as signifying a reduced social tolerance for these behaviours, and the existence of higher social standards for civil behaviour.[11]

Thus, there are three major qualifications that must be borne in mind while relating the data presented in this update with the cost estimates that follow. *First*, it is possible, as dictatorships have demonstrated, to lower crime rates through police-state measures and draconian punishments. In such a case, crime rates would fall even as costs rise.

It is assumed for the purposes of this update that respect for civil liberties and basic safeguards of human freedoms have remained and continue to remain constant over time, and that this precludes any diminution of human rights for the sake of fighting crime. In other words, we assume here that the principle of "proportionality"—that the sentence matches the seriousness of the crime—is maintained, and that principles of due process are not curtailed.

Without these assumptions, it is possible that crime rates and crime costs could move in opposite directions. There is evidence that this is, in fact, occurring in the United States, where lower crime rates in recent years are matched by higher rates of incarceration. Thus, a 2008 Pew Center study noted:

> For the first time in history more than one in every 100 adults in America are in jail or prison—a fact that significantly impacts state budgets without delivering a clear return on public safety . . . . Last year alone, states spent more than $49 billion on corrections, up from $11 billion 20 years before. However, the national recidivism rate remains virtually unchanged, with about half of released inmates returning to jail or prison within three years . . . . [W]hile one in 30 men between the ages of 20 and 34 is behind bars, the figure is one in nine for black males in that age group.[12]

Here we advance the hypothesis, which remains to be tested, that a growing gap between crime rates and crime costs may indicate movement towards a more repressive society.

Second, a fear of crime may raise costs through increased defensive expenditures, even though this fear may not be directly proportional to actual trends in crime rates. This may occur in several ways. For example, if the amount of criminal activity remains constant while population increases, particularly in urban areas, then the crime *rate* (measured as incidents per 100,000 population) will go down even though the public does not perceive the decrease.

This may also occur if there is a time lag. Crime rates in Canada rose rapidly through the 1970s and 1980s and then began to drop in the 1990s. However, public perceptions, fears, and defensive expenditures in 2008 may still be responding more vividly to the trends of the previous two decades than to current trends.

Third, official crime rates are dependent on public reporting rates, the discretion and capacity of police officers to respond to complaints, and changes in the social and political climate.[13] All three elements have varied over time, particularly in sensitive areas like domestic violence, sexual assault, and child abuse. As previously mentioned, the 2004 GSS found that Canadians report just over one-third of all criminal incidents.

Certainly, official crime rates *understate* the actual incidence of crime, and, because of increased reporting rates for certain categories of crime over time, they also *overstate* the rate of increase in crime. In other words, the official statistics cannot be taken entirely literally as representations either of the actual rates of victimization or of trends in crime rates over time.

Victim surveys have the advantage of accounting for both reported and unreported crimes. Statistics Canada's GSS collected data on victimization in Canada and the provinces in 1988, 1993, 1999, and 2004. However, there is insufficient information to estimate with any precision the percentage of the dramatic increase in official crime rates since 1962 that is attributable to higher reporting rates.

The most important qualification to the data presented in this section, therefore, is that they reflect only police-reported crime rates, unless otherwise stated. While the chance of being a crime victim in Canada in 2004, according to these official rates, was one in 11, surveys reveal that fully one in four Canadians was actually victimized in 2004, and that only 34%—down from 37% in 1999—of criminal acts are actually reported to police.[14]

The emphasis on police-reported crime rates produces significantly more conservative results than would the use of self-reported victimization surveys. This update, therefore, examines the extent to which crime *officially* impacts Nova Scotia. The real extent and impact of crime is clearly much greater, though there is evidence that the gap between reported and unreported crimes is narrowing.

10.2.1. Total criminal code violations

Data source: Statistics Canada, Canadian Centre for Justice Statistics: Uniform Crime Reporting Survey (UCR).

Result: Since 1997, there has been a decline in the official crime rate in both Canada (by 18%) and Nova Scotia (by 12%), where the chances of being of victim of crime declined from one in eleven in 1997 to one in 13 in 2007. However, the overall crime rate in Nova Scotia now exceeds the national average and remains considerably higher than 30 to 40 years ago.

The official crime rate is the number of criminal code violations reported to police per 100,000 population. Criminal code violations include violent crimes, property crimes, drug offences, and "other" crimes.[15]

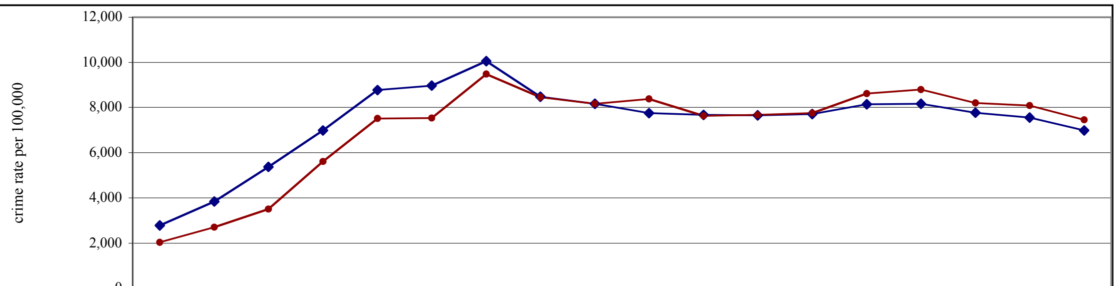
According to data from UCR, the official police-reported crime rate in Nova Scotia nearly quadrupled between 1962 and 2007, and nearly tripled in Canada as a whole during that time period. In 1962, the chances of being a crime victim in Nova Scotia were one in 49, counting only police-reported crimes. By 2007, they were one in 13. In other words, according to the official statistics, the chances of being a crime victim are now nearly four times greater than 45 years ago (Figure 10-1 below). When those numbers are adjusted for increased reporting rates in some categories, it is estimated that crime today remains about 2.5 to 3 times higher than in 1962.

Figure 10-1 below illustrates how the total crime rate in Nova Scotia, while consistently lower than the Canadian average prior to 1998, has surpassed the national average each year, except for one, in the last nine years. In both 2006 and 2007, the Nova Scotia crime rate was 7% higher than the national average. In the short-term, both the national crime rate and the Nova Scotia crime rate declined in 2007 for the third consecutive year, continuing an overall downward national trend in police-reported crime since the rate peaked in 1991.

Analysts link Canada's 1991 crime peak with the onset of a serious recession that was accompanied by major job losses and particularly high rates of youth unemployment. Conversely, the drop in crime rates since that time is linked with improved job prospects and declining rates of youth unemployment. Thus, GPI Atlantic's original 1999 *Cost of Crime* report noted that crime rates tend to follow the business cycle and employment trends. That observation is supported by the most recent statistics, with crime rates continuing to fall as unemployment rates have reached their lowest point in three decades. If Canada enters a serious recession in 2009, as analysts predict, crime rates can be expected to rise as jobs are lost.

Crime rates in 2007 were highest in Western Canada and the territories—continuing a pattern that has been observed over the past 30 years. Among the provinces, Saskatchewan reported the highest overall crime rate as well as the highest violent crime rate, and, for the fourth year in a row, Ontario and Quebec reported the lowest overall rates of crime.[16]

Figure 10-1. Crime rate, total incidents per 100,000 population, Nova Scotia and Canada, 1962–2007



	1962	1967	1972	1977	1982	1987	1992	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Canada	2,771	3,850	5,355	6,971	8,773	8,957	10,040	8,475	8,161	7,752	7,667	7,655	7,706	8,142	8,160	7,769	7,543	6,984
NS	2,036	2,701	3,509	5,602	7,498	7,525	9,475	8,461	8,163	8,380	7,624	7,670	7,738	8,611	8,791	8,206	8,081	7,456

Source: Statistics Canada. Uniform Crime Reporting Survey. CANSIM Table 252-0013. Minister of Industry. Ottawa.

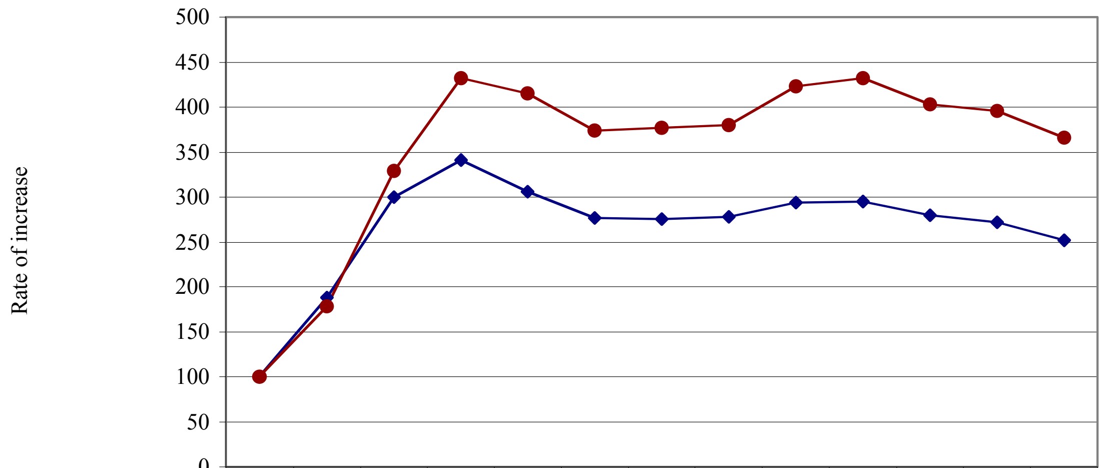
Notes:
- These figures exclude all traffic offences, including those (like impaired or negligent driving) that are classified as criminal offences.
- Rates for adult crime are based on the adult population (ages 18 and over), and rates for youth crime are based on youth population (between ages 12 and 17). The adult crime rate will generally be smaller than the youth crime rate, since the age range for the adult crime rate includes the elderly, who generally have very low rates of offending.
- Overall crime rates in this section are for total persons charged. "Total persons charged" is the total of "adults charged" and "youth charged." The rate of total persons charged (per 100,000) is calculated by using the total of adult population (18 years of age and over) and youth population (12 to 17 years of age) as the base.

Figure 10-2 below indicates that the crime rose at a faster rate in Nova Scotia than nationally, especially during the 1970s and 1980s, and then again in the early part of the present decade. However, overall crime levels remained slightly below the Canadian level until 1998 because crime levels in Nova Scotia were so much lower than the national average a generation ago. Thus, in 1972, Nova Scotia crime rates were only two-thirds the national average. In 1997, they were 99% of the Canadian average. By 2007, Nova Scotia crime rates exceeded the national average by 7%.

Throughout Canada, however, crime rates have dropped since peaking in 1991, when the chances of being a crime victim were one in nine nationwide. By 2007, the Canadian crime rate had fallen by 32% from the peak year of 1991, and in Nova Scotia it fell by 24% during this time period. Figure 10-2 reveals that—according to official police-reported statistics—Canadians are 2.5 times as likely to be victims of crime today as in 1962—down from 3.4 times as likely in 1990. Nova Scotians are 3.7 times as likely to be victims of crime today as in 1962—down from

4.3 times as likely in 1990. As noted above, these comparisons must be adjusted for higher reporting rates in some crime categories.

Figure 10-2. Changes in the crime rate: comparison of Nova Scotia and Canada rates of change (1962=100), 1962–2007

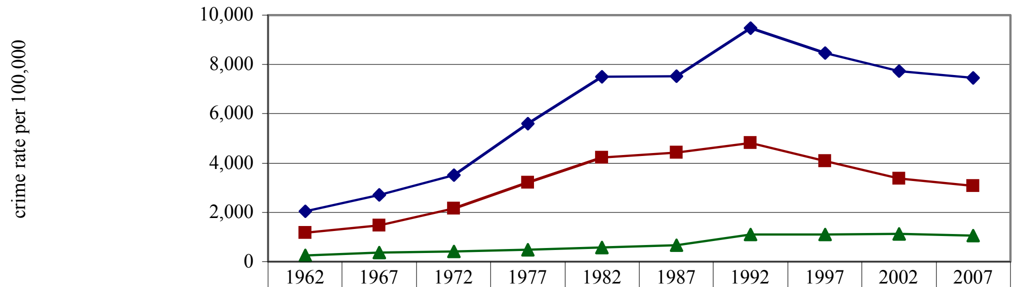


	1962	1970	1980	1990	1997	2000	2001	2002	2003	2004	2005	2006	2007
Canada	100	188	300	341	306	277	276	278	294	295	280	272	252
Nova Scotia	100	178	329	432	415	374	377	380	423	432	403	396	366

Source: Statistics Canada. CANSIM Table 252-0013. Minister of Industry. Ottawa.

Figure 10-3 below illustrates that—in absolute terms—the property crime rate far exceeds the violent crime rate in Nova Scotia, and accounts for most of the increase in total crime since 1962. In relative terms, however, this is not the case, especially in the last 20 years. Thus, the property crime rate in Nova Scotia increased by just 4.6% between 1987 and 1992, while the violent crime rate shot up dramatically by 67% during that period. As well, the property crime rate has fallen steadily in Nova Scotia since 1992, declining by 36% between 1992 and 2007, while the violent crime rate has remained remarkably stable in the last 15 years.

Figure 10-3. Property and violent crime rates, total incidents per 100,000 population, Nova Scotia, 1962–2007



	1962	1967	1972	1977	1982	1987	1992	1997	2002	2007
Total criminal code (excluding traffic offences)	2,036	2,701	3,509	5,602	7,498	7,525	9,475	8,461	7,738	7,456
Property crime	1,168	1,462	2,160	3,221	4,226	4,419	4,814	4,082	3,379	3,072
Violent crime	242	358	410	485	571	661	1,102	1,104	1,117	1,065

Source: Statistics Canada. CANSIM Table 252-0013. Minister of Industry. Ottawa.

Notes: Figures have been rounded. "Total criminal code" here excludes both traffic offences and "other" criminal code violations, such as mischief, counterfeiting currency, bail violations, disturbing the peace, offensive weapons charges, prostitution, arson, and forcible confinement / kidnapping.

Crime and Aboriginal peoples

According to Statistics Canada, a number of individual, economic, and social factors seem to be associated with a higher risk of criminal victimization and offending, and all these risk factors are more common among the Aboriginal population in Canada:

> Aboriginal people are younger on average, their unemployment rates are higher and incomes lower; they are more likely to live in crowded conditions; they have higher residential mobility; and children are more likely to be members of a lone-parent family. They also have a lower level of education, although the education profile has improved noticeably in recent years among Aboriginal people aged 25–64.[17]

The 2004 GSS on victimization found that four in ten Aboriginal people aged 15 and older reported they were victimized at least once during the twelve months prior to being interviewed—well above the level of 28% for non-Aboriginal Canadians.

Police-reported (UCR) data indicate that, in 2004, criminal code incidents on reserves across Canada represented 4% of the national total.[18] Over half of all on-reserve incidents were classified as "other" criminal code offences such as mischief and disturbing the peace, while 25% were violent crimes and 21% were property offences.

Rates of violent crime committed on reserves were eight times higher for assaults, seven times higher for sexual assaults, and six times higher for homicides than rates in the rest of Canada.

The only violent crime with a lower on-reserve rate was robbery, which had a rate about half of that in the rest of Canada.

In addition, Aboriginal adults represented 21% of admissions to provincial / territorial sentenced custody and 18% of admissions to federal facilities. Among the provinces, the highest proportions of Aboriginal correctional admissions were in Saskatchewan, Manitoba, and Alberta. In Saskatchewan, Aboriginal people made up 80% of those admitted to provincial prisons—though they account for only 10% of the provincial adult population. In Manitoba, Aboriginal people represented 68% of prisoners but only 11% of the provincial adult population. In Alberta, 39% of prisoners were Aboriginal people although they constitute just 4% of the provincial adult population.[19]

Youth crime

According to the Uniform Crime Report (UCR) survey, the overall crime rate in Canada among youth aged 12-17 decreased by 6% between 1997 and 2006, and by 25% since the 1991 peak, when the youth crime rate was 9,126 per 100,000 youth. Since 1991, the youth crime rate has followed a pattern similar to that of the overall national crime rate—decreasing through the 1990s, then increasing from 1999 to 2003, and decreasing again since then.

However, this overall decline in youth crime since 1991 conceals important distinctions in the types of crimes being committed. Property crimes by youth dropped by 34% between 1997 and 2006 to their lowest point in a decade. But the violent crime rate among youth increased by 12% during the same period, with much of the increase due to a 17% increase in common assault rates (Table 10-1 below).[20] “Other” criminal code violations, including mischief, bail violations, disturbing the peace, and use of offensive weapons, were up by 34% during this period, with a particularly sharp increase in charges for disturbing the peace, which more than tripled among youth between 1997 and 2006. The crime rate for youth drug offences (trafficking and possession) increased by 97% in this time period.

Table 10-1. Youth crime rate per 100,000 youth aged 12–17, and percent change between 1997 and 2006, reported to police for selected criminal code offences, Canada

CRIME	NUMBER OF YOUTH CHARGED	YOUTH CRIME RATE, 2006 (PER 100,000 YOUTH)	% CHANGE IN TOTAL YOUTH CRIME RATE (1997-2006)
Violent crime			
Homicide*	83	3	+41
Attempted murder	69	3	+6
Assault (total)	14,160	1,196	+17
Sexual assault (level 1,2,3)	1,188	83	– 8
Robbery (total)	3,704	175	– 2
Total	**20,500**	**1,528**	**+12**
Property crime			
Breaking and entering (total)	7,434	497	–47
Motor vehicle theft	3,012	198	–41
Theft over $5,000	152	12	–61
Theft $5,000 and under	9,164	1,431	–33
Shoplifting	4,514	751	–46
Possession of stolen goods	4,899	302	+9
Fraud	1,119	94	–24
Total	**25,780**	**2,534**	**–34**
Criminal code total (excluding traffic)	**73,941**	**6,885**	**–6**

Source: Taylor-Butts, Andrea and Angela Bressan. 2007. Youth Crime in Canada, 2006. *Juristat*. Vol. 28, no. 3. Statistics Canada. Canadian Centre for Justice Statistics. Minister of Industry. Ottawa. Table 1.

Notes:
- Rates are calculated on the basis of 100,000 youth aged 12–17.
- Total criminal code excludes traffic offences. Only selected offences are shown and will therefore not add up to the total in each category.
- A detailed look at the change in "other" criminal code violations between 1997 and 2006 indicates the following rates of change: mischief (+46%), bail violations (+33%), disturbing the peace (+217%), use of offensive weapons (+44%), arson (+1%) and other (- 3%). The crime rate for drug offences increased 97% in the time period.
- *Youth-perpetrated homicides are infrequent and the rates can vary greatly from year to year.

Between 2005 and 2006, crime rates among youth increased in all provinces except Quebec, with the largest increases occurring in Prince Edward Island (+38%), Newfoundland and Labrador (+22%), Nova Scotia (+17%), and Manitoba (+14%). However, provincial youth crime rates varied considerably in 2006, from a low of 3,765 for every 100,000 in Quebec to a high of 19,939 in Saskatchewan. The crime rate among youth in Nova Scotia was 11,113 for every 100,000 youth—the third highest rate among the provinces. Youth crime rates in the territories were much higher than in the provinces—about four to six times higher than the national average (Table 10-2 below).

Table 10-2. Youth crime rate per 100,000 youth aged 12–17, Canada, provinces and territories, 2006

	VIOLENT CRIME	PROPERTY CRIME	OTHER CRIMINAL CODE	TOTAL CRIMINAL CODE*
CAN	1,528	2,534	2,832	6,885
NL	1,620	2,915	4,245	8,780
PE	1,332	3,836	4,235	9,403
NS	2,272	3,687	5,154	11,113
NB	1,680	2,742	4,010	8,432
QC	1,110	1,512	1,143	3,765
ON	1,438	2,455	2,063	5,956
MB	2,709	3,395	5,037	11,140
SK	3,466	6,316	10,156	19,939
AB	1,590	3,057	4,078	8,725
BC	1,254	2,183	3,001	6,438
YT	4,524	6,155	14,868	25,547
NT	7,744	14,391	22,492	44,627
NU	5,635	11,374	14,152	31,161

Source: Taylor-Butts, Andrea and Angela Bressan. 2007. Youth Crime in Canada, 2006. *Juristat*. Vol. 28, no. 3. Statistics Canada. Canadian Centre for Justice Statistics. Minister of Industry. Ottawa. Table 2.

Notes:
- Rates are calculated on the basis of 100,000 youth aged 12-17.
- "Total criminal code" excludes traffic offences.
- The violent, property, and other categories do not add precisely to the total youth crime rate in the last column due to rounding.

If we are to identify a peaceful and secure society as a key social asset, then it can be said that Nova Scotia and the other Atlantic Provinces enjoyed an important "comparative advantage" over the rest of the country in this aspect of social capital (or wealth) a generation ago. However, in both absolute and relative terms, that asset—and the quality of life associated with it—has eroded significantly in the last 45 years in Nova Scotia, as the overall crime rate (including the rate for violent crime) in this province now exceeds the national average.

It must be emphasized again that the rates of increase cited here do not account for higher reporting rates in some categories. While higher *crime* rates may be seen as a symptom of a declining quality of life, higher *reporting* rates may indicate the opposite trend, since they can signify reduced social tolerance for violence and other previously “acceptable” harmful behaviour like domestic and spousal abuse. From that perspective, as noted earlier, the degree to which higher official crime rates can be accounted for by increased reporting rates may also indicate movement towards a more “civil” society.

The caveat here is that there is no evidence that reporting rates have increased faster in Nova Scotia than in the rest of Canada. Therefore, while Nova Scotia and the other Atlantic provinces enjoyed an important “comparative advantage” a generation ago over the rest of the country, this is no longer the case for Nova Scotia.

10.2.2. Violent crime

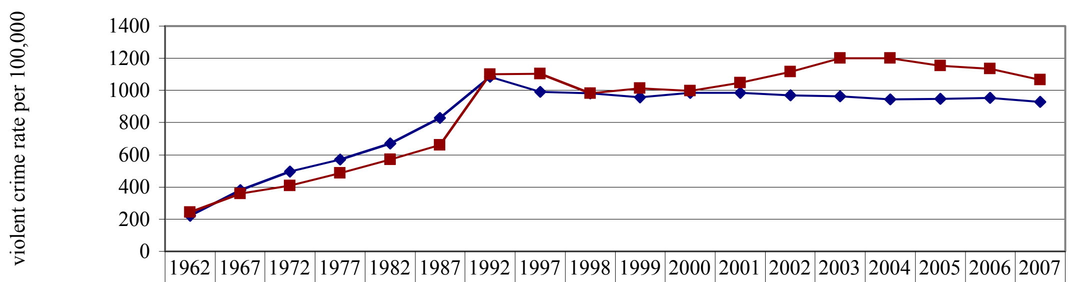
Data source: Statistics Canada, Uniform Crime Reporting Survey.

Result: Nova Scotia’s violent crime rate increased between 1998 and 2004, and has since declined somewhat. However, in 2007, the provincial violent crime rate was nearly 15% higher than the Canadian rate, indicating a reversal of the “comparative advantage” enjoyed by Nova Scotia for roughly the two decades from 1967 to 1987.

Counting only police-reported crimes, the chances of being a victim of violent crime in 2007 were one in 94 in Nova Scotia and one in 108 nationwide, compared to one in 413 and one in 452, respectively, in 1962.[21] In other words, according to the official police-reported statistics, the chances of being a victim of violent crime in the province have gone up by 342% since 1962.

Throughout the 1970s and 1980s, the Nova Scotia rate of violent crime averaged about 16% below the national rate. Since 1992, however, the provincial rate of violent crime has averaged 16.5% higher than the national rate—ranging from 7% higher in 2001 to 27% higher in 2004. In 2007, the rate of violent crime in Nova Scotia was nearly 15% higher than the national rate (Figure 10-4).

Figure 10-4. Violent crime rate per 100,000 population, Canada and Nova Scotia, 1962–2007



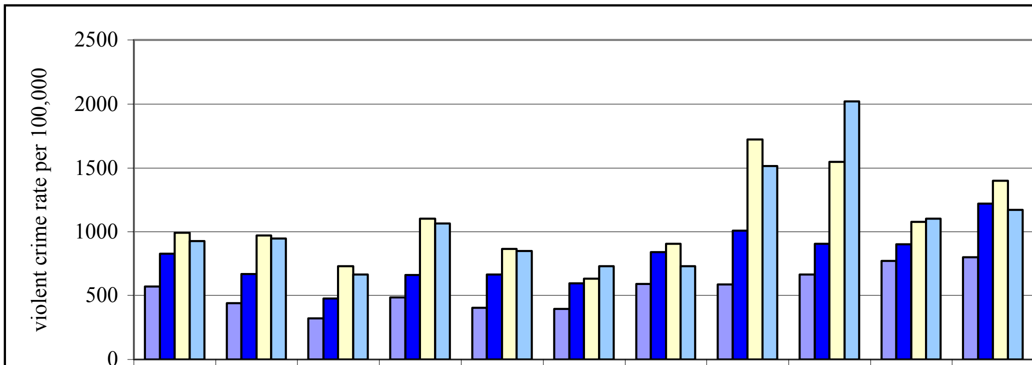
	1962	1967	1972	1977	1982	1987	1992	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Canada	221	381	497	572	671	829	1,084	993	982	958	984	984	969	963	944	949	954	930
NS	242	358	410	485	571	661	1,102	1,104	982	1,012	997	1,049	1,117	1,202	1,202	1,155	1,136	1,065

Source: Statistics Canada. Uniform Crime Reporting Survey. CANSIM Table 252-0013. Minister of Industry. Ottawa.

Note: All figures have been rounded.

Among the provinces, Nova Scotia now has the fifth highest rate of violent crime in the country after Saskatchewan, Manitoba, British Columbia, and Alberta, and the highest rate east of Winnipeg. It is 31% higher than Ontario and Quebec, and higher than any of the other Atlantic Provinces. Prince Edward Island had the lowest rate of violent crime in the country—29% lower than the national average in 2007—followed by Quebec and Ontario (Figure 10-5 below).

Figure 10-5. Violent crime rate per 100,000 population, Canada and provinces, 1977–2007



	Canada	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC
1977	572	438	320	485	402	394	592	586	663	774	804
1987	830	671	478	661	662	593	843	1,010	906	902	1,220
1997	993	975	732	1,104	867	630	909	1,723	1,549	1,077	1,401
2007	930	949	664	1,065	852	734	734	1,513	2,019	1,105	1,172

Source: Statistics Canada. CANSIM Table 252-0013. Minister of Industry. Ottawa.

Notes: All figures have been rounded. Due to the issue of scale, violent crime rates per 100,000 for the territories have not been included in the figure above. In 2007, the violent crime rate per 100,000 in the Yukon was 2,924, in the Northwest Territories it was 7,071, and in Nunavut it was 7,164.

It should be noted that the rate of violent victimization in Canada's North is substantially higher than in the rest of the country. According to the 2004 GSS, almost four in ten residents of the territories reported they were victimized at least once in the twelve months prior to being interviewed, compared to 28% for the rest of Canada.

When police-reported data (UCR) are analyzed, violent crime rates are also seen to be much higher in the territories than in the rest of the country—3.1 times the national average in the Yukon, and 7.6 to 7.7 times the national average in the Northwest Territories and Nunavut. Thus, violent crime rates were highest in Nunavut (7,164 per 100,000), followed closely by the Northwest Territories (7,071). Yukon's violent crime rate (2,924) was still 1.4 times higher than the highest provincial rate (2,019 in Saskatchewan).[22]

When the official 2007 crime data were analyzed by Census Metropolitan Area, violent crime rates were again generally found to be highest in the cities of Western Canada—following the regional pattern indicated in Figure 10-5 above. However, according to Statistics Canada, Saint John (NB), Thunder Bay (ON), and Halifax (NS) were exceptions to this general pattern, with each reporting violent crime rates similar to or higher than those in the West. For example, in 2007, Halifax reported 1,145 violent offences per 100,000 population, compared to the Canadian average of 930.[23]

In 1999, GPI Atlantic reported that these overall violent crime statistics do not present the entire picture for Nova Scotia. In fact, when only serious violent crimes were analyzed at that time, a very different picture emerged. Counting only homicide, robbery, sexual assault categories 1 and 2 (comparable to the US definition of forcible rape), and assault category 3 (comparable to the US definition of aggravated assault), Nova Scotia had only 63% of the Canadian violent crime rate in 1997, a ratio that had remained fairly constant between 1993 and 1997. By comparison, Nova Scotia's overall rate of violent crime was 11% higher than the national average in 1997.

In other words, Nova Scotia's rate of serious violent crime was well below the national average, indicating both that common assaults constitute the major portion of the increase in violent crime in Nova Scotia and that higher reporting rates for minor violent offences are likely to explain a significant part of this increase. When Nova Scotia was compared to the United States, Nova Scotia had only one-sixth the US crime rate for serious violent crimes.[24]

In addition to the official police-reported crime statistics, as previously noted, victimization surveys can also be used to shed some light on the incidence of crime. In 2004, respondents to Statistics Canada's GSS were asked about their experiences with criminal victimization. Anyone who reported being the victim of one of eight offences in the previous twelve months was asked for detailed information, including where the incident occurred; whether the incident was reported to police; the level of injury; use or presence of a weapon; and financial loss.

According to the 2004 GSS, 28% of Canadians aged 15 and older reported being victimized one or more times in the twelve months preceding the survey—up from 26% in 1999, when the last survey was conducted.[25] As seen in Figure 10-1 above, police-reported crime in Canada rose 5.3% between 1999 and 2004, indicating that reported and unreported crimes seem to have risen at roughly comparable rates. This also implies that higher rates of reporting—while they certainly explain part of the official police-reported crime increase since the 1960s and 1970s—no longer account significantly for changes in police-reported crime.

According to the 2004 GSS, rates of self-reported violent victimization—which includes physical assault, robbery, and sexual assault—among the population 15 years and older, were highest in Alberta at 160 per 1,000 population, with Nova Scotia a close second at 157 incidents per 1,000 population.[26] The lowest rate of violent victimization was found in Quebec (59 per 1,000). The Canadian average was 106 per 1,000. Halifax reported the highest rate of violent incidents per 1,000 population aged 15 and older of any major city in Canada (229 per 1,000).

According to the GSS, a total of 2,109,000 self-reported violent victimization incidents occurred nationwide in 2004. Of these, only 33%, or 687,000 incidents, were reported to the police (down from 37% in 1999)—8% of sexual assaults, 46% of robberies, and 39% of physical assaults.[27] It should be stressed that, according to victimization surveys, over half of unreported violent incidents do not come to the attention of police because the victim felt the incident was not important enough, "suggesting the crime may have been too minor to warrant police involvement."[28]

It should be noted here that it is not possible to compare GSS data with UCR data directly due to conceptual differences between the methodologies of the two surveys. According to Statistics Canada, the two surveys produce "two distinct sets of crime indicators."[29] On the one hand, any measure of criminal activity based on officially recorded crime statistics will be an underestimate due to the large proportion of unreported crimes. However, victimization surveys do not collect information on homicides or crimes committed against businesses and children. Data on victimless or consensual crimes (such as drug use, prostitution, illegal gambling), or on corporate or white-collar crime, are also not collected through victimization surveys.

Furthermore, the GSS and UCR use different units of measurement: the GSS counts the number of criminal victimizations—that is, the number of times an individual or household was a victim of crime. The UCR counts the number of criminal incidents reported to police. For example, for non-violent crime, the UCR registers one incident for every distinct or separate occurrence. So, a property crime targeting several victims would be recorded as a single offence if it is considered part of the same incident. In the GSS, the same incident would be counted by each victim.

The UCR classification that has the greatest impact on crime counts is the "Most Serious Offence" rule: incidents are classified according to the most serious offence occurring in the criminal incident. This rule results in an undercounting of less serious offences, while such offences would be counted in the GSS.[30]

One further factor that helps explain some of the differences between the crime rates reported in the UCR and the victimization rates reported in the GSS is that police regularly exercise discretion in the formal recognition and recording of a crime. In other words, in a case where the police officer determines that no "crime" actually took place, he/she would deem the original incident report as being "unfounded," and so the incident would not be included in the total number of "actual" offences recorded in the UCR. Conversely, according to Statistics Canada, the final count of criminal incidents recorded by victimization surveys "may include a number of victimizations that may be otherwise deemed unfounded according to UCR classification rules."[31]

However, it is possible to make crude comparisons between the two sets of data if a few "global adjustments" are made first. According to Statistics Canada, these adjustments include:

- Crimes mentioned by GSS respondents that were not reported to police have to be excluded from the GSS counts
- UCR data for the Yukon and Northwest Territories have to be omitted from UCR counts since they are not included in GSS surveys
- Police reports of "unfounded" incidents have to be included in the UCR counts
- UCR-based rates of offences reported to police have to be converted to conform to GSS rates for both persons and households[32]

10.2.3. Homicides

Data source: Statistics Canada, Uniform Crime Reporting Survey. *Result*: There was a decline in the average homicide rate in Nova Scotia between the 1992–1997 and 2002–2007 time intervals.

The small number of annual homicides makes it necessary to examine averages over several years, in order to correct for unusual fluctuations in particular years. As well, the year a homicide is reported as such may not be the year the crime occurred, if for example, a person is first reported as missing or if a person later succumbs to injuries. A closer examination of the 1997 data, for instance, revealed that while the data appeared to indicate a higher Nova Scotia homicide rate for that year, five of the homicides reported in 1997 actually occurred in 1981.

For this reason, averaging rates over longer periods will certainly yield more accurate and comparable results. Therefore, homicide rates are analyzed here in six-year intervals. Table 10-3 below indicates that the Nova Scotia homicide rate rose slightly from about 90% of the national average in the 1960s to a rate almost identical with the national average in the 1990s. Between 2002 and 2007, however, the Nova Scotia homicide rate averaged 25% lower than the national rate. Between the 1962–1967 and 2002–2007 intervals, the average homicide rate increased by 60% in Canada and by 35% in Nova Scotia.

Table 10-3. Increase in homicide rate, Canada and Nova Scotia, 1962–1967 to 2002–2007

SURVEY PERIOD	CANADA AVERAGE RATE/100,000	NOVA SCOTIA AVERAGE RATE/100,000
1962–1967	1.19	1.06
1982–1987	2.55	1.80
1992–1997	1.91	1.88
2002–2007	1.90	1.43
Percentage change (1962 and 2007)	+ 60%	+ 35%

Source: Statistics Canada. Uniform Crime Reporting Survey. CANSIM Table 252-0013. Minister of Industry. Ottawa.

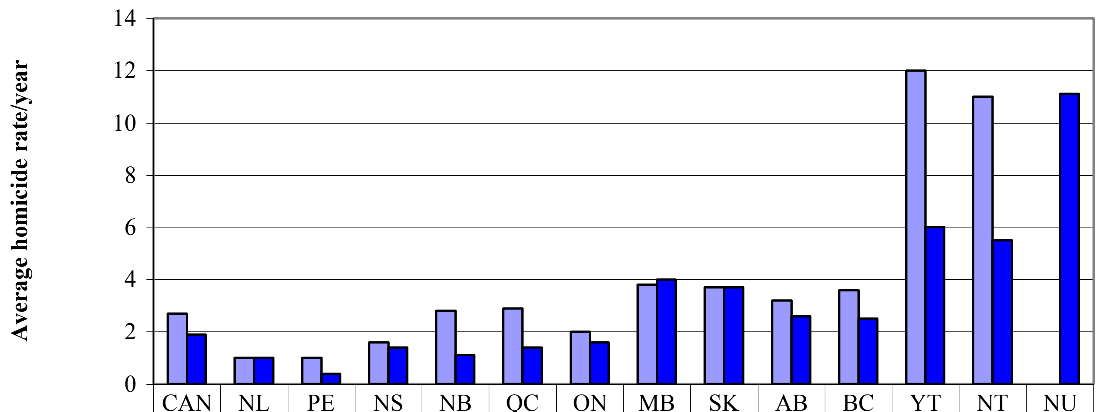
When average homicide rates are analyzed by province and territory, it is seen that Nova Scotia had the highest average rate east of Ontario between 2002–2007—1.43/100,000 compared to 1.35 in Quebec, 1.1 in New Brunswick, 1.0 in Newfoundland and Labrador, and 0.4 in Prince Edward Island (the lowest rate in the country). Among the provinces, Manitoba had the highest homicide rate (3.97), followed by Saskatchewan (3.72). Again, the territories had much higher average homicide rates—with Nunavut registering by far the highest in the country (11.10), followed by the Yukon (5.95) and the Northwest Territories (5.52).

Between 1977–1982 and 2002–2007, the average homicide rate declined or remained the same in all provinces except for Manitoba, where it increased marginally. In Nova Scotia, the average homicide rate declined from 1.6 per 100,000 in 1977–1982 to 1.4 per 100,000 in 2002–2007. The average homicide rate in the Yukon and the Northwest Territories dropped by half during this time period, but still remain well above provincial averages (Figure 10-6 below).

Though overall homicide numbers are small, the regional differences are significant. A resident of Manitoba or Saskatchewan is more than three times as likely to be murdered as an Atlantic Canadian.

In addition, while Aboriginal people accounted for an average of about 3% of the Canadian population between 1997 and 2004, they made up 17% of homicide victims and 23% of those accused of committing a homicide over the same time period. Between 1997 and 2000, the average homicide rate for Aboriginal people was almost seven times higher than that for non-Aboriginal people. When population was taken into account it was found that Aboriginal people were 10 times more likely to be accused of homicide than were non-Aboriginal people.[33]

Figure 10-6. Average number of homicides per 100,000 population, Canada, provinces, and territories, 1977–1982 and 2002–2007



	CAN	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC	YT	NT	NU
1977-82	2.7	1	1	1.6	2.8	2.9	2	3.8	3.7	3.2	3.6	12	11	
2002-07	1.9	1	0.4	1.4	1.1	1.4	1.6	4	3.7	2.6	2.5	6	5.5	11.1

Source: Statistics Canada. Uniform Crime Reporting Survey. CANSIM Table 252-0013. Minister of Industry. Ottawa.

Notes: 1977–1982 data for Nunavut were not available, as the territory was only officially separated from the Northwest Territories in 1999. Numbers have been rounded.

10.2.4. Property crimes

Data source: Statistics Canada, Uniform Crime Reporting Survey.

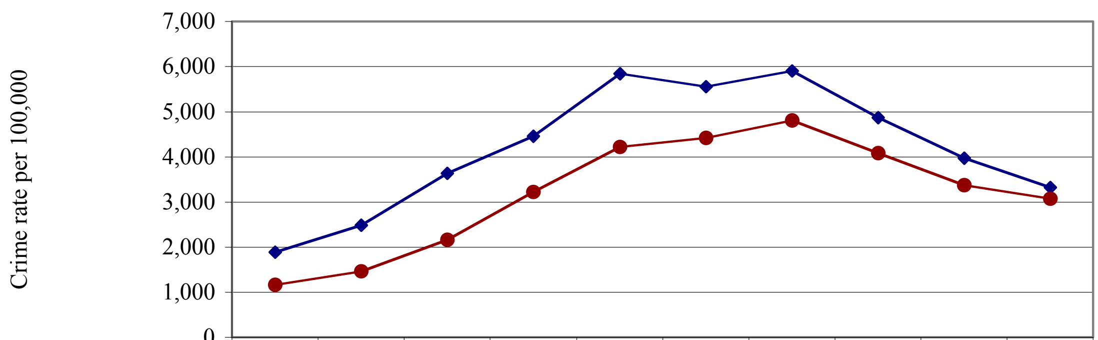
Result: The property crime rate in both Canada and Nova Scotia has been decreasing since the early 1990s.

Property crimes include breaking and entering, motor vehicle theft, theft over $5,000, theft $5,000 and under, possession of stolen goods, and fraud.

According to the UCR survey, the property crime rate increased steadily in the 1960s, 1970s, and 1980s, but began a steady decline after peaking in 1991. The rate of property crime in Nova Scotia has been consistently lower than the national rate, but in recent years the gap has narrowed.

In 2007, the rate of property crime in Nova Scotia was 163% higher than in 1962, but also 36% lower than in 1992. Thus, according to official police-reported statistics, a Nova Scotian was more than four times as likely to be a victim of property crime in 1992 as 30 years earlier, but only 2.6 times as likely to be a property crime victim in 2007 as in 1962 (Figure 10-7).

Figure 10-7. Property crime rate, per 100,000 population, Canada and Nova Scotia, 1962–2007



	1962	1967	1972	1977	1982	1987	1992	1997	2002	2007
Canada	1,891	2,484	3,634	4,466	5,840	5,553	5,904	4,880	3,975	3,320
Nova Scotia	1,168	1,462	2,160	3,221	4,226	4,419	4,814	4,082	3,379	3,072

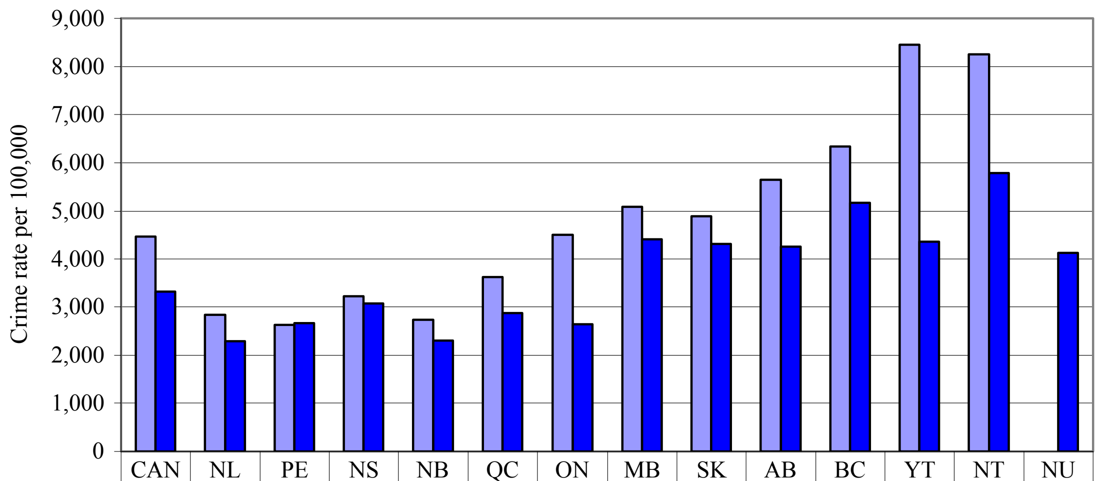
Source: Statistics Canada. Uniform Crime Reporting Survey. CANSIM Table 252-0013. Minister of Industry. Ottawa; Statistics Canada. 2004. Canadian Crime Statistics, 2003. Canadian Centre for Justice Statistics. Available from http://dsp-psd.tpsgc.gc.ca/Collection-R/Statcan/85-205-XIE/0000385-205-XIE.pdf. Accessed September 5, 2008.

Property crime seems particularly responsive to the business cycle and to changes in unemployment rates, so the 1991 property crime peak can be explained largely by the onset of serious recession and job loss, while the drop since then can be attributed in large part to the steady drop in unemployment rates since then. Similarly, the present economic crisis and impending job losses are likely to see a resurgence in property crime.

As Figure 10-8 below illustrates, property crime rates have declined in all provinces and territories over the 30-year period from 1977 to 2007, except for Prince Edward Island, where there has been just a marginal increase. However, within that period, as seen in Figure 10-7 above, property crime peaked nationwide at a rate of close to 6,000 per 100,000 during both major recessions—in the early 1980s and again in the early 1990s—indicating that nearly 6% of Canadians reported a property crime to police during those recession years.

The Atlantic provinces have consistently registered much lower rates of property crime than the western provinces and territories. The highest provincial rate was in British Columbia—at about twice the Atlantic Canadian rate—followed by Manitoba, Saskatchewan, and Alberta. Nova Scotia had the highest property crime rate among the Atlantic provinces in both 1977 and 2007 (Figure 10-8).

Figure 10-8. Property crime rate, per 100,000 population, Canada, provinces, and territories, 1977 and 2007



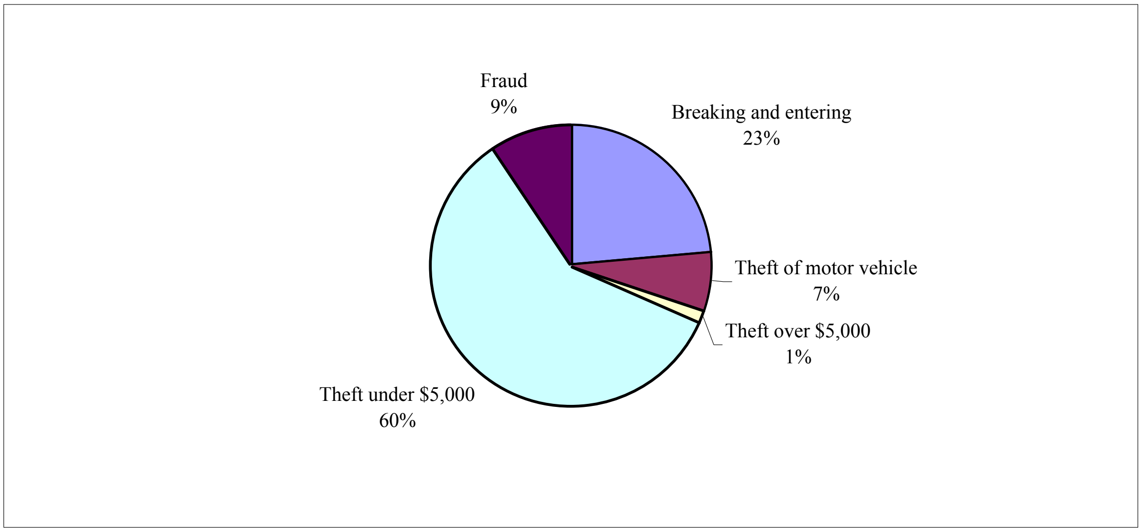
	CAN	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC	YT	NT	NU
1977	4,466	2,834	2,629	3,221	2,735	3,632	4,507	5,090	4,893	5,650	6,333	8,455	8,257	
2007	3,320	2,283	2,660	3,072	2,305	2,869	2,635	4,408	4,314	4,259	5,177	4,369	5,795	4,133

Source: Statistics Canada. Uniform Crime Reporting Survey. CANSIM Table 252-0013. Minister of Industry. Ottawa.

Notes: Data for 1977 were unavailable for Nunavut, as the territory was only officially separated from the Northwest Territories in 1999. Numbers have been rounded.

As Figure 10-9 below illustrates, when property crime is broken down into its various sub-types, 60% of all crimes (or 15,620 incidents) committed against property in Nova Scotia in 2007 were theft under $5,000.[34] Breaking and entering ranked second in terms of actual number of incidents (6,192) and accounted for nearly one-quarter (23%) of all property crimes that year. Theft over $5,000 accounted for only 1% of all property crime (356 incidents) in 2007.

Figure 10-9. Type of property crime, actual incidents, Nova Scotia, 2007



Source: Statistics Canada. Uniform Crime Reporting Survey. CANSIM Table 252-0013. Minister of Industry. Ottawa.

Note: From 1977 to 1984, the dollar value attached to the offence of "theft over / under" was $200. From 1985 to 1994, the dollar value was increased to $1,000, and since 1995, the dollar value has been $5,000. According to Statistics Canada, comparisons over time should not be made for the categories of theft "over" and "under" a certain amount, due to the changing dollar values defining these offences.

While GSS victimization data indicate that self-reported rates of violent victimization between the 1999 and 2004 surveys increased from 26% to 28%, Statistics Canada reports that, overall, "the GSS in 2004 found no significant change in self-reported rates of violent victimization, namely sexual assault, robbery, or physical assault."[35] However, there were much more significant increases in self-reported property crime victimization. Thus, rates of personal property theft across the country increased by 24%, while theft of household property rose by 42% and vandalism increased by 17% during this five-year time period.[36] Interestingly, this upward trend apparently contradicts the decline in police-reported property crime noted above, and thus largely explains the overall decline in reporting rates—from 37% in the 1999 GSS to 34% in the 2004 GSS.

10.3. Perceptions of crime

Data sources: Statistics Canada, General Social Survey (GSS), 1999 and 2004.

Result: Satisfaction with personal safety from crime has improved nationwide—from 86% of Canadians in 1993 to 94% in 2004—and is highest in all four Atlantic provinces, with Newfoundland and Labrador at 99%, Prince Edward Island at 98%, New Brunswick at 97%, and Nova Scotia at 95%.

Wellbeing is dependent on both objective and subjective factors; therefore, this crime update examines both types of data. In this case, a high-crime neighbourhood is obviously less conducive to wellbeing than a low-crime neighbourhood, and that indicator can fairly reliably be assessed using objective police-reported statistics and victimization rates (which include unreported crimes). However, wellbeing can also be enhanced by a subjective feeling of safety and security, and it can be diminished by fear of crime. While the previous indicator (crime rates) assessed objective victimization rates, this indicator explores subjective feelings of safety and fear of crime.

According to Statistics Canada's 2004 General Social Survey (GSS), satisfaction with personal safety has increased nationwide since 1993, and in 2004, it stood at 94% of the Canadian population aged 15 years and over—up from 86% in 1993 and 91% in 1999. In Nova Scotia, 95% reported they were satisfied with their safety in 2004, with all four Atlantic Provinces reporting higher levels of satisfaction with safety than other provinces.[37] Unfortunately, provincial trend lines are not publicly available.

In Newfoundland and Labrador, 71% of the population were "very satisfied" and 28% said they were "somewhat satisfied" with their personal safety. The other provinces experienced relatively high levels of satisfaction with personal safety overall, but were more evenly split between those who were "very" satisfied and those who were "somewhat" satisfied with their safety. In Manitoba, for example, 46% were very satisfied and another 47% were somewhat satisfied. Only in Quebec were responses more guarded, with just 27% saying they were very satisfied and 66% saying they were somewhat satisfied with their safety from crime. This level of analysis was not publicly available for Nova Scotia.[38]

Overall, feelings of personal safety nationwide were slightly higher among men (95%) than women (93%). While there has been a general increase in levels of personal satisfaction with safety among both men and women since 1999, feelings of personal safety improved at a greater rate for women (up five percentage points) than for men (up two percentage points).

Atlantic Canadians were not only generally more satisfied with their personal safety than other Canadians, but they were also less fearful of crime in particular circumstances. In 2004, for example, among those who walk alone in their neighbourhoods at night, 97% of residents in Newfoundland and Labrador and 96% of Prince Edward Islanders felt safe walking alone at night, as did 92% of Nova Scotians, and 90% of all Canadians (94% of males but only 84% of females). In Canada overall, 46% felt "reasonably safe" and 44% felt "very safe" walking alone at night.[39]

Atlantic Canadians also felt safer than other Canadians being home alone at night. Thus, 88% of those in Newfoundland and Labrador and 87% in Prince Edward Island were not at all worried being home alone at night, compared to 85% in New Brunswick, 83% in Nova Scotia, and 80% nationwide (Table 10-4 below).

Table 10-4. Feelings of safety from crime (%), Canada and provinces, 2004

	CAN	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC
Personal safety (%)											
Satisfied	94	99	98	95	97	94	94	93	94	94	93
Dissatisfied	5	1E	F	4	3	6	5	6	5	5	6
Walking alone after dark (%)											
Safe	90	97	96	92	95	88	90	90	93	92	88
Unsafe	10	4E	4E	8	5	12	10	10	8	8	12
Home alone in the evening or night (%)											
Not at all worried	80	88	87	83	85	79	80	80	83	82	78
Worried	20	11	13	17	15	21	20	20	17	18	22
Using public transportation alone after dark (%)											
Not at all worried	57	83	F	58	74	61	56	46	62	52	57
Worried	42	17E	F	42	26E	39	44	53	38	48	43

Source: Statistics Canada. General Social Survey on Victimization, Cycle 18: An Overview of Findings. 2004. Available from http://www.statcan.ca/english/freepub/85-565-XIE/85-565-XIE2005001.htm. Accessed September 9, 2008.

Notes: Figures may not add due to rounding. Data for "walking alone after dark," "home alone in the evening or night," and "using public transportation alone after dark," are based on responses only of people who engage in these activities.
E means data should be used with caution due to wide sampling variability.
F means that the estimate is too unreliable to be published.

While the vast majority of men and women overall were satisfied with their personal safety in 2004, considerable gender-specific variations in fear of crime were revealed when specific activities at night were examined. In 2004, feelings of anxiety about being victimized while waiting for or using public transit at night were much more prevalent among women than men—with twice as many women than men worried when relying on public transit alone at night (58% versus 29%). Similarly, women expressed considerably higher levels of fear than men when home alone at night (27% versus 12%) and walking alone after dark (16% versus 6%). For all three situations, women's fear of crime has dropped slightly since 1999, while men's level of fear has remained stable (Table 10-5 below).[40]

Table 10-5. Feelings of safety from crime (%), by gender, Canada, 2004

	MALE	FEMALE
Personal safety (%)		
Satisfied	95	93
Dissatisfied	4	6
Don't know / not stated	1	1
Walking alone in your area after dark (%)		
Safe	94	84
Unsafe	6	16
Being home alone in the evening or night (%)		
Not at all worried	88	73
Worried	12	27
Waiting for or using public transportation alone after dark (%)		
Not at all worried	71	42
Worried	29	58

Source: Statistics Canada. General Social Survey on Victimization, Cycle 18: An Overview of Findings. 2004. Available from http://www.statcan.ca/english/freepub/85-565-XIE/85-565-XIE2005001.htm. Accessed September 9, 2008.

Notes: Figures may not add due to rounding. Data for "walking alone after dark," "home alone in the evening or night," and "using public transportation alone after dark," are based on responses of people who engage in these activities.

Interestingly, although Atlantic Canadians generally felt safer from crime than other Canadians, residents of Halifax were less likely to feel safe walking alone in their neighbourhoods at night than residents of many other Canadian cities. Only 31% of Haligonians felt "very safe" doing so and 41% more felt "reasonably safe," while in St John's 43% felt "very safe," as did 42% in Saint John, 41% in Victoria and Regina, 40% in Calgary, and 36% in Ottawa.[41]

It is interesting to note that perceptions of crime may not be a very good indicator of actual safety from crime. For example, according to the 2004 GSS, although northern residents experienced higher levels of violent victimization than did provincial residents, they were more likely to report feeling safe from crime.[42] In 2004, 54% of northern residents said they were "very satisfied" with personal safety from crime, compared to 44% of residents in the rest of Canada. When asked about whether they employed measures to make themselves safer from crime, (i.e., locking car doors for personal safety when alone in a car, planning a route with safety in mind, or staying home at night), 64% of northern residents reported using such measures on a routine basis, compared to 76% of provincial residents.[43] Yet, residents in all three Canadian territories also experienced much higher rates of police-reported violent crime than did other Canadians.

In addition, despite much higher rates of violent victimization among Aboriginal people, the 2004 GSS found that they have relatively low levels of fear. About 92% of Aboriginal Canadians indicated being satisfied with their safety from criminal victimization, a proportion similar to that of non-Aboriginal Canadians.[44]

The 2007 National Justice Survey (NJS) was conducted by the Department of Justice Canada and sought information about respondents' confidence in the criminal justice system in general, as well as in specific components of the justice system (e.g., police, courts) in particular. The survey was also designed to solicit public attitudes towards criminal justice policies. Finally, the questions were structured in order to "better understand the factors that drive public confidence in the criminal justice system, with a particular emphasis on the relationship between justice policy and confidence."[45]

According to the NJS, Canadians' perceptions and opinions of the criminal justice system were shaped predominantly by TV news (43%) and by friends and family (41%). Government was considered a "highly important" source of information by roughly 27% of respondents, with TV shows and movies trailing at 20%.[46]

The study also asked respondents about their perceived level of safety in their communities compared to other communities; it found that 16.4% believed that their neighbourhood was not as safe as other neighbourhoods in their city, while nearly 43% felt their neighbourhood was safer than others, and 41% felt their neighbourhood was the same as others.

According to the 2004 GSS, nearly six in ten Canadians believe that crime is lower in their neighbourhood than others. In Nova Scotia, 72% felt their neighbourhood was safer than other neighbourhoods, and Atlantic Canadians were generally more likely than other Canadians to perceive their neighbourhoods as safer than others (Table 10-6 below).

Table 10-6. Perceptions of neighbourhood crime compared to other areas (%), Canada and provinces, 2004

	HIGHER	ABOUT THE SAME	LOWER	DON'T KNOW/ NOT STATED
CAN	9	29	59	3
NL	2	10	87	1
PE	F	11	87	F
NS	5	23	72	1
NB	4	23	72	1
QC	7	39	49	4
ON	9	25	62	4
MB	8	28	61	4
SK	9	26	62	3
AB	8	28	61	3
BC	13	29	56	3

Source: Statistics Canada. General Social Survey, 2004. Cycle 18.

Table 10-7. Perceptions of neighbourhood crime compared to five years ago (%), Canada and provinces, 2004

	INCREASED	DECREASED	ABOUT THE SAME	DON'T KNOW/NOT STATED
CAN	30	6	58	7
NL	23	7	68	2
PE	32	4	62	F
NS	28	6	62	4
NB	26	5	64	4
QC	23	8	63	6
ON	31	5	56	8
MB	33	4	56	7
SK	31	4	60	6
AB	35	4	52	9
BC	36	5	50	8

Source: Statistics Canada. General Social Survey, 2004. Cycle 18.

According to the GSS, nearly 60% of Canadians also felt that crime levels in their neighbourhood were unchanged over the past five years. Three in ten thought crime had increased and only 6% that it had decreased. Residents of the Atlantic provinces and Quebec were generally more likely than other Canadians to think that crime levels in their neighbourhoods were unchanged over the past five years, and they were less likely to think they had increased (Table 10-7 above).

According to a Statistics Canada analysis published in *Canadian Social Trends*, Canadians' perceptions of "incivility" in their neighbourhood arise from a number of influences including personal experience, the "tone of media reports about crime," and the stories told by other significant people in their lives.[47] Using data from the 2004 GSS, the study explores the types of "incivilities" Canadians in the 12 largest Census Metropolitan Areas (CMAs) identify as the biggest problems in the neighbourhoods in which they live.

The study examined both *physical* incivilities like excessive litter, abandoned buildings, graffiti, vandalism, and vacant lots, and *social* incivilities like noisy neighbours and loud parties, people "hanging around," people sleeping on the streets, people using or dealing drugs, prostitution, and people drunk or rowdy in public places.

The study reported that 75% of Canadians (aged 15 and over) living in the 12 largest CMAs felt no problems with incivility in their neighbourhoods.[48] In Halifax, 17% of residents perceived *physical* incivility to be a problem in their neighbourhood, slightly more than the 16% average for all 12 CMAs, and considerably more than in Quebec City (8%), Ottawa (12%), Calgary (13%), and Toronto (14%).

As well, one in four Haligonians (25%) reported that at least one type of behaviour (among those listed above) creates a problem with *social* incivility in their neighbourhood—compared to about one in five (21%) in all CMAs. This is the second highest rate in the country after Vancouver (26%), and considerably higher than Calgary and Quebec City (16%), Regina (17%), Hamilton (18%), Winnipeg (19%), and Toronto (20%).

According to Statistics Canada, the six types of social incivility looked at in the study and listed above are often considered "signs of crime":

> These behaviours have been widely used by criminologists to measure social incivilities that reflect the "signs of crime" visible in public places such as parks, boulevards, bus stops, malls, and so on. It is perceptions of social incivility in these shared spaces that are thought to be principal contributors to citizens' feelings of insecurity and fear of crime.[49]

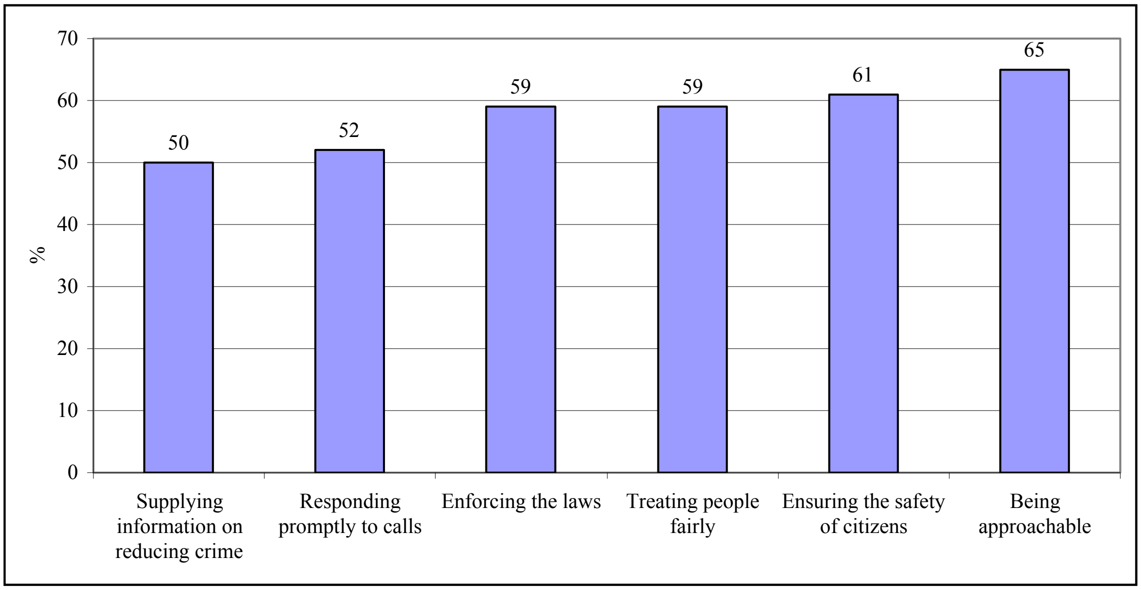
This hypothesis seems to be borne out by the apparent correlation between Halifax's high perceived rate of social incivility on the one hand, and its 23% higher than average rate of police-reported violent crime and #1 ranking among Canadian cities for violent victimization, as reported in the GSS, on the other hand. In general, it is noteworthy that residents of Canada's 12 largest CMAs more often reported that social rather than physical incivility was a problem. The evidence as a whole points to the importance of considering subjective perceptions as well as objective data as determinants of wellbeing and quality of life, and clearly indicates the connection between the two types of evidence.

Perceptions of physical and community safety are also influenced by the confidence people feel in law enforcement institutions and processes. While time and space do not permit here a detailed examination of Canadians' perceptions of the criminal justice system, we conclude this section by noting that six in ten Canadians felt that, overall, the local police were doing a good job of ensuring the safety of citizens.

Again, it is noteworthy that residents of Atlantic Canada and Quebec rated their police considerably more highly than other Canadians—with 66% of those in Newfoundland and Labrador, New Brunswick, and Quebec and 63% of Nova Scotians and Prince Edward Islanders agreeing that the "local police force does a good job ensuring the safety of the citizens in your area," compared to just 54% in British Columbia and 55% in Manitoba and Saskatchewan, and to 60% in Alberta, 62% in Ontario, and 61% nationwide.[50]

Approval ratings for specific police functions, as reported in the 2004 GSS, are indicated in Figure 10-10 below.

Figure 10-10. Perceptions about local police (%), Canada, 2004



Source: Statistics Canada. General Social Survey, 2004. Cycle 18.

10.4. Domestic violence

Data sources: Statistics Canada, Canadian Centre for Justice Statistics: Incident-based Uniform Crime Reporting Survey (UCR2), Annual; General Social Survey, 1999 and 2004.

Result: The rate of police-reported spousal violence in Canada peaked in 2000 but since then has steadily decreased.

According to 2004 Uniform Crime Reporting (UCR) data, across Canada, men commit about five times more crime than women. For violent crimes the male–female ratio is nearly 5.2:1.[51] Yet, in 2004, women represented 51% of all victims of violent crime reported to police (up from 49% in 1998). Among victims of violent crime, more than half of women (53%) were victims of common assault, another 13% were victims of sexual assault, 11% were victims of an assault with a weapon causing bodily harm, 10% were victims of criminal harassment, and 8% were robbery victims.

Women are also much more likely than men to be victimized by someone they know. In 2004, 70% of assailants in violent incidents against women were relatives or acquaintances, while this was true in 46% of violent acts committed against men. Women have most to fear from their families—40% of female victims (compared to just 8% of men) were attacked by someone with whom they had a relationship at one point through marriage or dating, another 8% of women (and just 5% of men) were victimized by family members other than a spouse or dating partner, and 8% of women and 10% of men were attacked by a close friend or acquaintance.[52]

According to the 1999 and 2004 General Social Surveys (GSS) on Victimization, there was little change in the overall rate of spousal violence reported by women (aged 15 and over) in those five years (7% in 2004 compared to 8% in 1999).[53] Interestingly, relatively equal proportions of women and men (7% and 6%, respectively) had experienced some form of physical or sexual violence by a common-law or marital partner in the five years prior to the 2004 survey. Of these, 57% of female victims and 49% of male victims had experienced more than one incident of spousal abuse in the previous five years, and women were more likely than men to report experiencing ten or more such violent attacks.

However, these overall averages conceal the fact that the types of spousal violence are very different, and that the impact of such violence on women tends to be far more serious. For example, 23% of women who experienced spousal violence reported that they were beaten, choked, or threatened with or had a gun or knife used against them, compared with 15% of their male counterparts. As well, 16% of female victims reported they had been sexually assaulted, compared with a statistically insignificant share of male victims. Male victims were more likely to report they had been kicked, bitten, hit, or hit with something (34% versus 10%).[54]

The 2004 GSS data also indicated that women were much more likely than men to suffer physical injury (44% versus 19%) as a result of the violence, and to require medical attention (13% versus 2%, respectively). Female victims of spousal violence were also more than three times more likely than male victims to fear for their lives (34% versus 10%). In 2004, nearly half of all female victims of spousal violence (47%) turned to a social agency for support, compared to only 20% of male victims.

Despite the continuing high rate of spousal violence in 2004 (7% for women), this is actually 40% lower than the rate reported in 1993 (12%) and slightly lower than the rate reported in 1999 (8%).[55] The difference is likely related to the recession and higher unemployment rates that prevailed in the early 1990s, as chronic unemployment of a male partner is a documented risk factor and predictor of wife assault.[56]

An annual Statistics Canada report, titled *Family Violence in Canada: A Statistical Profile*, provides important details, based on police-reported UCR2 survey data,[57] on the magnitude of family violence and on various types of family violence, including spousal abuse, child abuse and neglect, and violence against elderly family members. It reports on the nature and severity of injuries, on the incidence of reporting of crime, on the characteristics of both victims and perpetrators, and on socio-economic and demographic risk factors.[58]

According to police-reported crime data, there were 28,000 incidents of spousal violence reported to police nationwide in 2004—84% involving female victims and 16% involving male victims. Rates of police-reported spousal violence increased for both males and females from 1998 to a peak in 2000, but since then have steadily decreased (see Figure 10-11 below).[59] According to Statistics Canada, the recent downward trend in spousal violence is reflected in the decrease in overall violent crime rates in the country. Also, the rate of lethal spousal violence declined for the third consecutive year in 2004.

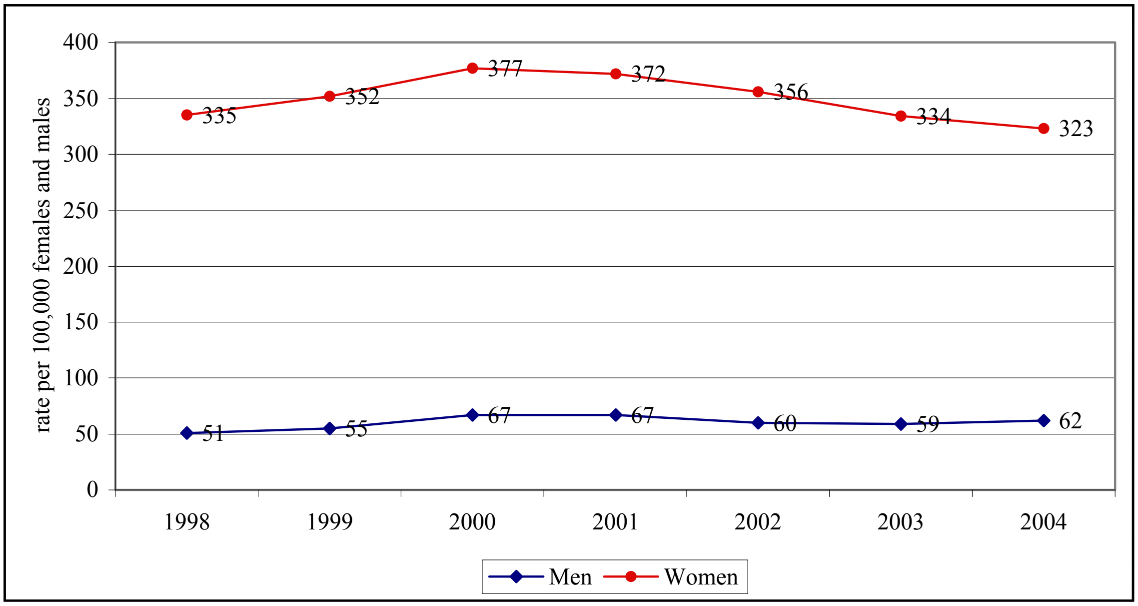
Statistics Canada attributes the recent declines in spousal violence in general to "increased awareness, increases in social services such as shelters, and better responses by police and the courts."[60] In addition, as noted above, unemployment is a proven risk factor for wife assault,[61] so the decline in spousal violence in recent years is also likely related to improved employment rates nationwide. Conversely, the present economic crisis and impending recession, which is likely to result in serious job losses, may predict an upswing in the incidence of spousal violence in the coming months and years.

According to Statistics Canada, the 2004 police-reported UCR results are consistent with the 2004 GSS victimization results that include unreported crime. Both data sources show that women are more likely than men to experience repeated spousal violence, and that women are more likely to report that they were violently targeted more than ten times in the previous five years.

According to 2004 GSS on victimization, Aboriginal people were three and a half times as likely as non-Aboriginal people to be victims of spousal violence. Overall, 21% of Aboriginal people—24% of women and 18% of men—said they suffered violence from a current or previous partner in the five-year period prior to the 2004 survey. This compares to 6% among non-Aboriginal people.[62]

Aboriginal victims of spousal violence were also more likely to sustain injuries and to fear for their lives as a result of violence by a spouse or common-law partner than were non-Aboriginal victims.

Figure 10-11. Rates of police-reported spousal violence, incidents per 100,000 females and per 100,000 males, Canada, 1998–2004



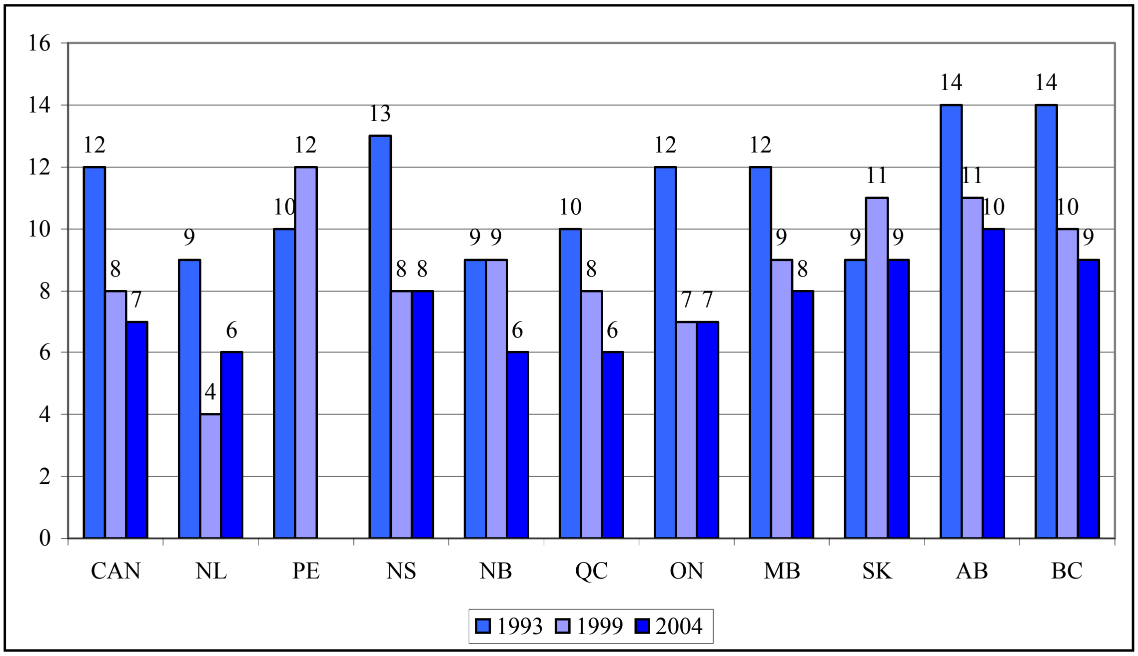
Source: Canadian Centre for Justice Statistics. 2006. Family Violence in Canada: A Statistical Profile, 2006. Statistics Canada. Available from http://dsp-psd.tpsgc.gc.ca/Collection/Statcan/85-224-X/85-224-XIE2006000.pdf. Accessed September 11, 2008.

Notes: Results are based on data from 68 police departments, representing 37% of the national volume of crime in 2004, and are extrapolated nationally from these data. Rates are calculated per 100,000 population aged 15 years and older by sex for the geographic areas policed by the subset of UCR2 police respondents. In other words, rates of spousal violence against women are calculated per 100,000 women 15 and older, and rates of spousal violence against men are calculated per 100,000 men 15 and older.

As seen in Figure 10-12 below, rates of spousal violence against women decreased or stayed the same in all provinces between 1993 and 2004.[63] As with other crime categories, the rate of spousal violence has generally been higher in the west in all years, with the highest rates reported in Alberta, British Columbia, and Saskatchewan. The lowest rates of spousal violence are in Newfoundland and Labrador, New Brunswick, and Quebec. Between 1999 and 2004, Nova Scotia's rate of spousal violence remained stable at 8% (Figure 10-12).

It should be noted that Aboriginal women in Canada have traditionally reported much higher rates of spousal violence than non-Aboriginal women. In 2004, Aboriginal women were three times as likely as non-Aboriginal women to have been assaulted by a current or former spouse during the five-year period prior to the survey in 2004—21% (down from 25% in 1999) versus 7%.[64]

Figure 10-12. Spousal assault rates for women in the past five years (percent of all women 15 and older), Canada and provinces, 1993, 1999, and 2004



Sources: 1993 and 1999 data: Canadian Centre for Justice Statistics. 2001. Family Violence in Canada: A Statistical Profile, 2006. Statistics Canada. Original 1993 data from Violence Against Women survey and 1999 data from General Social Survey 1999. 2004 data: Canadian Centre for Justice Statistics. 2005. Family Violence in Canada: A Statistical Profile, 2005. Statistics Canada.

Notes: Results are statistically significant for all provinces except Prince Edward Island, New Brunswick, Manitoba and Saskatchewan. 2004 data for Prince Edward Island were too unreliable to be published by Statistics Canada due to very wide sampling variability.

According to the 1999 and 2004 GSS, there has been no major change in the level of reporting by victims of spousal violence to the police. In 1999, 27% of respondents (including both men and women) who self-reported being victims of spousal violence reported going to the police, compared to 28% in 2004. Among victims of spousal violence, women were more likely than men to report the incident to the police—36% versus 17% in 2004, and 37% versus 15% in 1999.[65]

Clearly, reporting to police remains severely inhibited by the secrecy and shame that still surround domestic violence, by the frequent economic dependency of the victim on the perpetrator, by the fear of repercussions, and by lack of knowledge. However, Statistics Canada notes that, overall, there has been an increase in reporting spousal violence to police since the early 1990s, which may be due in part to:

> a reduction in the social stigma of being a victim of spousal violence and seeking help, increased public awareness, improved training of police- and court-related victim support

services, and, consequently, increased public confidence in the ability of the criminal justice system to deal effectively with spousal violence cases.[66]

Statistics Canada recently studied the differences between those who reported spousal violence and those who decided not to contact the police. Among the study's findings are the following:[67]

- The strongest predictor for whether or not a victim chooses to report to the police is the severity of the incident. When the abuse resulted in an injury, 50% of injured female victims and 43% of injured male victims reported the attack to the police.
- The majority of men and women who do report to the police do so to stop the violence from continuing (88% of female victims and 77% of male victims).
- The main reasons given by victims for not reporting spousal abuse were that they did not want anyone to find out about the violence (36%), they wanted to deal with the violence in some other way (21%), and they felt that it was a personal matter which did not concern officials (14%).
- Those who have left an abusive relationship are more than twice as likely to have contacted police as those who continue to live with the abusive spouse or partner (38% versus 15%).
- There is a clear inverse age gradient among women reporting spousal violence, with young females, aged 15-24, most likely to report spousal violence to the police (50%), compared with those 25-34 (43%), and those 35 and older (36%).
- Indicating inverse relationships to both age and income, female victims with less than a high school education are more than twice as likely to report the violence to the police (55%) than those who had completed university (23%).
- In the case of spousal violence against women, police are also more likely to be contacted if the victim is an Aboriginal person.
- Reporting rates are 2.5 to 3 times higher for both men and women who fear for their lives compared to those who do not.
- Notifying the police is more likely if children witnessed the violence (51% versus 30%). Police reporting rates are lowest among women who have no children (25%).
- The use of alcohol by an abusive partner increases the likelihood of the victim contacting the police.
- Rates of police reporting do not seem to be influenced by rural–urban residency.

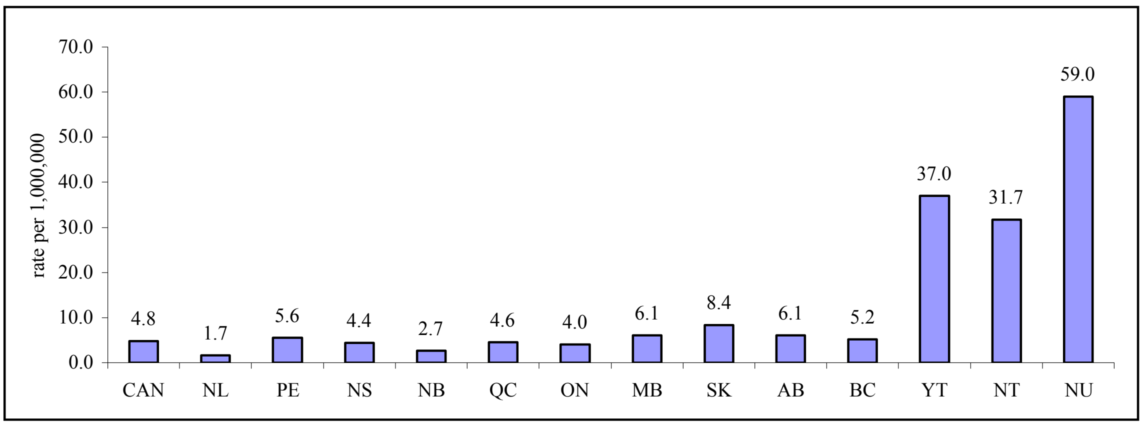
Clearly, the most serious form of spousal violence is homicide. In such cases, it is not uncommon for the suspect to commit suicide following the murder. Between 1961 and 2004, there were a total of 873 spousal homicides in Canada in which the chargeable suspect committed suicide—an average of about 20 such spousal murder-suicides a year nationwide. Of these cases, wives were the victims in 97% of the cases, and husbands were the victims three times out of a hundred.

The rate of spousal homicide for both men and women has declined sharply since the mid-1970s. Women in 2004 were 57% less likely to be killed by their partners than in 1974—with a decline from 16.5 victims per million women in spousal relationships to 7.1 per million. The rate for male victims dropped by 68% from 4.4 per million men in spousal relationships to 1.4 per million.

Possible explanations for this sharp decrease in spousal homicide rates, particularly among female victims, include "increased gender equality, changes in police and court policies towards spousal violence and an increase in services for persons experiencing family violence such as specialized domestic violence courts and emergency shelters for abused women."[68]

Following the regional patterns already observed for overall crime, homicide, and violent crime rates in Canada, Figure 10-13 below illustrates that spousal homicide rates also generally tend to be lower in the eastern provinces than in the western provinces, and are very much higher in the northern territories than in the provinces.

Figure 10-13. Spousal homicide rates per 1,000,000 population, Canada, provinces, and territories, average 1995–2004



Source: Canadian Centre for Justice Statistics. 2006. Family Violence in Canada: A Statistical Profile, 2006. Statistics Canada. Table 4.3. Available from http://dsp-psd.tpsgc.gc.ca/Collection/Statcan/85-224-X/85-224-XIE2006000.pdf. Accessed September 11, 2008.

Notes: Rate per 1,000,000 legally married, common-law, separated, and divorced spouses, 15 years of age and older. Nunavut officially became a territory in 1999, so data for Nunavut are from 1999–2004.

Figure 10-13 above indicates that spousal homicide rates over the ten-year time period from 1995 to 2004 were lowest in the Atlantic provinces (with a combined average of 3.3 cases per million spouses). Ontario and Quebec reported comparable rates of spousal homicide during the same time period (4.0 and 4.6, respectively). Rates in the four western provinces were higher—with Saskatchewan reporting the highest average rate at 8.4 spousal homicides per million spouses followed by its neighbouring provinces of Manitoba and Alberta (6.1 each), and British Columbia at 5.2. The spousal homicide rates in the territories far exceeded the provincial rates with 59 per 1,000,000 in Nunavut, 37 in the Yukon, and 31.7 in the Northwest Territories.[69]

Domestic Violence against Children and the Elderly

Any discussion about family or domestic violence is incomplete if it does not also address violence against children and the elderly. It should be noted that these incidents are very frequently under-reported because they generally take place within the privacy of the home and involve victims who are dependent on their abusers and fear the consequences of talking to anyone about it.[70]

On an annual basis since 1998, Statistics Canada has provided important details on the incidence and nature of these forms of violence, based on police-reported data.[71] The findings include:

- In 2005, the rate of police-reported sexual assault against children and youth was over five times higher than it was for adults (206 child and youth victims per 100,000 children and youth compared to 39 adult victims per 100,000 adult population). Conversely, rates of physical assault against children and youth were slightly lower than physical assault rates against adults. In 2005, there were 563 physical assault victims for every 100,000 children and youth, compared to a rate of 637 for adults.
- Children and youth under the age of 18 were at the greatest risk of being physically or sexually assaulted by someone they knew. Thus, in 2005, the rates of police-reported physical and sexual assault were highest when the accused was a friend or acquaintance (348 per 100,000), followed by a family member (200 per 100,000) or a stranger (120 per 100,000).
- In 2005, nearly four in ten child and youth victims of family violence sustained a physical injury (37%)—with male victims more likely to sustain injuries than female victims (44% versus 33%).
- The rate of police-reported sexual assault against children and youth by a family member increased by 15% between 2003 and 2005. Similarly, rates of physical assault also showed an increase (8%) in that time period. However, rates of sexual assault by a non-family member remained unchanged from 2003 to 2005 (119 incidents per 100,000 population), and the rate for physical assault by a non-family member fell 10% during the same time period.[72] It is unclear whether the increase in police-reported sexual and physical assault against children and youth by family members in recent years is the result of increased incidence or higher reporting rates to police in an area that was previously considered more taboo.
- According to the Homicide Survey, there were 60 homicides committed against children and youth in Canada in 2005, with more than one-third of these committed by family members. More than seven in ten (71%) family-related homicides against children and youth were committed by parents—with fathers more likely than mothers to be the perpetrators.
- Between 1996 and 2005, 56% of children and youth killed by a family member were killed by their fathers, 33% by their mothers, and the remaining 11% by other family members (including siblings, grandparents, cousins, or other extended family).
- Of the 1,990 solved homicides of children and youth recorded by police in Canada between 1974 and 1999, family members were responsible for 63% of the deaths. The remaining solved homicides against children and youth were committed by acquaintances and strangers (27% and 10%, respectively).

- Overall, the rate of family-related homicide against children and youth has fluctuated since 1974. However, between 2004 and 2005, the rate of child and youth homicide by family members decreased by 38% (13 fewer homicides) to just over 3 homicides per million children and youth—the lowest rate in 31 years. In 1999, the rate of homicides against children and youth by family members was 4 per 1,000,000 children and youth in the population.

In 2007, seniors (aged 65 and older) made up 14% of the Canadian population (up from 12% in 1996). According to police-reported data, seniors have the lowest risk of victimization of any age group, representing only 2% of all victims of violent offences in 2005, or a rate of 160 violent incidents per 100,000 seniors (172 per 100,000 for senior men and 114 per 100,000 for senior women). Trend data show that, between 1998 and 2005, the overall rate of police-reported violence against seniors increased by 20%. The rates increased between 1998 and 2000, then declined for three years, and then increased again between 2003 and 2005.[73]

As with all victims of crime, police-reported data show that, in 2005, senior victims were more likely to experience violence at the hands of someone they knew (88 per 100,000) than at the hands of a stranger (51 per 100,000). Of perpetrators known to the victim, friends or acquaintances were the most common, followed by their adult children and current or former spouses. However, in all categories, seniors are much less likely than their younger counterparts to have been victimized—whether by a stranger (51 compared to 318 per 100,000), by a family member (42 compared to 279 per 100,000), or by a friend or an acquaintance (38 compared to 431 per 100,000).[74]

As with spousal and child abuse, it is likely that only a small fraction of elder abuse ever comes to the attention of police or the justice system. As noted by the Canadian Centre for Justice Statistics:

> Older adults may be reluctant to report abuse and maltreatment to police due to emotional, physical, or financial dependence on the abuser or simply because of embarrassment that the abuse is taking place, especially if the abuser is an adult child. Fear may also contribute to the secrecy of the abuse if the older adult is being threatened with institutionalization.[75]

Among seniors were who were victims of violence in 2001, 38% of older female victims and 21% of older male victims were victims of family violence. There were 49 reported victims of family-related violent crime for every 100,000 older women in the population, while the rate for older men was 40 per 100,000.[76] In 2005, 42 per 100,000 seniors were victimized by a family member.[77]

Unfortunately, reliable provincial time-series data on family violence and abuse against children, youth, and seniors are not readily available at this time, so it is not presently possible to report whether rates in these areas are increasing or declining in Nova Scotia. However, these indicators, including changes in reporting rates, should be regularly tracked, monitored, and publicly reported at the provincial level.

It must be emphasized, as noted at the start of this chapter, that physical safety is one of most fundamental conditions of wellbeing. The family, in particular, is often regarded as a core source of safety, security, protection, and support. When that trust is broken, and when the family itself becomes a source of violence and abuse, health and wellbeing are inevitably compromised. For this reason, crime in general, and family violence in particular, are key components of the Genuine Progress Index that must be monitored regularly, with declines in both these areas clearly signifying improvements in wellbeing.

10.5. Economic costs of crime in Nova Scotia

The following section begins by addressing the cost of direct economic losses due to crime.[78] However, monetary estimates of direct economic costs clearly convey only a small part of the true costs of crime, which include psychological costs—particularly those associated with trauma or violence, pain and suffering, and fear and insecurity. For example, aside from trauma experienced directly by crime victims, enormous long-term suffering, loss, anxiety, and grief may also be experienced by the family and friends of victims of murder, rape, aggravated assault, and other serious attacks.

There are also numerous indirect costs associated with crime, including loss in property values, the expenses associated with moving from a high-crime neighbourhood to one perceived to be safer, and the loss in potential investment or tourism in areas where the likelihood of crime and personal loss is high. Fear of violence, personal violation, or theft may also restrict movement and reduce economic activity. There is also an economic opportunity cost to foregone activities, and to the time and effort devoted to replacing stolen possessions, producing and installing security devices, and recovering from crime. Because these and other indirect costs are not counted in the following cost estimates, the losses described below clearly understate the full economic impact of crime.

The first set of cost of crime estimates below are referred to here as "conservative," not only because they exclude a wide range of indirect costs such as those noted above, but also because they exclude all costs associated with the emotional pain and suffering that frequently result from crime. These conservative cost estimates include only:

- Those direct victim losses due to property crime and violent crime that are calculable in monetary terms
- Public expenditures on police, courts, and prisons
- Individual defensive expenditures on security devices, crime prevention, and theft insurance

Despite the limitations of conservative monetary estimates of crime costs noted above, the trends in victim losses, public expenditures on justice, and defensive expenditures over time may provide at least a partial indicator of the economic impact of changes in the crime rate. They also demonstrate clearly that a decline in personal security and quality of life due to crime directly lowers our economic standard of living, since at least a portion of these crime-related expenditures could be invested in other more productive projects and programs designed to enhance wellbeing and quality of life if crime rates dropped. Economic cost estimates also demonstrate the absurdity of adding these crime-related costs to our official estimates of economic wellbeing and prosperity, and of assuming that any kind of growth signifies an increase in prosperity.

In 1985, the Solicitor General of Canada gave several important reasons to measure the costs of crime in economic terms—reasons that are still applicable today:

> Information on the cost of crime can serve several purposes:
>
> a. Cost data allow a complementary and, in some cases, a particularly meaningful way of quantifying the amount of crime in society;
> b. By reference to such concepts as gross national product or constant dollars, cost data allow standardized historical comparisons of crime and the response to crime;
> c. Cost data allow important comparisons between criminal justice and other basic social expenditures; and
> d. Cost data allow comparative cost–benefit analyses to help evaluate social programs and contribute to social policy development . . . .
>
> Until we link social issues to some economic cost concept, until we know more about the cost of crime to society, to victims, and indeed to criminals, we will be unable to answer our ethical questions to our own satisfaction. That is, ethical choices about crime demand knowledge about the consequences of crime.
>
> Obviously, questions of efficiency demand cost information. But so too do the more fundamental questions about whether social programs and policies are working. If we think they are "working," we still want to know at what price. When we wish to choose among beneficial programs, we will also want to know their relative cost.
>
> Social policy and program development would benefit from knowledge about which crimes cause the greatest losses and which the least, and which groups or categories of people suffer the most heavily.[79]

Because of the severe limitations inherent in the conservative cost estimates described above, we also attempt to construct a more "comprehensive" estimate of crime costs based on the following additional five categories of losses that are not included in the conservative estimates:

- *Unreported crimes*: The conservative estimate counts only those losses associated with police-reported crimes, while the comprehensive estimate uses data from victimization surveys to include estimated losses due to unreported crimes.
- *Unpaid work losses*: The conservative estimate includes only economic losses to the market economy, and excludes any productivity losses due to the disruption of lives outside the

workplace. Because the Genuine Progress Index values unpaid as well as paid work, Statistics Canada estimates of the hourly value of unpaid work will be used here to estimate losses of civic and voluntary work and household production due to crime.

- "*Shrinkage*": Reports from the retail trade industry are used to estimate inventory losses due both to employee theft and to consumer shoplifting. As these costs are typically passed onto the consumer in the form of higher prices, they represent actual out-of-pocket costs attributable to crime and borne by consumers.
- *Insurance fraud*: Reports from the insurance industry are used to estimate the additional amount paid by consumers in the form of higher premiums due to fraudulent claims against insurance companies. Since such fraud is classified as criminal activity, these higher than necessary premium payments can also be attributed to crime.
- "*Shattered lives*": Court awards for grief and suffering are used to approximate the human and psychological costs of crime that cannot be captured in a simple economic cost analysis.

Even this comprehensive estimate does not include indirect costs like those described above, and, therefore, should also be seen as an underestimate of the true and full costs of crime.

In the following, economic costs and potential savings (where appropriate) are provided for each of the listed crime cost categories. From the GPI perspective, which distinguishes economic activity that causes benefit from that which causes harm, any savings from lower crime rates would be available for more productive purposes such as investments in education, public health, conservation, recreation, and other activities that enhance wellbeing and quality of life.

10.5.1. Conservative estimate[80]

10.5.1.1 Direct victim losses due to property crime

Many losses due to property crime are uncompensated and borne entirely by the victims of the crime. To the extent that they are compensated by insurance claims, the cost is borne by society in the form of theft insurance premiums. Property crimes included in the following cost estimates are theft, mischief, break and enter, motor vehicle theft, robbery, and fraud.

As previously mentioned, Nova Scotia's property crime rate has been declining since the early 1990s—after peaking in 1991—and has been consistently lower than the Canadian rate. However, in recent years the gap between Canadian and Nova Scotian property crime rates has narrowed, and in 2007, there were 3,320 property crimes per 100,000 population in Canada compared with 3,072 per 100,000 population in NS.

In 1985, the Solicitor General of Canada for the first time provided average per incident estimates of victim economic losses due to crime, based on survey data. Extrapolating from these original financial loss per crime estimates from the Solicitor General and from the latest Uniform Crime Reporting (UCR) survey, the direct victim losses due to property crime in Nova Scotia can be estimated to total $95.6 million in 2007—down from $128 million in 1997 (all figures in

$2007). In other words, in constant 2007 dollars, it can be estimated that the drop in the province's property crime rate over the last decade resulted in a decline in annual financial losses attributable to property crime of more than $32 million in 2007.

In 2007, property crime rates were 25% lower that rates in 1997. However, if property crime rates had remained at 1997 levels (i.e., had property crime rates not declined), the cumulative additional cost in victim losses over the decade would have been $146 million ($2007) higher. In other words, the decline in the property crime rate in Nova Scotia resulted in a cumulative savings of $146 million in avoided victim losses.

While the property crime rate in Nova Scotia in 2007 was the lowest it has been in the last 30 years, it still remains significantly higher than rates of 35 and 45 years ago—2.6 times higher than the rate in 1962 and 1.5 times higher than the 1972 rate.[81] If the property crime rate continues to decline to 1960s levels, avoided victim losses (or savings) will clearly be even greater.

10.5.1.2 Direct victim losses due to violent crime

Three types of victim losses due to violent crime can be measured in monetary terms: direct monetary losses due to assault and sexual assault, hospitalization costs, and productivity losses. Clearly these do not come close to measuring the actual costs of violent crime, including the pain and suffering it engenders; therefore, these three cost categories must be regarded as a substantial underestimate of the actual costs associated with violent crime.[82]

Direct victim monetary losses due to assaults and sexual assaults

Extrapolating from 1985 data from the Solicitor General's report on crime costs—the only publicly available source of per incident losses due to violent crime—and from 2007 police-reported data, the direct financial losses in money and possessions stolen from victims of assault and sexual assault in Nova Scotia in 2007 can be estimated at $750,000—down from an estimated $860,000 in 1997 ($2007). The decline could be attributed to the the dramatic 41% decline in the number of reported sexual assaults (from 1,191 in 1997 to 702 in 2007) and a slight (5%) decrease in the number of assaults (from 9,734 in 1997 to 9,247 in 2007).

Cost of hospitalization due to violent crime

The cost of hospitalization due to violent crime has increased by almost two-thirds in the last decade. This increase has occurred entirely because of the sharp increase in real (inflation-adjusted) health care costs in the province, since the number of violent crimes has actually fallen in the last ten years. Based on Nova Scotia health care cost figures, UCR data, and the Solicitor General's estimated ratio of hospitalizations per violent crime, the hospitalization costs due to violent crime are estimated to be $3.3 million for 2007—up from $2 million a decade ago.[83]

Lost potential economic production due to homicide

Between 1997 and 2007, the homicide rate in Nova Scotia declined from 2.6 per 100,000 to 1.4 per 100,000. In 1997, there were 24 homicides in the province, compared with 13 in 2007. The lost productive capacity due to homicide is, therefore, assumed to have decreased proportionately in the ten-year period due to this decline in homicides. In actual fact, however, the number of people who would have been in the Nova Scotia workforce in 2007 but for murder is not known, since this calculation requires knowing the age of every homicide victim in Nova Scotia for several prior decades—a painstaking research exercise that was undertaken for the original 1999 GPI *Cost of Crime* report but not replicated here due to time and resource constraints—in order to calculate the number of prior homicide victims who would have been aged 16-65 in 1997 and, therefore, in the workforce at that time. As a proxy, the ratio between the 1997 and 2007 homicide rates is used in this calculation.

This methodology is far from perfect, and likely seriously underestimates actual productivity losses due to homicide, since the 2007 production losses will also still reflect higher prior homicide rates. Here however, lost production due to homicide simply reflects the downward trend in homicide in the province in the last ten years alone.[84] In actual fact, the lower 2007 homicide rate in Nova Scotia will be reflected in future avoided production losses in subsequent years, while the 2007 production losses attributable to homicide reflect not only this year's homicide losses but those of many prior years even far pre-dating 1997. For example, if a 16-year-old was murdered in 1970, the 2007 production losses would still include his absence.

Based solely on the ratio between the 1997 and 2007 homicide rates, however, the productive capacity lost to homicide in 2007 in Nova Scotia is estimated here to be $16.3 million, down from $29.3 in 1997 (all figures in constant $2007).[85]

Lost production due to absenteeism resulting from criminal attack

In 2007, absenteeism due to criminal attack is estimated to have cost the Nova Scotia economy $6.3 million in lost production, with little change since 1997. This figure is based on the police-reported data (UCR), on the Solicitor General's survey that found that 25% of crime victims are absent from work as a result of victimization, and on the 2007 GDP per capita. Based on the Solicitor General's 1985 crime cost report, for every 100 criminal code incidents, victims spent 3.15 days in hospital and missed 25.3 days of work. These ratios have been applied to the total number of police-reported (UCR) criminal incidents in Nova Scotia in 2007 to calculate the hospitalization and absenteeism costs in these cost estimates.

Though the productivity cost of absenteeism due to crime in Nova Scotia is here estimated to have been the same for both 1997 and 2007, there was a change in the breakdown of the composite figures. Productivity losses due to absenteeism were adjusted for higher GDP levels in 2007 (as output per worker in 2007 was higher than in 1997). That increase in GDP drove the increased per victim cost attributable to crime-related absenteeism despite the drop in crime rates. Based on the Solicitor General's report, for every 100 criminal code incidents, victims spent 3.15 days in hospital and missed 25.3 days of work. This has been applied to the total number of police-reported (UCR) criminal incidents in Nova Scotia in 2007.

10.5.1.3 Public justice costs

Expenditures on police, courts, and prisons are taxpayer costs that are the direct consequence of criminal activity. In other words, without crime these institutions would not be required. More crime translates into more spending on police, lawyers, courts, and prisons, which in turn appears in the GDP as economic growth. From the GPI perspective, less crime and lower public justice costs are positive signs, which translate into taxpayer savings available for health care, education, and other activities that improve wellbeing and quality of life. For this reason, public justice costs (spending on police, courts, and prisons) are here counted as a cost of crime.

Police expenditures, including Nova Scotia's share of RCMP expenditures

According to the Canadian Centre for Justice Statistics, the number of police (including RCMP officers) in Nova Scotia increased from 1,582 in 1999 to 1,758 in 2007.[86] This overall trend towards higher rates of policing holds true for all provinces and territories in Canada. The increase in police personnel has resulted in an increase in police expenditures. In Canada overall, 2006 marked the tenth year in a row that spending on police went up, totalling roughly $10 billion ($2007) nationwide in 2006, or $300 per Canadian.[87]

In real terms, the cost of municipal and provincial policing in Nova Scotia in 2006 amounted to approximately $180 million. However, Nova Scotians also contributed to non-provincial RCMP expenditures through their federal tax dollars. Based on the provincial share of the national population in 2007, this portion can be estimated to amount to $59 million.[88] When the federal share of police expenditures is included, therefore, Nova Scotians can be estimated to have paid a total of $239 million for policing costs. The cost of policing in Nova Scotia has risen by a third in the last decade. In 1997, the cost of policing totalled $179 million, or $60 million less than 2007 (all costs in constant $2007).

The increase in police expenditures at a time of falling crime rates raises some interesting questions that could not be properly investigated or answered here: to what extent do these increased expenditures constitute an investment in reducing crime, and to what extent might the drop in crime be related to improved policing? Hopefully, further studies will examine this inverse correlation more closely.

Criminal court costs

Between 1996 and 2005, there was a 16% decline in the rate of adults charged. This corresponds with a decline in the number of court cases processed in the decade.[89]

According to a recent (2008) analysis from the Canadian Centre for Justice Statistics (CCJS):

> the adult criminal court data have remained quite stable over time. However, it is important to note that despite a long-term decline in the number of charges laid by police, those cases that appeared in court were more complex, required more appearances and took longer to dispose of. These factors likely played a significant role in the decline in the number of cases being completed in adult criminal courts over the last several years.[90]

Because we are not able to assess such increased complexity in criminal court proceedings in Nova Scotia, or to assess how much longer the average trial is taking, the criminal court cost estimate presented here is based solely on the decline in the actual number of court cases in the province. If the 2008 CCJS analysis cited above applies to Nova Scotia, the 2007 estimate presented here is likely an underestimate. Based on the significant decline in the number of adult criminal court cases in the province—11,685 in 2006/2007 compared to 17,325 in 1997/1998—it may be surmised here that the cost of courts, legal aid, and prosecutions could potentially have fallen by up to a third since 1997, provided the cost per case did not increase in real terms. Again, based solely on changes in the number of cases heard, and taking no account of potential increased complexities and per case costs, it might be estimated that the total cost of the criminal court system in Nova Scotia today might be approximately $33.3 million compared to nearly $50 million in 1997.[91]

Corrections

According to the CCJS, there was a shift between 1996/1997 and 2005/2006 in the composition of those admitted to provincial or territorial custody in Canada. A decade ago, adults remanded to custody to await a court appearance (not yet convicted or sentenced) and adults admitted to serve a sentence represented roughly equal proportions of all admissions to custody. In 2005/2006 (most recent data available), remanded admissions represented 63% of all admissions. Thus, the number of adults admitted to non-sentenced custody (remand) or other temporary detention increased by 22% in the decade, while admissions to provincial / territorial sentenced custody fell by 28%.[92]

In Canada in 2005/2006, total nationwide expenditures on adult corrections were approximately $3 billion ($2007) or $93.50 per Canadian.[93]

In 2006/2007, the proportion of offenders sentenced to prison after being tried in adult court cases varied widely by province and territory. The highest rate of incarceration following trial was in Prince Edward Island, where 55% of guilty cases resulted in a prison term, while Nova Scotia and New Brunswick both had the lowest rates of incarceration in the country at 25% of guilty cases—less than half the proportion in neighbouring Prince Edward Island. The Canadian average was 34%.[94]

The cost of corrections in Nova Scotia has remained relatively constant over the last decade at about $93 million ($2007). These costs consist of $32 million for provincial jails, $53.5 million for federal penitentiaries,[95] and $7.5 million for youth facilities.[96]

10.5.1.4 Private defensive expenditures

Defensive expenditures in this context are those undertaken by households and businesses to protect themselves against crime. Such expenditures are called "defensive" because they do not contribute to welfare in a positive sense, but are designed to guard against any decline in security and wellbeing or to compensate for a past decline. The public costs described in the previous section can also be viewed as defensive expenditures, but this section focuses on private spending on locks, burglar alarms, surveillance systems, security guards, and theft insurance premiums for the purpose of crime prevention, detection, and compensation.

Defensive expenditures increase in direct response to fear of crime and to subjective perceptions of the likelihood of crime, as well as to objective changes in the crime rate itself, and can, therefore, be seen as an important indicator of public perceptions of personal security.

Once again, our conservative definition of costs is confined to monetary expenditures only. Fear of crime can clearly produce defensive behaviour as well as defensive expenditures. Restricting one's movements by staying home at night, or taking a taxi instead of walking in the dark may be reactions to the fear of crime that have a direct impact on quality of life, and which produce indirect costs that are not measured here.

As previously noted, Statistics Canada's 2004 GSS found that satisfaction with personal safety has increased since 1993 and now stands at 94% of the Canadian population aged 15 years and over—up from 86% in 1993 and 91% in 1999. In Nova Scotia, 95% reported they were satisfied with their safety in 2004, with the Atlantic provinces generally reporting higher levels of satisfaction with safety than other provinces.[97]

While, overall, the vast majority of Canadian men and women were satisfied with their personal safety in 2004, considerable gender-specific variations in fear of crime were revealed when specific activities at night were examined. In 2004, feelings of anxiety about being victimized while waiting for or using public transit at night were more prevalent among women than men—with twice as many women as men nationwide worried when relying on public transit alone at night (58% versus 29%). Similarly, Canadian women expressed much higher levels of fear than men when home alone at night (27% versus 12%) and walking alone after dark (16% versus 6%). For all three situations, women's fear of crime has dropped slightly since 1999, while men's level of fear has remained stable.[98]

The decline in private defensive expenditures seen below reflects the improved satisfaction with personal safety and the reduced fear of crime indicated above.

Home security systems

Expenditures on private defensive equipment like burglar alarms and other security systems in Nova Scotia have fallen by 18% in the last decade. In 2007, Nova Scotians spent $46 million on these items—roughly $10 million less than what they spent in 1997, as reported in the 1999 GPI *Cost of Crime* report.[99]

Private security guards and private investigators

According to census data, there are now fewer people working as security guards in Nova Scotia than a decade ago. In 1997, there were 3,100 guards, and by 2007, that number had dropped to 2,945. On average, Nova Scotia security guards earn $18,500 annually, according to the census statistics. Updating the financial numbers using the change in the number of security personnel and a wage adjustment using the Consumer Price Index (CPI), the cost of security guards in Nova Scotia in 2007 can be estimated at $66.3 million. This represents a decline of about $3.5 million or 5% since 1997.

If these defensive expenditures (home security expenditures, security guards, and private investigators) were assessed on a per capita basis, and *if* per capita expenditures today were the same as they were in 1997 ($138.35), the cost of all these defensive expenditures would have been 13% or $14.1 million higher than it is today—which denotes a real saving achieved by greater safety and lower crime rates.[100]

Retail business defensive costs (e.g., store surveillance, alarms)

The cost of business defensive measures in Nova Scotia may be estimated at about $37 million in 2007. This amounts to a decrease of about $9 million or 18% over the last decade. Because current data on retail business defensive expenditures to guard against crime were not available for Nova Scotia using the same sources as in the original 1999 GPI *Cost of Crime* report, the 2007 estimate is based on data on household trends in defensive measure purchases, on the assumption that these are reflected in business practices. However, this important caveat indicates that the 2007 estimate provided here should be used with great caution. It is included for illustrative and comparative purposes here in order to maintain the same cost template as presented in the 1999 GPI report and in order to compare likely 2007 costs with 1997 costs.[101]

Theft insurance (premiums minus claims)

Designed to guard against losses due to crime, theft insurance is as defensive in nature as the installation of burglar alarms or the hiring of security guards. Since direct victim losses from property crimes have already been considered above, only the difference between premiums and claims is counted here, in order to avoid possible double counting. In other words, it is known that theft insurance claims actually compensate a portion of victim losses due to property crime. Therefore, only the amount paid in premiums above and beyond these claims can truly be considered a “defensive” expenditure.

As previously noted, based on police-reported (UCR) data, the property crime rate increased steadily in both Canada and Nova Scotia through the 1960s, 1970s, and 1980s, but began a steady decline after peaking in 1991. The rate of property crime in Nova Scotia has been consistently lower than the national rate, but in recent years the gap has narrowed. In 2007, the rate of property crime in Nova Scotia was 163% higher than 1962 rates, but 25% below 1997 rates.[102,103]

Interestingly, the cost of insurance due to criminal activity appears to have risen despite a fall in the crime rate. However, this hypothesis must be treated with caution, as theft insurance estimates are here extrapolated from total national insurance data based on insurance industry evidence showing that theft accounted for 19% of all homeowner's claims in 2006. Thus, separate data on the gap between theft insurance premiums and theft insurance claims are not publicly available. Such theft insurance-specific data would make it possible to investigate whether insurance companies have profited and been the primary beneficiaries of the decline in crime rates and theft insurance claims, or whether any of those savings have been passed along to homeowners and members of the public in the former of lower premiums. Based on total insurance data, the former seems to have been the case.

According to the Insurance Bureau of Canada, net premiums for all insurance in Canada totalled $34.9 billion in 2006, while claims incurred totalled $20.3 billion—a gap of $14.6 billion. In 1997, the gap between total net premiums and claims incurred was $5.4 billion, and in 1986, the gap was $3.4 billion.[104] The widening gap between premiums and claims appears to indicate that insurance companies are profiting from the reduced incidence of claims, and that these benefits are not being passed on to the public. Needless to say, these total insurance data would also reflect declines in motor vehicle accidents and other categories subject to insurance as well as the declines in crime.

Certainly, the GPI accounting methods—by focusing on costs, benefits, savings, and economic valuation—can raise such provocative questions on the apportioning of benefits and savings in a way that conventional accounting and indicator systems are unable to do.

Using the gap between net premiums and claims for total insurance as a proxy for the gap between theft insurance premiums and claims and then applying those national trends to Nova Scotia, it appears that the cost of theft insurance may have more than doubled in the province in the last decade. In monetary terms, this would mean that Nova Scotians are now paying a total of $67 million in theft insurance-related defensive expenditures compared to $31 million in 1997.[105]

10.5.1.5 Total conservative estimate for cost of crime in Nova Scotia

When all the components of this conservative crime cost estimate are added, it appears that the direct monetary cost of crime in Nova Scotia (victim losses, public justice costs, and private defensive costs) has remained fairly steady in the last ten years. In 1997, the conservative estimate for crime costs was $692 million, while in 2007, the figure was $703.9 million—an increase of just 1.7% during this period (all figures in constant 2007 dollars).

However, it was observed that many aspects of this crime cost estimate have to do with non-crime related factors such as increased GDP per capita which, in turn, results in higher per capita production loss estimates, higher hospitalization and health care costs, hiring more police, and the likely failure of insurance companies to pass along savings to homeowners. Due to such factors, crime costs increased marginally over the decade even while crime rates declined quite significantly.

Some categories of crime costs did decline during this period. Since the original 1999 *Cost of Crime* report was released, there appears to have been a decline in the direct economic costs incurred by victims of property crime as well as in the lost productive capacity due to homicide—due to significantly lower rates of property crime and homicide. The money spent on courts is also likely to have fallen in response to the smaller criminal court caseload, though the degree to which per case costs have risen is not known. Similarly, there have likely been fewer expenditures on personal and business defensive measures and on security guards. As many of these conclusions are based on extrapolations, however, caution is required in interpreting these results.

On the debit side of the cost of crime equation, there have been major increases in some crime cost categories, including crime-related costs of hospitalization, police expenditures, and theft insurance. As noted above, the increase in theft insurance is related to the increasing gap between premiums and claims, which is not well understood, and on which GPI Atlantic is still awaiting responses to its inquiry of the insurance industry.

Therefore—given the declines in some cost categories and the increases in others—there has not been much change between 1997 and 2007 in the total direct crime cost estimates for the reasons cited above, despite the reduction in crime rates during this period.

It is also important to recall that—despite the significant decline in crime over the last decade—crime rates remain much higher today than they were in the 1960s and 1970s. In 1962, according to official police-reported statistics, the chances of being a victim of crime in Nova Scotia were one in 49. By 2007, the ratio was one in 13. If increases in the official crime rate over the last 45 years are discounted by one-third to account for higher reporting rates in 2007 than in 1962 for some categories, and if crime costs are roughly proportional to crime rates, then it can be estimated that Nova Scotians could have saved about $415 million in 2007 in excess crime-related costs if crime rates were still at 1962 levels, according to the conservative estimate provided here. In other words, the potential crime cost savings are not yet what they could be if Nova Scotia communities were as safe as they were 40 to 45 years ago.[106]

From this perspective of potential savings based on extrapolating prior crime rates to the present, it is important to note that the absolute 2007 crime cost estimates indicated above ($704 million) would look more positive if population increase were taken into account. Thus, both the costs and the savings within each cost component described above represent absolute reductions that do not account for population increase. The savings are larger if we consider *rates* (which take into account population increases) rather than absolute changes.

For example, if home security expenditures, and spending on police, prisons, security guards, and other defensive expenditures were assessed on a per capita rather than absolute basis, then the 2007 results would look more favourable. Thus, it can be argued that, *if* per capita expenditures today were the same as they were in 1997, the costs of crime would have been considerably higher than they actually are today. This framing of the question and results more accurately denotes the real savings achieved by greater safety and lower crime rates.

The significantly reduced crime rates, the drop in some categories of crime cost (including private defensive expenditures), and the relative steadiness of overall crime costs in the last decade also provide some commentary on the understanding of perceptions of safety and crime. It is often reported conventionally that Canadians think that crime is still high, or higher than it was, and that they do not believe it is less. However, the numbers presented in this update belie that conventional argument and analysis. In fact, Canadians would not likely be spending less protecting themselves (as reduced private defensive expenditures indicate) if they did not feel safer.

10.5.2. Comprehensive estimate

The true or full costs of crime are significantly greater than the direct economic losses and expenditures described above. As previously noted, crime may also shatter lives, cause psychological trauma and long-term physical disabilities, and have a variety of negative and even debilitating consequences that induce further social and economic losses not measured in the conservative estimate.

It should be noted that, while the following five costs, in addition to the conservative estimate, form the basis for our comprehensive estimate of crime costs, they still exclude some major categories of loss including corporate or "white collar" crime; tax evasion and tax fraud; and a range of indirect costs like those described at the start of this costing section.

10.5.2.1 Victim losses due to unreported property crime

The conservative estimate of crime costs reported above included only police-reported crimes from the Uniform Crime Reporting (UCR) data. However, there are many more crimes that are not reported to police. According to Statistics Canada's 2004 General Social Survey (GSS) on Victimization, 34% of all victimization incidents in that year were reported to police (compared to 37% in 1999), 33% of all violent crimes (compared to 31% in 1999), and 31% of all theft of personal property incidents (compared to 35% in 1999).[107,108]

Using GSS self-reported victimization data for total crimes against property and UCR data for all police-reported crimes, the ratio of all property crime incidents to reported property crime incidents for 1999 was 2.5:1 and for 2004 was 3:1. Based on these ratios, the number of unreported crimes in Nova Scotia in 2007 is estimated to be 57,400. [109] Based on the 1999 *Cost of Crime* report, the average monetary loss per property crime in 1997 was estimated to be $2,484 for a total of $203.7 million ($2007). In 2007, based on the same average cost per property crime, the cost associated with unreported property crime in the province was $142.6 million.

For the sake of comparability with the 1999 crime cost estimates, these numbers are maintained here. However, further investigation reveals that they are very likely to be overestimates, for the simple reason that unreported crimes are frequently less serious and involve smaller losses than reported crimes. While some categories of unreported crime are very serious indeed—only 8% of sexual assaults are reported, for example—Statistics Canada notes that, in many cases, "the crime may have been too minor to warrant police involvement."[110] Based on that evidence, it is almost certain that the average monetary loss of $2,484 per reported property crime should not be applied to unreported crime.

Unfortunately, there is no publicly available estimate of average victim losses in unreported crimes. For illustrative purposes, however, if we were to assume that the average loss per unreported property crime is only 20% that of reported property crimes, then the victim losses due to unreported crime would amount to $28.5 million rather than $142.6 million.

The UCR data reveal that the number of reported incidents of property crime in Nova Scotia has fallen by 25% since 1997.[111] Let us assume for a moment that the per incident cost estimates provided in the Solicitor General's crime cost studies applied to all property crimes. If we then apply the 3:1 ratio of reported to unreported crimes in 2004 to the 2007 data, then the decline in property crime in the last decade indicates that Nova Scotians might have lost $50 million less in total property crime losses in 2007 than they did a decade ago or compared to what their losses would have been were crime still at 1997 levels. It should be recalled that two-thirds of the economic losses in this category are due to thefts.

Again, the assumption that the per incident loss estimate of $2,484 can be applied to all cases of victimization is almost certainly unwarranted. Therefore, the saving attributable to the decline in property crime rates is more likely to be about $23.2 million for the reported property crimes and $5.4 million for the unreported crimes, for a total of about $28.6 million rather than the $50 million reported above.

10.5.2.2 Losses, hospitalization, absenteeism: unreported violent crime

Using GSS data on self-reported victimization, in 2004 only 33% of all violent incidents were reported to the police (up from 31% in 1999).[112] Based on the ratio of reported violent crimes to total number of violent crime incidents, the number of unreported crimes in Nova Scotia in 2007 is estimated to be 19,870.[113] The economic losses incurred by victims of unreported violent crime in 2007 can be estimated at $16.5 million: $1.6 million for monetary losses due to unreported sexual assaults and assault, $4.1 million for hospital bills, and $10.8 million for absenteeism.[114]

As above, however, this assumes that the average loss per incident is the same for reported and unreported crimes. According to victimization surveys, however, over half of unreported violent incidents do not come to the attention of police because the victim felt the incident was not important enough, "suggesting the crime may have been too minor to warrant police involvement."[115] This suggests that some significant downward adjustment to the estimate above is required, though there is presently no publicly available evidence on the cost of monetary losses, hospital bills, and absenteeism attributable to unreported violent crime. GPI Atlantic's 1999 *Cost of Crime* report estimated costs of $6.5 million (in 2007 dollars) attributable to unreported violent crime—considerably less than the $16.5 million estimate provided here for 2007.

10.5.2.3 Unpaid work losses: household and voluntary work

While the conservative estimate of crime costs above assesses only market production losses, the actual loss experienced by crime victims and by society at large clearly goes beyond the work place. For example, an assault victim may not be able to take care of children or household tasks, and may incur additional expenses by hiring someone to perform this work. A crime victim may also be unable to perform civic and voluntary work.

Since the Genuine Progress Index explicitly values unpaid work, this should also be included in the comprehensive assessment of production losses due to crime. The dollar figures for unpaid work losses may be taken as a proxy for lost quality of life in the home and in the community due to crime, as experienced by the recipients of household services and of volunteer services.

It was reported in GPI Atlantic's 1999 *Cost of Crime* report that unpaid household work losses totalled $10.1 million ($2007). Using police-reported (UCR) data only, and based on the Solicitor General's 1985 crime cost report findings, it can be estimated that, in 2007, crime victims in Nova Scotia spent a total of 2,405 days in hospital due to crime and missed an estimated 19,312 days of work due to crime.[116] At eight hours a day, this amounts to 154,496 hours of work lost in 2007. Based on Statistics Canada's time use and labour force surveys and GPI Atlantic's study titled *Economic Value of Unpaid Housework and Child Care in Nova Scotia*, Nova Scotian adults put in an average of 25% more unpaid household work hours per year than paid work hours.[117] Therefore, there would have been an estimated 193,120 hours of lost unpaid household work in 2007 attributable to crime.

Based on Statistics Canada's replacement values for household domestic work, unpaid household work time lost due to crime in Nova Scotia in 2007 can be estimated to be worth $2.2 million ($2007).[118]

According to 2005 General Social Survey (GSS) time use data, the average Nova Scotian volunteer put in 3.75 hours per week of voluntary work outside the home in 2005—16% above the national average. Considering only formal volunteer work contributed through organizations, volunteerism accounted for 73.5 million hours of unpaid work in Nova Scotia in 2004, according to the 2004 Canada Survey of Giving, Volunteering and Participating—or the equivalent of roughly 38,000 full-time jobs.[119] When both formal and informal voluntary work are considered, Nova Scotians contributed a total of 112 million hours of voluntary work in 2005, according to 2005 GSS data.[120]

Based on the loss of 147 person-years of paid work attributable to crime, and the fact that Nova Scotians contributed an average of 146 hours per year of voluntary work, it can be estimated that Nova Scotia crime victims would have missed 21,462 hours of voluntary work a year due to crime, creating a substantial loss of services to recipients.

Statistics Canada has estimated the replacement value of voluntary services in Nova Scotia at $16.28 ($2007) an hour. This represents the average of what it would cost to hire workers in the market economy to perform equivalent work to that performed by volunteers. On this basis, voluntary services lost due to crime may be estimated at $350,000 a year.[121]

Aside from the victim losses described above, the existence of volunteer organizations devoted to law and justice issues (such as Neighbourhood Watch, Crime Stoppers, Block Parents, John Howard Society, Elizabeth Fry Society, legal aid groups, victim counselling groups, etc.) must be counted as a cost of crime. In fact, the time invested in some of these organizations must be counted as defensive expenditures—much in the same way that hiring security guards or investing in alarm or surveillance systems are defensive actions. Lower crime rates would render such voluntary activity less necessary, and the time of these volunteers would correspondingly be freed up for more welfare-enhancing activities.

According the Canada Survey of Giving, Volunteering and Participating (CSGVP), "law, advocacy and politics" volunteers account for 2% of all volunteers. However, they put in the second highest average number of volunteer hours per year—123 hours per year per volunteer.[122]

In 2004, there were 377,000 volunteers in Nova Scotia and roughly 7,540 of these contributed 927,420 hours of their time for volunteer work in the field of "law, advocacy, or politics."[123] Based on the volunteer replacement value of $16.28 per hour, their work can be estimated to be worth $15 million a year to the Nova Scotia economy. While not all of this volunteer time is attributable to crime-related issues, the publicly available data provided by Statistics Canada do not permit finer distinctions. Thus, while the $15 million figure is used here, it must be accepted as an overestimate for crime-related voluntary activity.

Therefore, when these three categories of unpaid work—the lost unpaid household work and voluntary work of crime victims and the volunteer work contributed to crime-related voluntary organizations—are combined, it can be estimated that $17.6 million worth of unpaid work each year is attributable to crime.

10.5.2.4 Business shrinkage due to shoplifting and employee theft: retail only

Shrinkage is the retail industry term for unexplained inventory losses that are primarily due to shoplifting and employee theft. Thus, shrinkage refers to the difference between the inventory recorded in business ledgers and that actually on the shelves.

In 2002, the Retail Council of Canada estimated that 1.75% of retail stock is stolen by customers and staff.[124] As noted, this loss is commonly referred to as shrinkage. When this percentage is applied to retail sales in Nova Scotia, the loss to businesses in the retail sector in 2007 may be estimated at $204 million.[125] This represents an increase in shrinkage over the last decade of more than $40 million. Due to time and resource constraints, it was not possible to determine at this time whether the increase in shrinkage costs is due to increased consumption (i.e., the same proportion of shrinkage applied to higher retail turnover) or to higher rates of consumer and employee theft.

The most recent 2007 Canadian Retail Security Survey deals with a whole range of crime-related business costs that are, for the most part, not included in either the conservative or comprehensive cost estimates presented here. According to the Retail Council of Canada:

> This year's survey confirms that Canadian retailers face a broad spectrum of criminal elements stretching security measures to their limits. Traditional theft areas such as break and enter, and counterfeiting are still prevalent, while technology theft is impacting retail crimes. Technology based thefts include pin pad tampering and credit card fraud, and are largely associated with organized criminal activities. In fact, the 2007 Criminal Intelligence Service Report identifies financial crimes as being one of the socio-economic harms of organized crime in Canada.[126]

While we have noted some areas in these cost estimates that are certainly overestimates—for example in the application of per incident victim loss estimates to unreported crimes—this statement from the Retail Council of Canada illustrates the kind of crime costs that are almost entirely omitted from this cost estimate, unless the criminal activities described above actually lead to prosecution and conviction. Since the costs incurred by retailers both in succumbing to and preventing the kinds of financial crimes described are generally passed on to customers in the form of higher prices, these costs of overt financial crimes are actually borne by society.

10.5.2.5 Insurance fraud (higher premiums)

Like shrinkage, insurance fraud leads to higher prices for consumers. In 1998, it was estimated that fraudulent claims against insurance companies add an average of 15% to the cost of insurance premiums in Canada. Based on data used for the 1999 *Cost of Crime* report, and updated using the CPI, it is here estimated that $81.9 million should be added to the comprehensive estimate as a result of higher prices due to insurance fraud.[127]

10.5.2.6 "Shattered lives" (based on court awards for serious violent crimes)

As noted, some of the most severe costs of crime are emotional and psychological. Lives can literally be shattered by crime—both for victims and perpetrators and for their families and friends. Such costs are not easily monetized, and yet the effort to do so is essential in order to acknowledge the actual impact, pain, suffering, and cost engendered by crime more fully. The original 1999 *Cost of Crime* report referenced a Fraser Institute study that used court awards for the grief and suffering experienced by victims of serious violent crime to produce a monetary estimate for "shattered lives."[128]

Based on the Fraser Institute's estimates used in the original 1999 GPI *Cost of Crime* report, the costs of shattered lives for 2007 is estimated to be $288 million. This updated estimate takes into account the decline in the prevalence of violent crime between 1997 and 2007. As a direct result of that decline in violent crime, the shattered lives estimate is now $22 million less than it was a decade ago.[129]

In 2004, the Research and Statistics Division of the Department of Justice Canada published a new study titled The Cost of Pain and Suffering in Canada, which used an entirely different methodology to put a monetary value on crime-induced pain and suffering.[130] Using data from both the Uniform Crime Reporting survey (UCR) and the 1999 General Social Survey (GSS), the Justice Canada study multiplied the number of incidents of each type of violent and property crime by the proportion of victims within each crime category who reported feeling very worried about their safety. That product was then multiplied by $86,077 ($2007) for victims of violent crime—which represents the study authors' estimate of the average economic value of each victim's crime-induced distress and worry related to the risk of suffering non-fatal injuries.[131] For property crimes, a discount factor of 0.25 was used on the assumption that 25% of the worries experienced by property crime victims were a direct consequence of their crime experiences. The authors' $86,077 per incident estimate was, in turn, based on a labour market study estimating risk-dollar trade-offs based on worker wages for risky jobs.[132] Using these methods, the Department of Justice Canada concluded that the cost of pain and suffering experienced by crime victims in Canada in 1999 was $11.75 billion based on police-reported UCR data, and $42.84 billion based on 1999 GSS data. As noted earlier, it is not appropriate to apply the same dollar value per incident to unreported crimes as to reported crimes, since a considerable portion of unreported crimes are much less serious than reported crimes. Therefore, the Department of Justice Canada estimate based on GSS data is likely substantially exaggerated, and we, therefore, only reference the much more modest UCR-based estimate for our purposes here.

If the Department of Justice Canada police-reported UCR-based estimate is multiplied by 3% to obtain a rough population-based estimate for the cost of crime-induced pain and suffering in Nova Scotia, this amounts to $353 million. Using an entirely different methodology and different set of assumptions than those used by the Fraser Institute and GPI Atlantic, it is noteworthy that this Department of Justice Canada estimate is not substantially greater than the $288 million GPI estimate for shattered lives indicated in Table 10-8 below, and, therefore, serves as a rough sensitivity test indicating that the GPI estimate is well within reasonable bounds. Indeed, the decline in crime rates since 1999 would lower the Justice Canada estimate and further reduce the gap between the two estimates to match the GPI estimate even more closely. Here, we have stuck with the original Fraser Institute estimates used in the 1999 GPI *Cost of Crime* report—adjusted for the decline in crime rates—for the sake of comparability with the earlier GPI estimate.

10.5.2.7 Summary

The total comprehensive estimate for the cost of crime in Nova Scotia is $1.5 billion—a marginal decrease of 0.5% (or $8 million) over the last decade and about twice the magnitude of the conservative estimate (Table 10-8 below).

If increases in the official crime rate are discounted by one-third to account for higher reporting rates in some areas in 2007 than in 1962, and if crime costs are roughly proportional to crime rates, then Nova Scotians could have saved $851.2 million in 2007 if crime rates were still at 1962 levels, according to the comprehensive estimate, which includes the conservative estimate.

Table 10-8. Costs of crime in Nova Scotia ($2007), 2007

CONSERVATIVE ESTIMATE	MILLIONS ($2007)
Victim losses: reported crimes	
Direct victim losses due to property crime	$95.6
Direct victim monetary losses in assaults and sexual assaults	$0.75
Cost of hospitalization due to crime	$3.3
Lost potential economic production due to homicide	$16.3
Lost production due to absenteeism resulting from criminal attack	$6.3
SUBTOTAL	$122.3
Public justice costs	
Police expenditures	$239.0
Courts, legal aid, and prosecutions	$33.3
Corrections	$93.0
SUBTOTAL	$365.3
Private defensive expenditures on crime prevention/detection	
Home security systems	$46.0
Private security guards and private investigators	$66.3
Retail business defensive costs	$37.0
Theft insurance	$67.0
SUBTOTAL	$216.3
TOTAL CONSERVATIVE ESTIMATE	**$703.9**
COMPREHENSIVE ESTIMATE	
Total conservative estimate (from above)	$703.9
Victim losses due to unreported property crime	$142.6
Losses, hospitalization, absenteeism: unreported violent crime	$16.5
Unpaid work losses: household and voluntary work	$17.6
Business shrinkage: retail	$204.0
Insurance fraud	$81.9
Shattered lives	$288.0
TOTAL COMPREHENSIVE ESTIMATE	**$1,454.5**

11. Educated Populace

For the original GPI Atlantic report on education, please see the following:

Education Indicators for the Nova Scotia Genuine Progress Index (2008)
http://gpiatlantic.org/pdf/education/nseducation.pdf

Headline Indicators

1. Government student debt and tuition fees
2. Public expenditures per full-time student (K–12)
3. Public versus private share of sponsored research at universities
4. Trends in prose and document literacy (1994–2003)
5. Trends in general political knowledge by age cohort
6. Ecological Footprint by educational attainment

11.1. Purpose and definition

The goal of education is to make people wiser, more knowledgeable, better informed, ethical, responsible, critical and capable of continuing to learn. Education also serves society by providing a critical reflection on the world, especially its failings and injustices, and by promoting greater consciousness and awareness, exploring new visions and concepts, and inventing new techniques and tools. Education is also the means for disseminating knowledge and developing skills, for bringing about desired changes in behaviours, values and lifestyles, and for promoting public support for the continuing and fundamental changes that will be required if humanity is to alter its course, leaving the familiar path that is leading towards growing difficulties, and starting the uphill climb towards sustainability. Education, in short, is humanity's best hope and most effective means to the quest to achieve sustainable development.

– United Nations[1]

The Genuine Progress Index (GPI) is based on the understanding that the wellbeing of Canadian and Nova Scotian society is correlated with certain key conditions, including physical and mental health, healthy ecosystems, decent living standards and economic security, strong social ties, safe communities, a vibrant culture, and the ability to balance the often competing demands of paid and unpaid work with ample leisure time. Wellbeing in the GPI is also explicitly defined to include the welfare of future generations as well as that of the present generation.

Whether Canadians and Nova Scotians have the knowledge required to improve wellbeing and sustainability is seen as a key connection among all the above conditions. In this sense, the GPI educated populace indicators serve as vital connective tissue linking all the components of the Genuine Progress Index.

Abundant evidence indicates that education has a significant effect on quality of life in terms of its impact on income, population health, environmental quality, civic engagement, and other dimensions of wellbeing. Therefore, the evidence of whether or not Canadians and Nova Scotians are learning what they need to know to create a healthy, wise, and sustainable society should be seen in desirable social outcomes such as peace, equity, environmental stewardship, good health, cultural diversity, and social acceptance. This view of educational objectives and indicators is considerably broader than that found in conventional education indicator systems.

From this perspective, and in order for a society to assess social progress in general, and advances in learning and education in particular, it must first identify and define the knowledge required to create a healthy and sustainable society. In this endeavour, the key question is: What is an educated populace?

Based on an extensive review of the research in this field, the following is the general consensus among a wide body of analysts and commentators about the key characteristics that constitute an educated person or populace:

- Engagement and capacity to learn throughout life with an attitude of openness, interest, and curiosity
- Willingness to engage in personal and social transformation
- Awareness of contextual situations and systems, social and economic interconnections, current world events, the processes of the natural world, the influence of current lifestyles on population health, and the choices and quality of life of future generations
- Ability to analyse, communicate, and integrate ideas
- Ability to solve problems collaboratively
- Knowledgeable in areas required to improve societal wellbeing, and using that knowledge for the public good

In sum, an educated populace has the knowledge and skills required to foster wellbeing in individuals and in the population as a whole—that is, to live healthy lives, have decent jobs, participate actively in their communities as citizens, and understand the interdependence of the world in which they live—without imperiling these prospects for future generations. In the framework for this study developed by GPI Atlantic and illustrated graphically in Figure 11-1 below, an "educated populace" is the ultimate outcome of the effective dissemination and development of knowledge and wisdom, which is, in turn, the most important goal and result of effective learning. In the words of David Orr:

> What will people need to know to live responsibly and well in a finite world? What skills, abilities, values, and character traits will be useful and / or necessary for the transition ahead? What does sustainability imply for technology? Politics? Community design?

> Social structures? Economics? Values? What is the appropriate balance between the sciences, the social sciences, and the humanities? And between intellect, spirit, and practice? What do all of these imply for the substance and process of education? In short, what does the dawning awareness of planetary limits and interrelatedness of all life have to do with the way we define, direct, and transmit knowledge? No single answer can, or should, be given to such a large question. It is possible only to propose measures by which answers might eventually be judged.[2]

This effective transmission and use of knowledge for societal benefit requires both basic literacy (reading, writing, and numeracy) and multiple literacies in relevant areas such as ecology, civics, art, science, health, and multiculturalism. Thus, an educated populace would have a reasonable understanding about important issues that affect daily life, which, in turn, requires practical skills like the ability to understand the meaning of statistics, how the media present information, and how to make informed decisions when voting.

In 1997, the Organisation of Economic Co-operation and Development (OECD) initiated an interdisciplinary program to identify "key competencies" that contribute to a "well-functioning society" and that are "necessary for individuals to lead an overall successful life, and for society to face the challenges of the present and the future."[3]

> Key competencies are defined by the demands of modern life and conceptualized as contributing to a successful life and a well-functioning society, as expressed by universal values such as respect for human rights, integrated economic, environmental, and social development, and democratic processes. [. . .] Competent performance or effective action implies the mobilization of knowledge, cognitive and practical skills, as well as social and behavior components such as attitudes, emotions, and values and motivations.[4]

The OECD program identifies three criteria for competencies that are broad enough to be used in a variety of contexts. Competencies should 1) contribute to highly valued outcomes at the individual and societal level; 2) be instrumental for meeting important, complex demands and challenges in a wide variety of contexts; 3) be important for all individuals.[5] The OECD emphasizes that the specific nature of competencies in their application to particular conditions, times, and circumstances is shaped by cultural, situational, and other contextual factors.

In its background research, GPI Atlantic has used these OECD criteria to assess competencies in relation to multiple literacies, including basic literacy, science, ecology, health, nutrition, civics, arts, statistics, Indigenous knowledge, and the media. While not comprehensive or all-encompassing by any means, these eleven knowledge areas have been identified by analysts as at least representative of what an educated populace needs to know for its own wellbeing and that of future generations.

GPI Atlantic has also defined these OECD criteria more specifically using the "principled ground" proposed by Canadian philosopher John McMurtry. McMurtry's main principled ground and criterion for an educated populace, which he has developed and suggested for specific application to the selection of education indicators for this study, can be applied to formal, nonformal, and informal education:[6]

> The principled ground and criterion of education that has been proposed is: those processes of the society that enable learning which is not instrumental to a non-learning goal such as private profit, sectarian belief, or other ulterior purpose that does not enable a more inclusively coherent understanding of human and natural phenomena.[7]

In applying this principled ground to informal learning, McMurtry argues that the learning or lack of knowledge of Canadians in matters of gender, race, cultural tolerance, ecological awareness, corporate responsibility, and other dimensions of literacy can all be evaluated on the basis of this criterion:

> All of these forms of understanding express educational attainment or lack of it insofar as they enable a more inclusively coherent understanding of human and natural phenomena. The same principle holds across all spheres, and allows us to include these very important forms of understanding as far as we are able in a consistent manner. For example, sexism or racism score very badly on the criterion of education, and [the principled ground] explains exactly why. Both are incoherent in principle and non-inclusive in what they take into account as fact and as value. The same is true of ecological or corporate irresponsibility. Consistent and exact principled grounds enable us to identify attainments, shortfalls, and trends across informal and formal education spheres as far as is logistically feasible. In all cases, the prior state of the sphere in question can provide a basic reference body from which to evaluate or measure an educated populace.[8]

Therefore, the basic criteria used to assess competencies in the various literacies explored by GPI Atlantic in its background research (including basic literacy, science, ecology, health, nutrition, civics, arts, culture, statistics, Indigenous knowledge, and the media), and in the few selected literacies presented in this summary report, are 1) that they "enable a more inclusively coherent understanding of human and natural phenomena," as McMurtry suggests, and 2) that they "contribute to highly valued outcomes at the individual and societal level," as the OECD recommends.

From the perspective presented above, an educated populace indicator framework should be able to track changes over time not only in the store of factual knowledge, but also in the values, attitudes, and wisdom of the populace. Sadly, those key dimensions of an educated populace are virtually absent from most conventional indicator systems. As well and with few exceptions, like basic literacy assessments, most conventional education indicators also provide very little information about learning *outcomes* or social *outcomes*, which are the key concern of GPI Atlantic in all its indicator work.

By contrast to the goals and principles outlined above, an extensive exploration of the literature in this field found that the conventional education indicators that currently exist to assess educational attainment are too limited, and that many key learning outcomes are not adequately represented. In addition, those indicators—focusing as they generally do on formal schooling—do not adequately account for the role and outcomes of nonformal and informal learning processes and contexts, including the roles of the family, community, television, the Internet, and other media.

As well, the last two decades have seen a surge in education indicators related to economic policy objectives in an effort to assess whether formal education in particular is contributing adequately to economic productivity and competitiveness in the global economy. However, critics have argued that what is perhaps most problematic about this increased focus on the role of education in serving economic imperatives is that broader considerations, such as "the role of schooling in social justice, the inculcation of democratic values and the transmission of cultural values and forms of knowledge," have become increasingly marginalized.[225]

A Special Study Panel on Education Indicators convened by the US Department of Education in the early 1990s to review existing education indicator models and the criteria for indicator selection concluded that the common practice of relying on limited sets of conventional education indicators was "misguided" and did not "do justice to the complexity of the educational enterprise."[9] The Special Study Panel rejected the dominant "input-processes-output" model, stating that this model was "flawed" and mistakenly "encouraged the view that the educational system produces 'products' by taking various raw materials (e.g., students and resources) and processing them in schools."[10] This critique has also been echoed by UNESCO's *Education for All* report, and by other experts in the field.

In sum, conventional indicators focus too narrowly on *outputs* of the formal education system that may be unrelated to desired learning and societal outcomes; they generally ignore informal and nonformal learning processes that may have a greater impact on learning outcomes than schooling; and they frequently send contradictory messages, as noted in the examples discussed in Section 11.2 below.

Therefore, while we continue to measure what is easily quantifiable—graduation rates, test scores, drop out rates, financing—we may be losing sight of societal outcomes that might be less easily measured but more meaningful in terms of measuring whether the populace is becoming more educated or not.

Based on three years of extensive research and exploration of data sources, the authors of the GPI Atlantic Education Indicators report (2008)—on which this update is based—strongly recommended the development of a new Canadian Knowledge Survey (CKS) that would indicate levels of knowledge and lifelong learning in the Canadian populace in the specific areas of ecological literacy, scientific literacy, arts literacy, health literacy, food and nutrition literacy, civic literacy, multicultural literacy, media literacy, Indigenous knowledge literacy, and statistical literacy. Administered regularly, the proposed new survey would assess whether or not knowledge in these areas is improving, deepening, and expanding. As such, its results would be of great interest to Statistics Canada and to educators, educational institutions, and policy audiences nationwide, as well as to the general public. Such a survey would effectively constitute an important and highly practical outcome of this education research.

Presently, indicators of these broader literacies and knowledge areas beyond basic adult literacy are not systematically tracked in Canada, although these new directions are being explored within individual disciplines.

The indicators presented in this *Nova Scotia GPI Accounts* report, deal with only two of the key dimensions of an educated populace explored in the background research and reflected in the framework represented in Figure 11-1 below. Those two dimensions are the formal education system (where most existing data currently exist) and multiple literacies (broadly conceived to encompass the knowledge required to enhance wellbeing). In the broader multiple literacy area, and in the absence of a Canadian Knowledge Survey as recommended above, the indicators that can be presented here are severely constrained by limited data availability. For that reason, GPI Atlantic's education report was accompanied by a far more extensive list of desirable indicators in that area for which data still need to be collected and developed. Further dimensions of an educated populace beyond these two areas also require development over time (see Framework in Figure 11-1 below for those additional dimensions).

Another key caveat is that reliance on existing data sources in the formal education realm will necessarily produce a focus on indicators that are inputs (like financing and access), processes (like class size), or outputs (like graduation, drop out rates, and test results) rather than on indicators that are true learning outcomes. The three formal education indicators presented below are recommended as key indicators for the GPI from among the dozens of indicators presented in the background research based on the following substantive and technical criteria:

- They provide information about a feature of the formal education system known to be linked with desired outcomes, and in this way, they potentially have predictive value
- They provide a benchmark for measuring progress by describing the educational system's performance in achieving a desired condition
- They reflect important values and aspirations for education
- They are valid and reliable
- They have time series data available

The remaining three key indicators recommended below deal with indicators reflecting the "literacy" of the Canadian or Nova Scotian populace. As noted above, literacy here is defined not only as basic adult literacy (reading, writing, and numeracy), but also as knowledge in areas like health, science, civics, culture, statistics, and ecology that contribute both to individual development and to effective social functioning and wellbeing. The multiple literacies presented in the background research are, therefore, much more in keeping with the basic approach of the GPI, and yet they are far more constrained by limited data availability. The key indicators on literacy presented below focus on a few key areas for which at least some data, however sparse or inadequate, are available. Despite these data limitations, these indicators at least do focus on outcomes, and they also serve to demonstrate the further indicator development required in the future for other literacy components.

At the same time, there is no pretence that the indicators and results presented below adequately measure an "educated populace" as defined above. To begin to move in that direction, a new

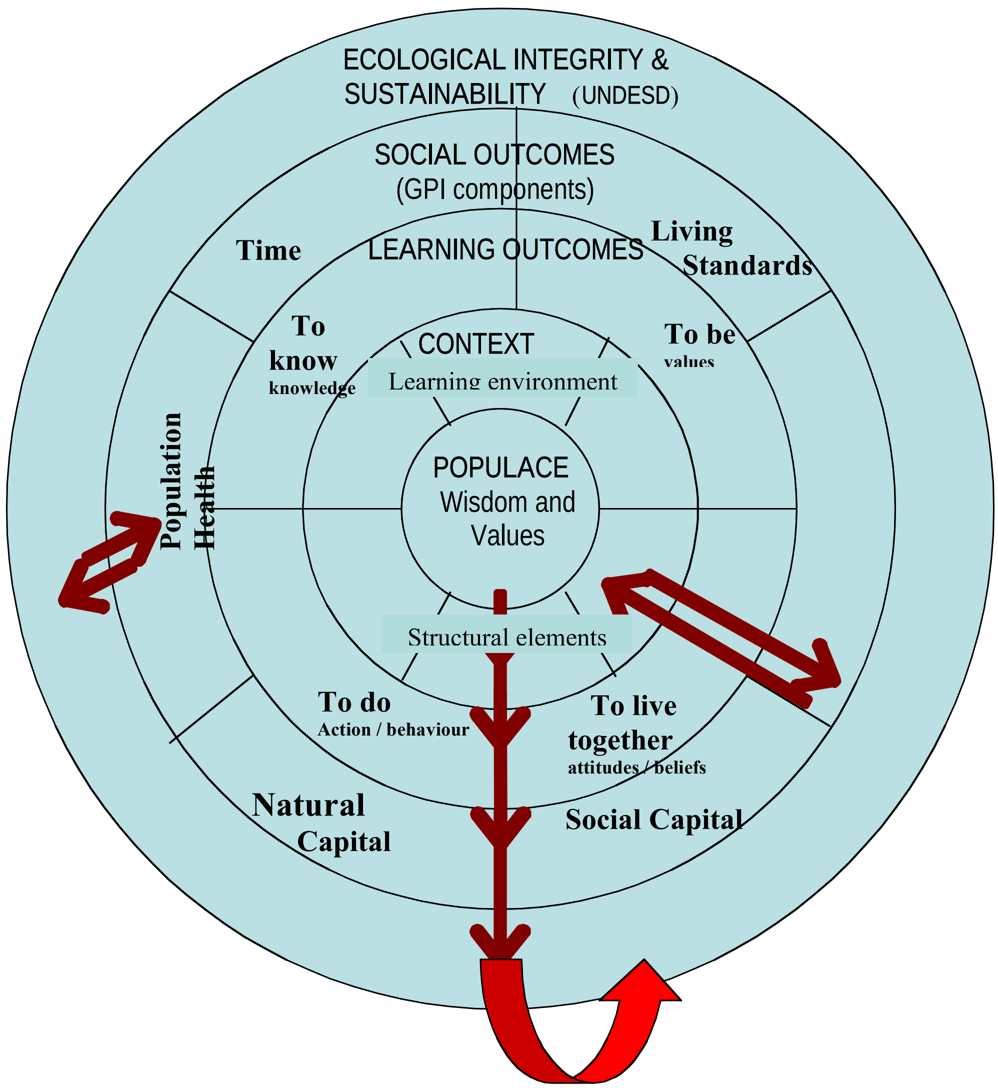
Canadian Knowledge Survey as described above is a minimum essential requirement. As well, further development is required in other spheres of the framework outlined in Figure 11-1 below, and in accord with the more comprehensive definition of an educated populace described above. These new directions are outlined in materials that will be released in several volumes in 2009.

A note on data limitations

A number of major data challenges arose in the process of developing indicators for the education component of the GPI. For example, there are a number of recommended indicators where no pan-Canadian data were available, where only single-year data existed, where the available data were too old to be useful, or where no data were available at all.

The lack of data is especially the case for indicators of multiple literacies. However, current data, research, and promising initiatives in various parts of the world, including Canada, suggest that it is indeed possible to develop suitable composite indicators for each of the literacies. To give just one example, while no assessment of science literacy is yet possible for the adult population in Canada, the United States has comprehensive, multiple-year national data on science literacy at the population level that could serve as a model for Canada. Promising research in these new directions is outlined in GPI Atlantic's extensive background investigations, which, as noted, will be released in several volumes in 2009.

Figure 11-1. Framework for the GPI education component



11.2. Conventional output indicators: graduation rates, drop-out rates, and standardized test results

Data sources: Graduation rates from National Graduates Survey, reported by the Pan-Canadian Education Indicators Program (PCEIP); drop out rates from the Labour Force Survey, reported by Statistics Canada; standardized test results from the OECD's Programme for International Student Assessment (PISA).

Result: Conventional indicators of "educational attainment" such as graduation rates and standardized test results are contradictory and inadequate, and do not tell us whether the Canadian populace is becoming more educated or not.

Standardized test results and graduation / drop out rates provide conflicting messages. For example, among the provinces, Alberta has the lowest high school graduation rate and second-highest drop out rate in the country, yet the highest standardized test results; the Atlantic provinces have the highest graduation and lowest drop out rates, yet have among the lowest standardized test results. This shows that graduation and drop out rates are reflections of labour market conditions rather than indicators of "educational attainment" (as usually interpreted).

Graduation and drop out rates are among the most commonly used indicators of educational attainment and education system effectiveness. However, they are system "outputs" rather than societal "outcomes," and thus do not tell us how educated the Canadian populace is or whether Canadians are becoming more knowledgeable. They are also poor indicators of school performance, since they are influenced by a number of other factors that have little to do with actual achievement, including trends in labour market conditions, child poverty, and teenage pregnancy, to name a few.

For example, provincial disparities indicate the strong influence of labour market conditions in influencing decisions to stay in school or leave school. In 2002/2003, high school drop out rates were much higher in Manitoba (13%), Alberta (12%), and Quebec (12%) than in British Columbia (7.5%), Newfoundland and Labrador (8%), Nova Scotia (9%), New Brunswick (9%), and Prince Edward Island (10%). Conversely, in 2002/2003, graduation rates were highest in the Maritimes, with 83% in Prince Edward Island, 82% in New Brunswick, and 81% in Nova Scotia, and lowest in Alberta (67%).

Analysts generally attribute Alberta's high drop out and low graduation rates to the financially lucrative opportunities offered by a booming economy that lures students out of school and into the work force. By contrast, a greater lack of such opportunities in Atlantic Canada is apparently encouraging young people to stay in school. If labour market conditions influence high school graduation and drop out rates to this extent, it is difficult to use those indicators as markers of school performance or educational system effectiveness, let alone of "educational attainment."

Trend analysis further confirms that higher graduation and lower drop out rates do not necessarily signify higher attainment, achievement, educational performance, and knowledge. Thus, Statistics Canada's Labour Force Survey (LFS) shows high school drop out rates in Canada declining fairly steadily from 16.7% in 1990/1991 to 9.8% in 2004/2005—falling in every province in the country. The decline was sharpest in Atlantic Canada where, on average for the 1990/1991 to 1992/1993 school years, 20% of youth between the ages of 20 and 24 in Newfoundland and Labrador, 19% in Prince Edward Island, and 18% in Nova Scotia were not attending school and had not graduated from high school. At that time, these were the highest drop out rates in the country, and were about double current rates.

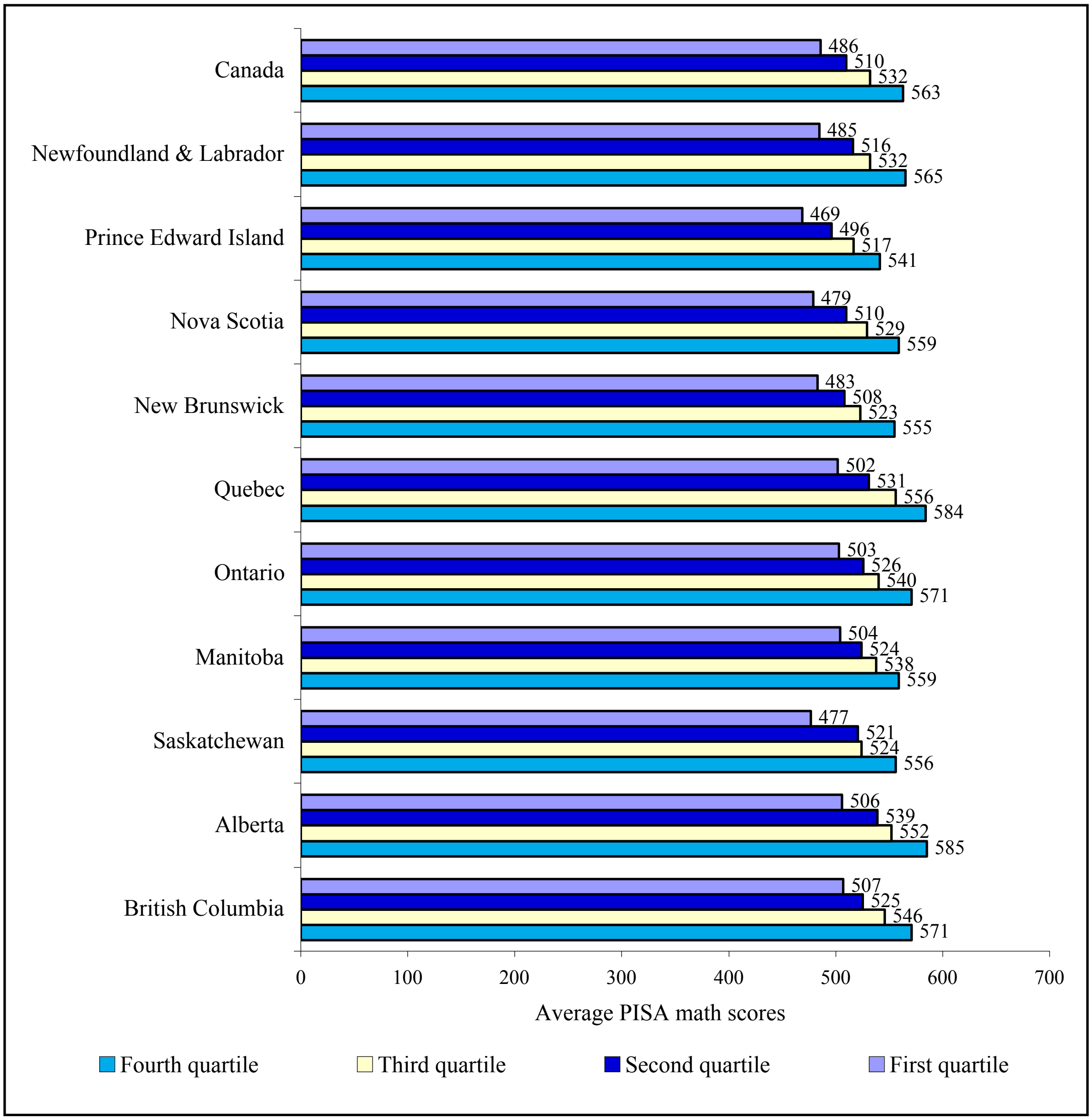
There has been a concomitant increase in high school graduation rates across Canada—from 72% to 74% in the five-year period between 1997/1998 and 2002/2003 alone. Postsecondary graduation rates for university Bachelor's and first professional degrees increased from 18.4% in 1976 to nearly 31% in 2001. College graduation rates also increased from 12% in 1976 to nearly 28% in 1998 (the most recent year data were available). Yet, the existing evidence simply does not allow a correlation between higher rates of secondary and postsecondary graduation on the one hand and higher levels of knowledge, educational performance, and attainment on the other—as conventionally assumed. Three examples are discussed in this summary: 1) in the same period that graduation rates have increased, national literacy scores have not improved; 2) political knowledge among youth has declined sharply; and 3) higher levels of formal education have been found to produce more unsustainable lifestyles.

Student achievement is also frequently measured—on the international, national, and provincial levels—using standardized testing in the areas of mathematics, reading, writing, and science, mostly for the purposes of cross-national or cross-provincial comparisons. In some cases, standardized provincial exams also count for a portion of a student's final grade. In fact, educational achievement measurement has in many cases become synonymous with the use of standardized examinations and test scores.

However, a key problem with relying on both test scores and graduation rates as key indicators of student achievement and educational attainment in Canada is that test scores and graduation rates frequently send contradictory rather than complementary messages. For example, in the OECD's 2000 and 2003 Programme for International Student Assessment (PISA), Alberta's 15-year-olds ranked the highest in the country in reading, math, and science, and yet Alberta had the lowest high school graduation rate (67%) and the second highest drop out rate (12%) among the provinces in 2002/2003, as seen above.[11] By contrast, the Atlantic provinces generally registered the lowest scores in the PISA results despite having the highest graduation and lowest drop out rates.

PISA results also show that students from higher socioeconomic backgrounds tend to have stronger literacy skills and perform better in math—a pattern observed in all 32 countries that participated in the PISA assessments.[12] By way of example, see Figure 11-2 below for a breakdown of 2003 math results by quartile for Canada and the provinces. The results reveal a clear income-related performance gradient, with scores increasing with each income level in every province in the country.

Figure 11-2. Average scores in the PISA math assessment by quartile of family income, 15-year-olds, Canada and provinces, 2003



Source: PCEIP, 2006. Table C4.6, p. 208.

In 2000, in a book analysing the PISA results, the OECD observed that "the school students attend is strongly predictive of their performance" and that "the socio-economic composition of schools explains far more of the differences in student performance between schools than do other school factors that are more easily amenable to policy makers, such as school resources and school policies."[13]

In other words, the standardized test results may reveal far more about students' socio-economic status and the socio-economic composition of the schools they attend than about their actual academic and intellectual capacity and their potential attainment and knowledge.

In addition to the contradictory messages transmitted by conventional indicators of educational attainment and the fact that scores often reflect and reinforce socioeconomic inequalities, educators have pointed to other key problems associated with reliance on standardized test scores. Analysts note that these tests focus on only a few academic subject areas—mathematics, reading / writing, and science—which have thereby come to dominate curricula and classroom effort at the increasing expense of music, art, history, foreign languages, social studies, ecology, and other key subject areas.

As well, critics have noted instances where standardized test results have been misused and manipulated to support misguided calls for educational reform, including curriculum reforms that emphasize a "return to basics"—again at the expense of other key subjects and the development of critical thinking skills. Educators also frequently bemoan the fact that, since standardized tests take place every few years, they frequently do not reflect or evaluate what the students have actually been learning in the classroom. As well, teachers have complained that the pressure to perform well on the standardized math, science, and reading / writing tests can result in *teaching to the test*, at the expense of class discussion, creative teaching, fostering of critical skills, and focus on non-test subject areas.

Beyond all these specific issues is the even more basic problem that—like graduation rates and drop out rates—standardized test results are simply system outputs and not societal outcomes. They tell us nothing about how knowledgeable the populace is, or even whether material specifically learned for the test is retained and can be practically applied.

In sum, any assessment of how educated a populace is cannot reasonably rely on the most commonly used conventional education indicators like graduation and drop out rates and standardized test scores, which:

- produce contradictory results
- fail to improve basic adult literacy, political knowledge, and other knowledge areas (and thus to remain unrelated in key respects to societal outcomes)
- have more to do with labour market and socio-economic conditions than attainment
- are pedagogically questionable

11.3. Government student debt and tuition fees

Data sources: Canadian student debt data from National Graduates Survey, reported by Statistics Canada; provincial debt data reported by Pan-Canadian Education Indicators Program (PCEIP); Maritime Provinces Higher Education Commission; tuition data from Survey of Tuition and Living Accommodation Costs for Full-time Students, reported by Statistics Canada.

Result: Postsecondary students in Nova Scotia today are graduating with unprecedented debt loads. Nova Scotia has the second highest level of (university) student debt in the country. The province also has the highest average undergraduate tuition fees in Canada. Over the last 30 years, tuition has accounted for an increasing share of university operating revenue.

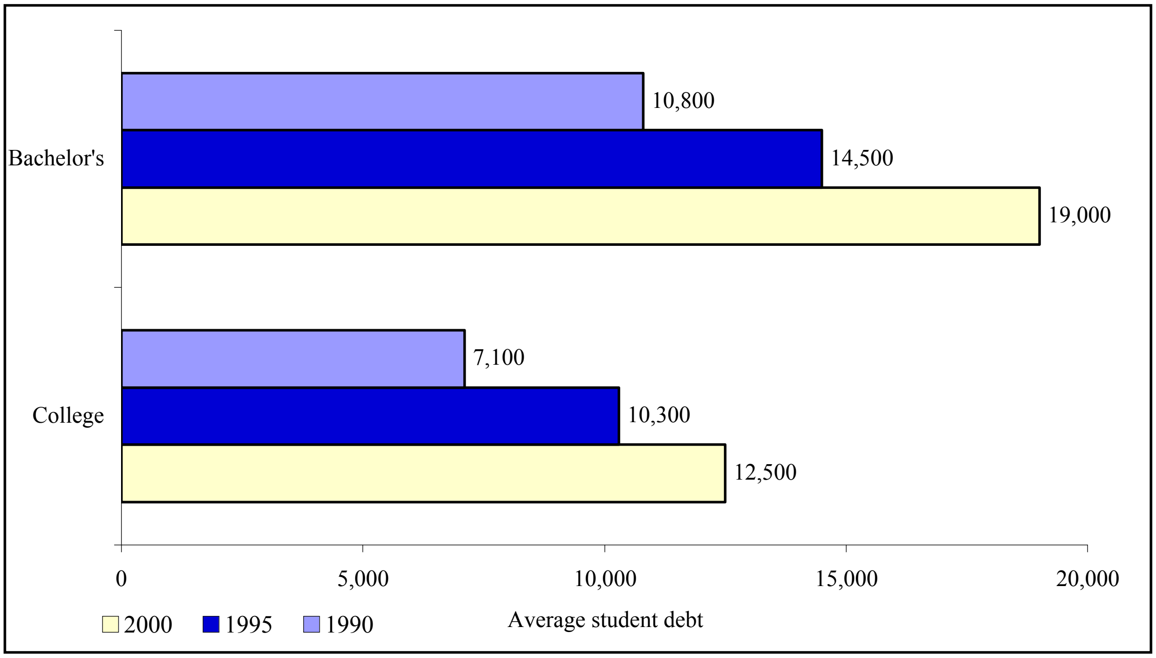
Students pursuing a postsecondary education today face increased financial pressures, as evidenced by rising tuition fees, record high student debt levels, slower loan repayment rates, higher loan default rates, and increased reliance on paid work (often for long hours) and private fundraising to finance studies.

Rising student debt levels, in particular, raise serious concerns both about equitable *access* to postsecondary education and about the *wellbeing* of Canadian youth who may face the stress of loan repayment requirements for years to come.

According to Statistics Canada, the amount of student debt increased dramatically in the 1990s. The undergraduate university graduating class of 2000 owed $19,000 in government debt—about 30% more than the class of 1995, and 76% more than the class of 1990 (in 2000 constant dollars). College graduates with student loans from government loan programs owed $12,500 in 2000—21% more than their counterparts in the class of 1995 and 76% more than those in the class of 1990 (see Figure 11-3 below).

When private sources of debt are also included, debt loads are much higher. In 2000, the 11% of undergraduate university graduates who owed money to both government and non-government sources had an average combined debt of $32,000. The average combined public and private debt of the 8% of college graduates who owed money to both sources was $20,000.[14] Unfortunately, no time series data are available for combined public and private debt loads, so Figure 11-3 reports only on debt from government loan programs.

Figure 11-3. Average amount of government student debt at time of graduation ($2000), classes of 1990, 1995, and 2000, Canada



Source: Mary Allen and Chantal Vaillancourt. *Class of 2000 – Student Loans*, *Canadian Social Trends*. Autumn 2004. Statistics Canada. Catalogue No. 11-008. Data from National Graduates Surveys (classes of 1990, 1995, 2000).

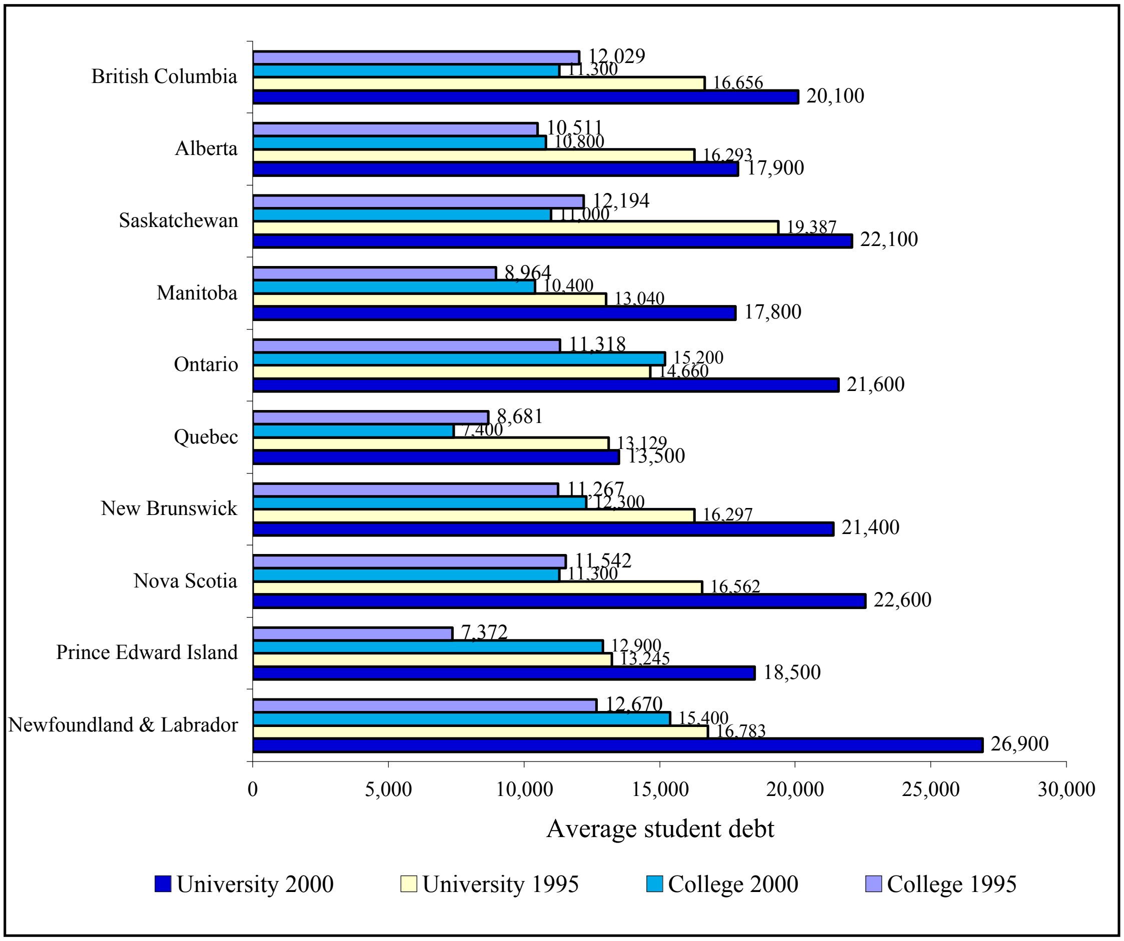
Note: This figure refers only to graduates who have not completed any further education in the two years after graduation.

At the provincial level, average student debt from government sources in 2000 was highest in Newfoundland and Labrador, followed by Nova Scotia, Saskatchewan, Ontario, and New Brunswick. Quebec had by far the lowest average debt levels in the country—about half the levels in Newfoundland and Labrador (see Figure 11-4 below).

These sharp provincial disparities are clearly related to the relatively lower tuition levels in Quebec and the correspondingly higher provincial government support of postsecondary education in that province. In addition, while average student debt levels from government sources increased sharply in almost all provinces when comparing the classes of 1995 and 2000, they increased only marginally in Quebec (by 3%) during this period.

The sharpest increases in student debt from government sources were in Newfoundland and Labrador (60%), Ontario (47%), Prince Edward Island (40%), and Nova Scotia and Manitoba (36.5% each).

Figure 11-4. Average debt from government student loans at graduation ($2000), by province, class of 1995 and 2000



Source: PCEIP, 2005. Data from National Graduates Survey.

Note: University here includes graduates with Bachelor's, Master's, and Doctorate degrees.

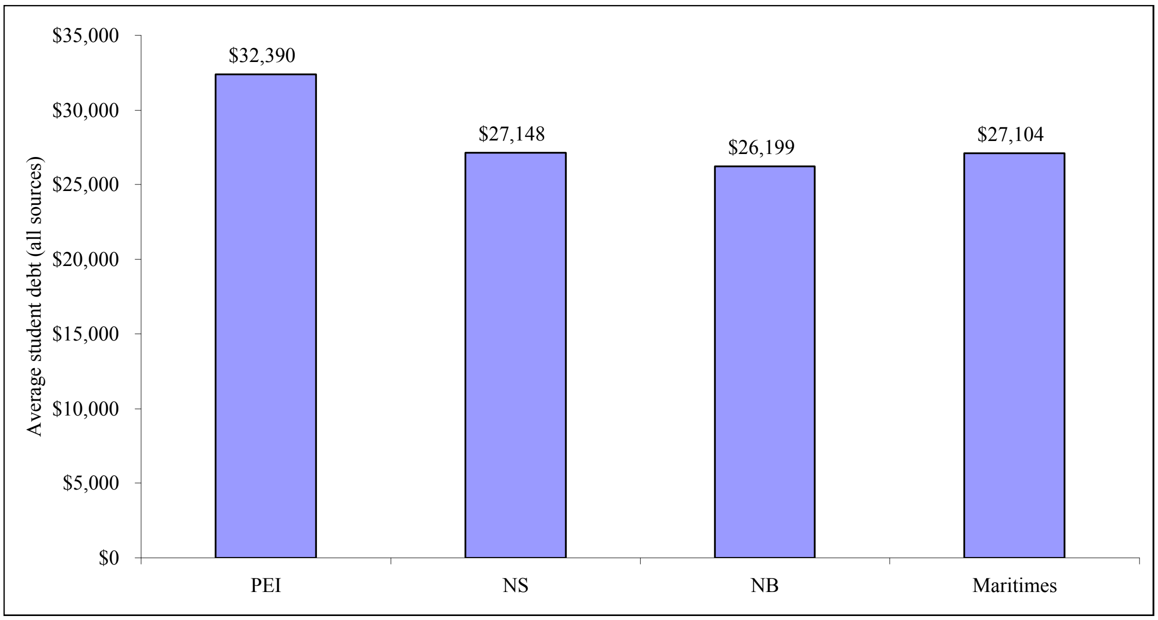
GPI Atlantic always conservatively uses the latest pan-Canadian, provincially comparable data available from Statistics Canada. These are the data on debt and tuition reflected in the charts and text presented in this report. As the report acknowledges, provincially comparable student debt trends from Statistics Canada are only presently available to 2000 and are only provided for government debt (excluding the burgeoning portion of debt that is from private sources). In light of these limitations in the available pan-Canadian Statistics Canada data—both in scope and in currency—it is important to note that there are more recent Nova Scotia-specific and regional data, which show that average student debt in the Maritimes from all sources (government student loans and private sources) has increased 10% in recent years from $24,976 in 2003 to $27,486 in 2007 ($2007).[15]

Survey data from the Maritime Provinces Higher Education Commission (MPHEC) indicate that the average amount of student debt in Nova Scotia from all sources for the class of 2003 was

$27,148, second to Prince Edward Island ($32,390). New Brunswick students owed $26,199 in student loans. In Nova Scotia, 40% of all graduates with student debt owed more than $30,000 in loans (see Figure 11-5 below). [16]

Any future updates of the Education Indicators report for Nova Scotia would utilize these regional data in order to get a more up-to-date picture of the student debt situation in this province.

Figure 11-5. Average amount borrowed (all sources) for a 2003 degree, post-2003 degree, or both, by Maritime province of graduation, 2005



Source: Maritime Provinces Higher Education Commission. 2007. 2005 Survey of 2003 Maritime University Graduates: Selected Provincial Statistics. MPHEC. Available from http://www2.mphec.ca/english/pdfs/GFU2003in2005ProvEng.pdf. Table 1.11a.

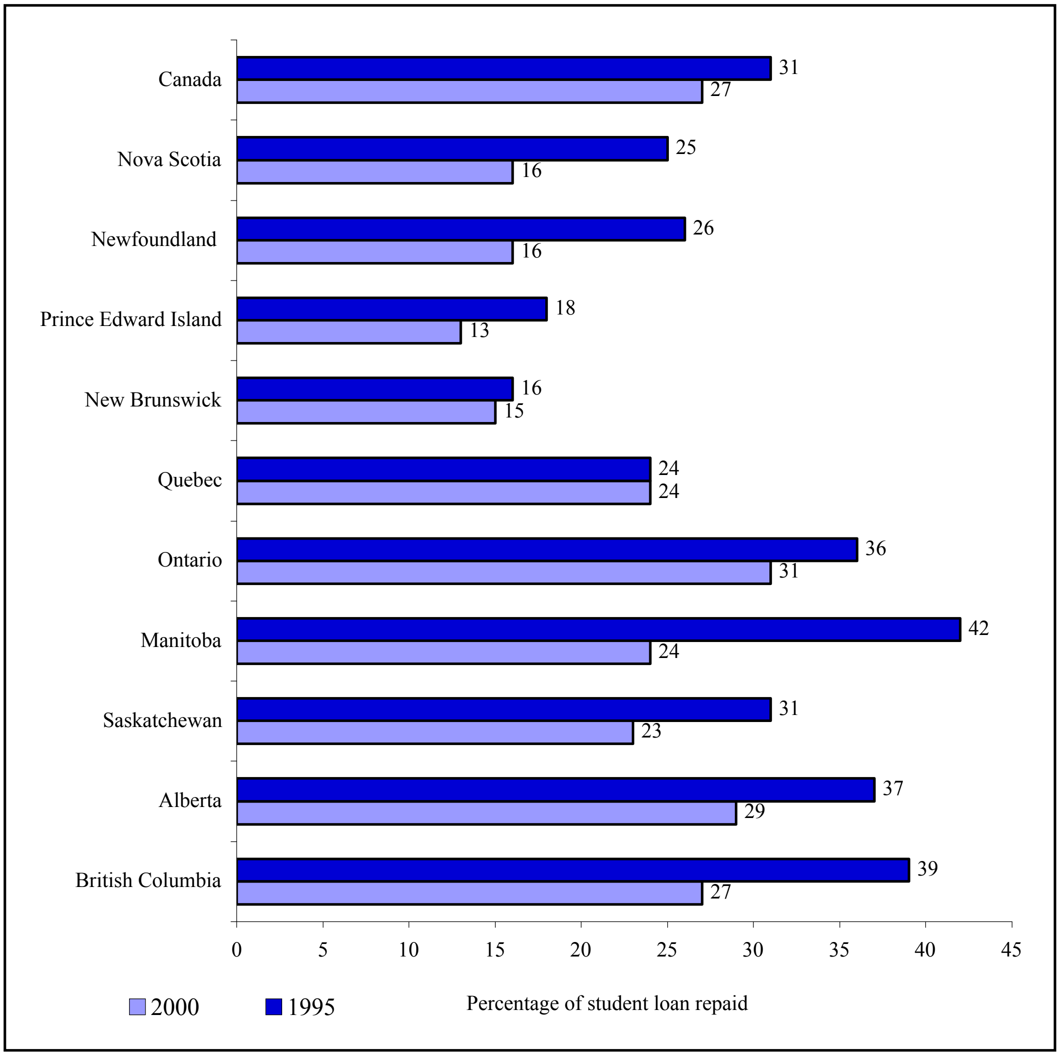
EKOS Research Associates and the Canada Millennium Scholarship Foundation conducted a national survey of the finances of postsecondary students in 2003 and did a follow-up survey in 2005. The Canadian Post-Secondary Student Financial Survey, administered to both students and parents, found that the incidence and amount of student borrowing from government loan programs declines with the level of parental financial support, particularly among those under the age of 23.[17]

This has important implications for access, as it indicates that students from families with higher incomes are more immune to the trends described above with their concomitant stresses, and that the increases in student debt depicted in the figures above are disproportionately affecting students of lower socioeconomic status.

In fact, according to a the recently released GPI report on *Financial Security and Debt in Atlantic Canada*, student loan debt *is* disproportionately concentrated in the poorest 40% of Canadian households, who hold fully 70% of all student debt in the country ($14 billion). By far the largest holders of student debt in Canada are households in the bottom wealth quintile (bottom 20% of households in terms of wealth) who collectively owed $9.4 billion or 47% of outstanding Canadian student loans in 2005.[18] Households in the third wealth quintile owed $3.6 billion in student loans, or 18% of the total. By contrast, richer Canadian households held a correspondingly smaller proportion of total student debt in Canada. The second wealthiest quintile (fourth) held 6.5% of total student debt in 2005. Unfortunately, 2005 data for the top quintile is statistically unreliable due to the small sample size of the 2005 Survey of Financial Security (SFS). However, it can be surmised that the debt load of the top quintile is substantially smaller than the $1.28 billion in student debt owed by the fourth quintile in 2005 and may have declined from the $1.3 billion estimate for the top quintile in 1999.[19]

Furthermore, using data from Statistics Canada's National Graduates Survey (NGS), the 2005 report of the Pan-Canadian Education Indicators Program notes that, in almost all provinces, postsecondary graduates took longer to pay off their government student loan debts in 1995 than in 1990, and even longer still in 2000.[20] Nationwide, graduates from the class of 2000 repaid 27% of their debt within two years of graduation, while those from the class of 1995 repaid 31% of their loan within two years (see Figure 11-6 below).

Figure 11-6. Debt repayment rate (percentage of student loan repaid two years after graduation), all university graduates, Canada and provinces, 1995 and 2000



Source: Canadian Education Statistics Council. 2006. Education Indicators in Canada. Report of the Pan Canadian Education Indicators Program. Statistics Canada and Council of Ministers of Education, Canada. Ottawa. Table B3.1, p. 191. Data are from the National Graduates Survey.

Note: "All university graduates" includes Bachelor's, Master's, and Doctorate graduates.

The difference between the 1995 and 2000 cohorts in the rate of debt repayment was most dramatic in Manitoba, where graduates from the 1995 cohort had repaid 42% of their student loans two years after graduation, while graduates from 2000 had only repaid 24% of their loan two years after graduation.

Debt repayment for the class of 2000 was slowest in Atlantic Canada (13% to 16%), where students had repaid only about half as much debt within two years as in Ontario. For the class of 2000, the rate of loan repayment was generally faster in Ontario (31% of debt repaid two years after graduation), Alberta (29%), and British Columbia (27%) than in the rest of the country. Similarly, college graduates also had increasing difficulty repaying their debts between 1995 and 2000.

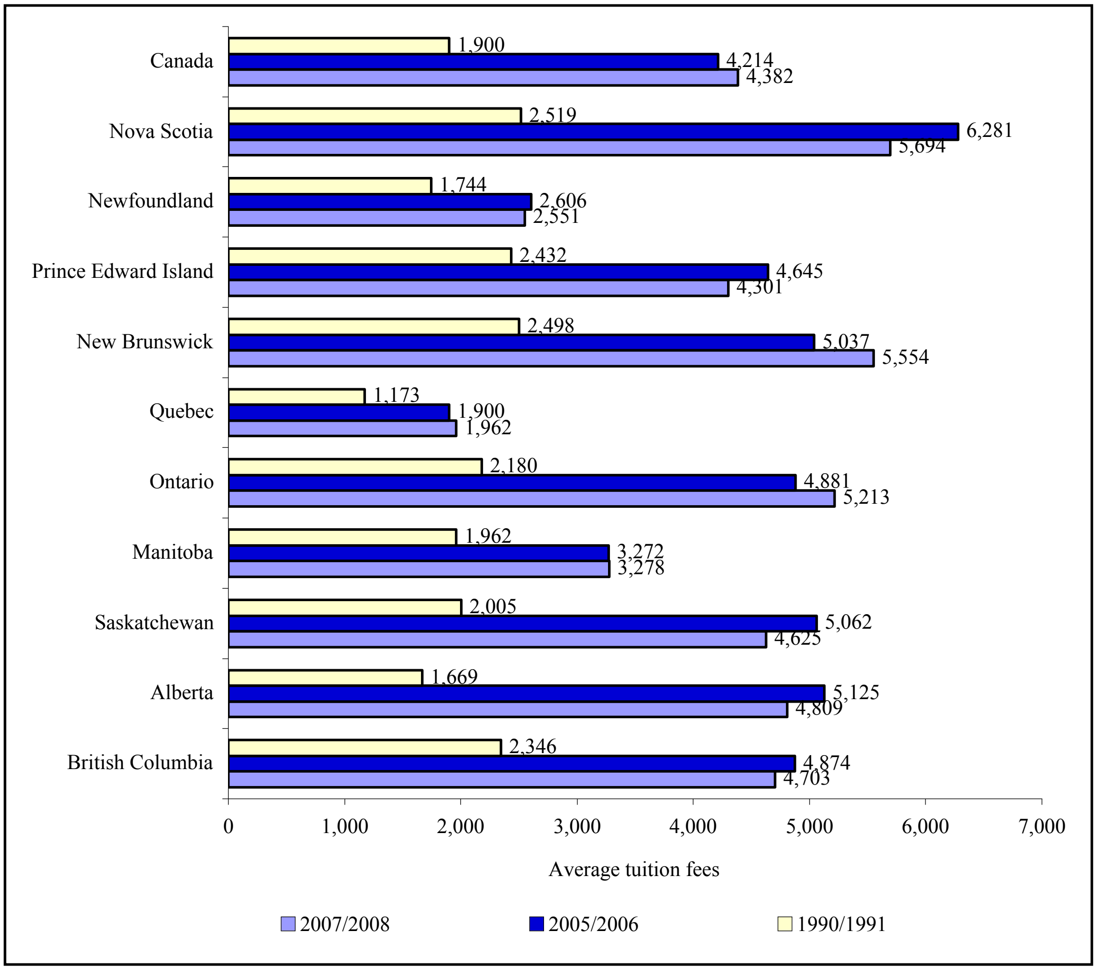
The increase in student debt in the 1990s, illustrated in the figures above, mirrors the simultaneous rise in postsecondary tuition fees—which also has serious implications for equitable access to postsecondary education. Between 1990/1991 and 2007/2008, average annual undergraduate tuition fees in Canada more than doubled from less than $2,000 to $4,382 (constant $2005). In many provinces, the rise in tuition fees has sharply exceeded the Canadian average, leading to increasing inter-provincial disparities. For example, in Nova Scotia, average undergraduate tuition jumped by nearly 126% from $2,519 in 1990/1991 to $5,694 in 2007/2008 ($2005) and is currently the highest in the country (see Figure 11-7 below). Undergraduate tuition fees in Nova Scotia are presently nearly 30% higher than the Canadian average and 190% higher than in Quebec. It should be noted that, between 2005/2006 and 2007/2008, tuition fees in Nova Scotia declined by 9%.

However, it should be acknowledged here that there has been some controversy over whether this is in fact the case. According to the Department of Education, administrative changes at Acadia University "caused some statistical anomalies in Nova Scotia's reported numbers."[21] According to an October 2007 news release, Acadia University transferred a $1,419 laptop computer charge from tuition to compulsory fees, which "artificially increased StatsCan's reported tuition decrease" and artificially increased the rise in compulsory fees in Nova Scotia.

According to Statistics Canada, compulsory fees in Nova Scotia increased by 26% between 2006/2007 and 2007/2008 (the Canadian average was 10%). However, the Nova Scotia Education Department maintains that, "even when the Acadia anomaly is factored out, Nova Scotia remains one of two provinces to reduce tuition at a time when several provinces are increasing tuition."[22]

Yet Kaley Kennedy, Nova Scotia representative of the Canadian Federation of Students, argues that the increases in compulsory fees, and the fact that these fees are already the highest in the country, render the recent tuition cuts meaningless.[23] According to Statistics Canada, Nova Scotia university students pay an average of $882 in extra fees, which is one-third higher than the Canadian average. Statistics Canada reports that average compulsory fees in Canada in 2007/2008 were $663.[24]

Figure 11-7. Average undergraduate university tuition fees (2005 constant dollars), Canada and provinces, 1990/1991, 2005/2006, and 2007/2008



Source: Statistics Canada. *University Tuition Fees*. *The Daily*. Thursday, September 1, 2005; Statistics Canada. *University Tuition Fees*. *The Daily*. Thursday October 18, 2007. Data source: Survey of Tuition and Living Accommodation Costs for Full-time Students, Statistics Canada.

Note: All figures for 1990/1991 were converted to 2005 constant dollars using Bank of Canada's Inflation Calculator, February 19, 2007. Figures for 2007/2008 were converted using Bank of Canada's Inflation Calculator, October 22, 2007.

According to the MPHEC, between 1999/2000 and 2006/2007 the enrolment of Maritimers at Memorial University in Newfoundland increased 884% from 103 students to 1,014 students. Students originally from Nova Scotia showed a more than ten-fold increase from 64 students in 1999/2000 to 725 students in 2006/07. This increase in enrolment from the Maritimes has been largely attributed to the Newfoundland government freeze and lowering of tuition fees in that province.[25]

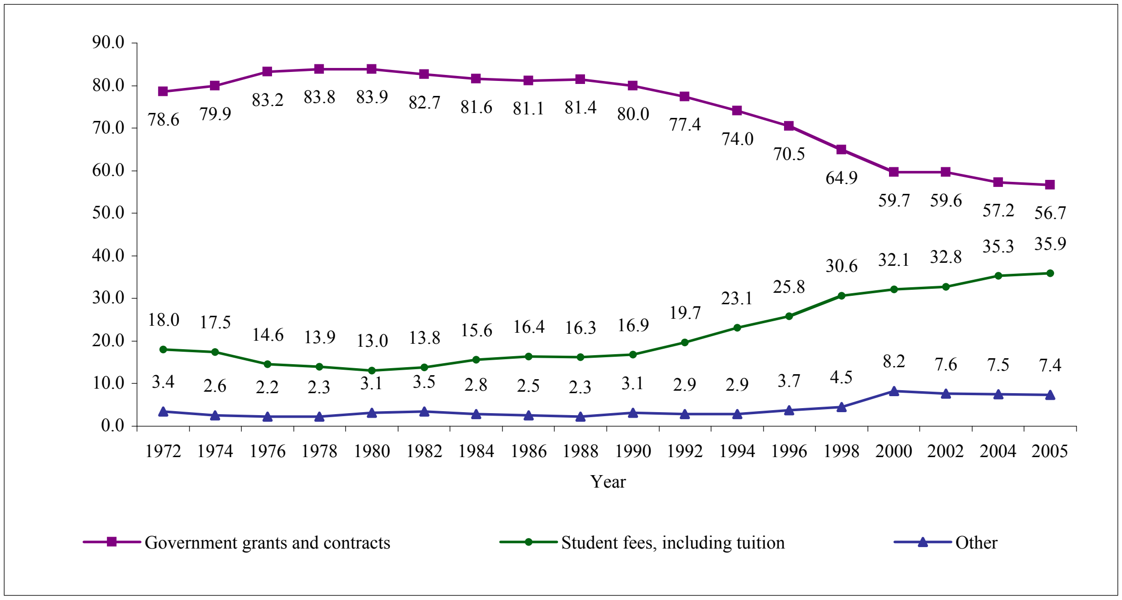
In addition to increases in average undergraduate tuition, tuition fees in several professional graduate programs skyrocketed between 2000/2001 and 2005/2006. In particular, annual fees dentistry, medicine, and law in Canada jumped by 248%, 194%, and 128%, respectively, in this short time period. In dentistry and medicine, average annual tuition fees in 2005/2006 were $11,805 and $9,440, respectively ($2001).

Not surprisingly, students are working longer hours at paid jobs than ever before to support their studies. According to Statistics Canada data, the employment rate of full-time students aged 20 to 24 years increased from 26.6% in 1976 to 46.9% in 2006. Unpublished Statistics Canada data show that average usual work hours during the school year for full-time students between the ages of 18 and 24 years with jobs steadily increased from 14.1 hours a week in 1992 to 16.7 hours in 2006—the highest ever recorded in the 30 years that consistent records have been kept.[26]

The additional time commitment required by jobs has an effect on the amount of time these students can devote to their studies, and these time pressures, in turn, can result in increased stress.[27] This also has equity implications. Students who have to work long hours to help finance their postsecondary studies will have less time for study, may perform less well, and are, therefore, at a distinct academic disadvantage compared to students who do not have to hold down jobs or who can afford to work fewer hours.

Higher tuition also signifies a change in government commitment to postsecondary education. Thus, tuition fees and other student fees now make up a much larger share of total university operating revenues than ever before, increasing in the last 34-year period from 18% of operating revenues in 1972 to 35.9% in 2005—effectively doubling their share. At the same time, the government share of total university operating revenues, counting all levels of government, decreased from 78.6% in 1972 to 56.7% in 2005 (see Figure 11-8 below).

Figure 11-8. Share of university operating revenue (%), by source, Canada, 1972–2005



Source: Data are originally from the Financial Information of Universities and Colleges (FIUC) survey and were provided free of charge by Larry Dufay, Senior Research Officer, Canadian Association of University Teachers (CAUT).

Note: "Other" includes revenue from donations (including bequests), non-government grants and contracts, investments, and the sale of services and products. Prior to 2000, funds from the sale of products and services were not used as general operating revenue.

11.4. Inputs: public expenditures per full-time student (K–12)

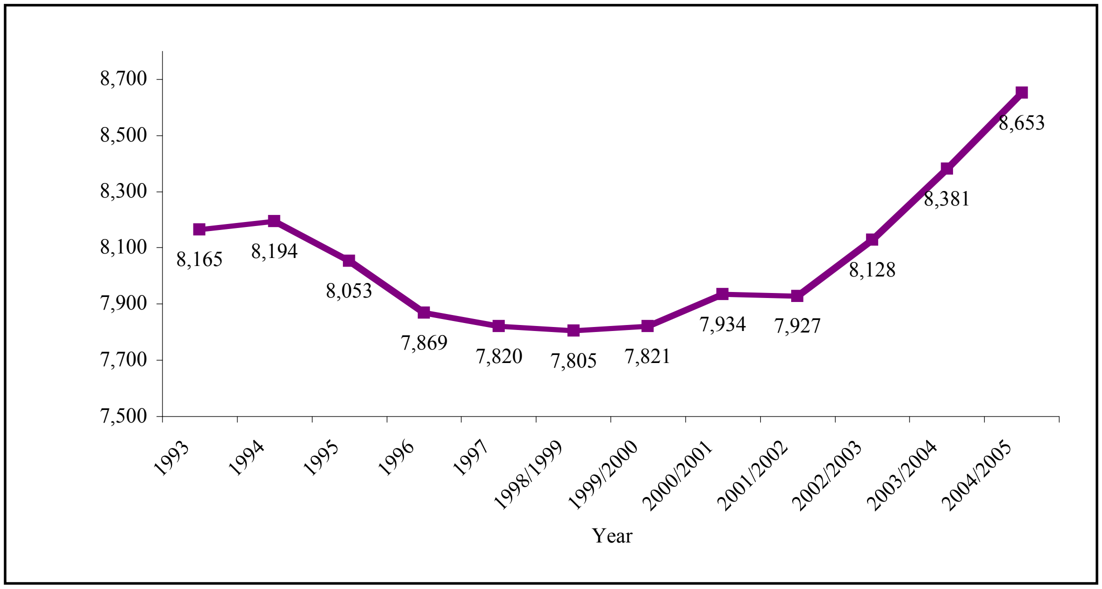
Data sources: Summary of Public School Indicators, Statistics Canada.

Result: Nova Scotia spent the second lowest amount of money per public school student in the country in 2004/2005.

While the GPI *Education Indicators* report focused on learning outcomes to the extent possible, there is a demonstrated link between public funding level inputs and the quality of education. Under-funded schools are less likely than well-funded schools to provide good computers, quality library books, adequate facilities, art and music supplies, and a range of extra-curricular programs, and are more likely to have students sharing outdated texts.

In Canada, public expenditures per full-time student declined in the 1990s from an average of $8,194 per full-time student in 1994 to $7,805 per student in 1998/1999 ($2003). Since then, expenditures per student have risen, finally surpassing the levels of the early 1990s for the first time in 2003/2004, at $8,381 per student and reaching $8,653 in 2004/2005—6% more than in 1993 (see Figure 11-9 below).[28]

Figure 11-9. Public expenditure per full-time equivalent public school student ($2003), Canada, 1993–2005,



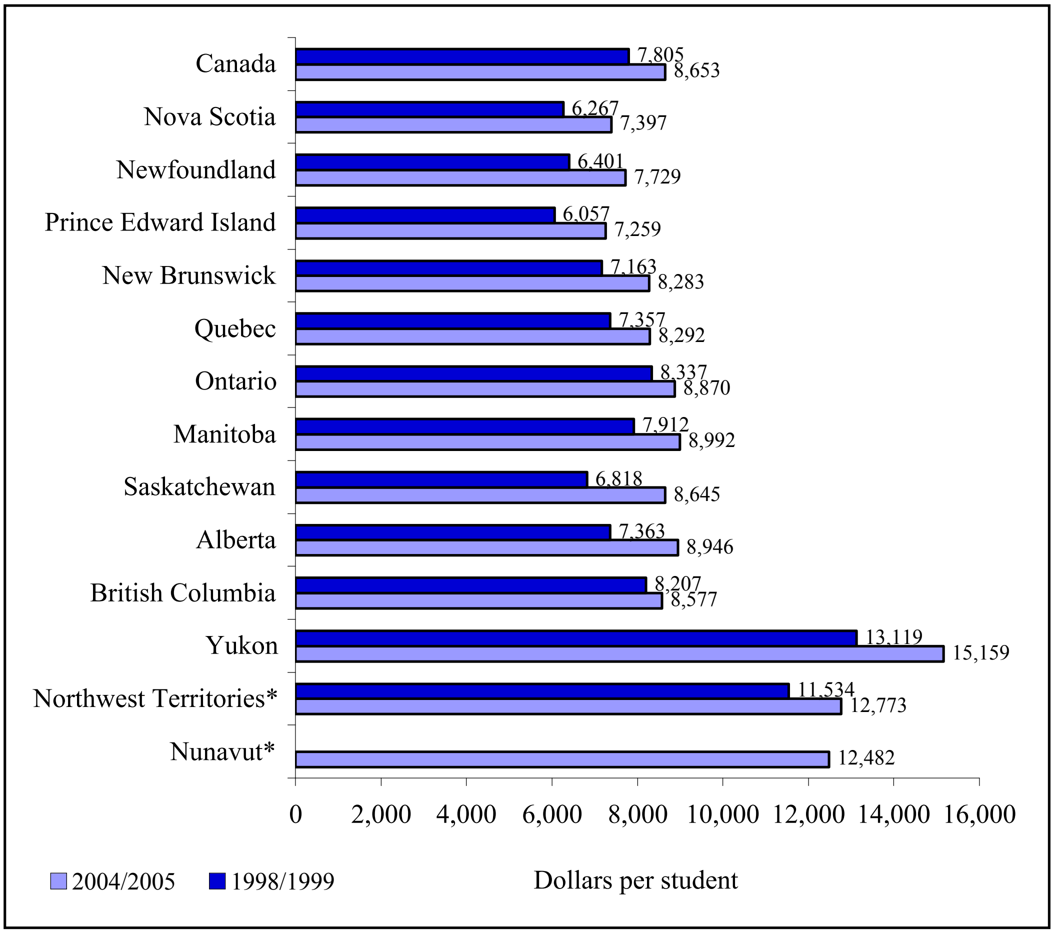
Sources: Blouin, Patric and Marie-Josee Courchesne. 2007. Research Paper: Summary Public School Indicators for the provinces and territories, 1998/1999 to 2004/2005. Statistics Canada. Ottawa; Statistics Canada, The Daily, July 28, 2000. School board revenues and expenditures, 1993–1997. Accessed December 2004.

Notes: All figures were converted to 2003 constant dollars using the Bank of Canada's Inflation Calculator, September 26, 2007. The data are for school years, rather than calendar years. The more recent year was used when converting to constant dollars. Figures were also rounded.

At the provincial and territorial level, Nova Scotia spent the second lowest amount per student ($7,397) in 2004/2005—17% less than the Canadian average ($8,653), more than 21% less than provincial front-runner Manitoba ($8,992), and 12% less than neighbouring New Brunswick ($8,283). Spending per student was highest in the Yukon, Northwest Territories, and Nunavut—where operating costs are higher due in part to geographic dispersal of a small population over a large area—followed by Manitoba, Alberta, Ontario, Saskatchewan, and British Columbia. Prince Edward Island spent the least amount ($7,259) per student (see Figure 11-10 below).

The provincial and territorial data also indicate that real (inflation-adjusted) public spending per student increased in all provinces and territories over the seven-year period from 1998/1999 to 2004/2005, with the largest increases occurring in Saskatchewan (28%) and Alberta (21%), compared to an 11% increase nationwide. Newfoundland and Labrador, Prince Edward Island, and Nova Scotia also experienced significant increases—21%, 20%, and 18%, respectively. All three of these provinces were among the lowest spenders per student in 1998/1999; moreover, despite the large increase in per student spending, they still remain below the Canadian average.

Figure 11-10. Public expenditure per full-time equivalent student ($2003), provinces and territories, 1998/1999 and 2004/2005



Source: Blouin, Patric and Marie-Josee Courchesne. 2007. Research Paper: Summary Public School Indicators for the provinces and territories, 1998/1999 to 2004/2005. Statistics Canada. Ottawa.

Notes: All figures were converted to 2003 constant dollars using the Bank of Canada's Inflation Calculator, September 26, 2007. The data are for school years, rather than calendar years. The more recent year was used when converting to constant dollars. Figures were also rounded.
*Starting in 1999/2000, the Northwest Territories excludes Nunavut. Higher spending per student in the Northwest Territories, Yukon Territory, and Nunavut reflects higher operating costs in the north.

11.5. Independence: public versus private share of sponsored research at universities

Data source: Statistics Canada's Financial Information of Universities and Colleges (FIUC) survey, and Canadian Association of University Business Officers (CAUBO), with data from both sources provided by Canadian Association of University Teachers (CAUT).

Result: The ratio of private to public funding of research has increased markedly since the early 1970s, posing a potential threat to the academic integrity and independence of Canadian university research.

Evidence indicates that, when university research is privately funded, there is a greater potential for investigators to face outside interference and challenges with regard to study design, access to data, and publication rights than when research is publicly funded. In addition, increased pressure is being placed on university researchers to find commercial applications for their work, thus potentially restricting basic or curiosity-based research.

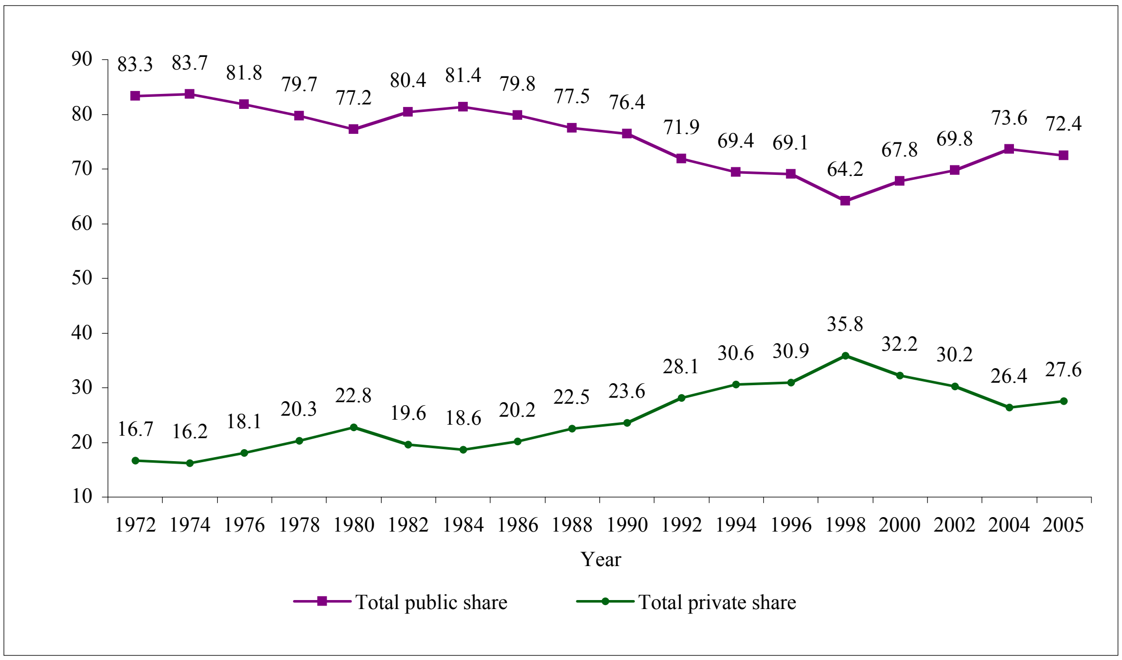
Anything that restricts or limits the educational horizons of researchers or students, or prevents them from an unhindered pursuit of truth, runs counter to the principle of "systematic, scientifically-based investigation" that the Pan-Canadian Education Indicators Program identifies as a central and defining role of postsecondary education.[29] Analysts have described external influences on university research as anti-educational. According to philosopher John McMurtry:

> If society's education system is ineluctably determined by economic requirements, and these economic requirements are the requirements of established market-capitalism, then it follows that we face the prospect of an inevitable transformation of our educational process into an organ of the capitalist market [. . .]. Because an educational process is required by its nature to reflect upon and question presupposed patterns of being, its absorption into one of these patterns, the global market system, must leave society in a very real sense without its capacity to think. It becomes a kind of mass creature, a collective system of gratifying desires for private profit and consumption with no movement beyond itself towards understanding and consciousness as a human purpose in its own right.[30]

While no direct measures of external influence or interference in research are available, the public versus private share of sponsored research at Canadian universities may potentially point to issues of independence and academic integrity. It should be noted, however, that increased requirements for public–private partnerships and for commercialization of research in some public funding agreements are blurring conventional distinctions between public and private funding.

Over the last 30 years, there has been a marked increase in the private share (and decline in the public share) of funding for university research. As Figure 11-11 below indicates, the public share of sponsored research gradually declined from 83.3% in 1972 to 64.2% in 1998 and then increased to 72.4% in 2005, largely as a result of recent public funding commitments to the Canada Research Chairs, Canada Foundation for Innovation, and Canadian Institutes of Health Research (CIHR). During the same time period, the private share of sponsored research increased from 16.7% in 1972 to 35.8% in 1998 and then declined to 27.6% in 2005.

Figure 11-11. Public versus private share of sponsored research at Canadian universities (%), 1972–2005



Source: Larry Dufay, Senior Research Officer, Canadian Association of University Teachers (CAUT). Personal communication, September, 2006. Original data from Statistics Canada's Financial Information of Universities and Colleges (FIUC) survey and Canadian Association of University Business Officers (CAUBO).

Notes:

- Categories of public funding sources include Social Sciences and Humanities Research Council (SSHRC), Health Canada, Natural Sciences and Engineering Research Council (NSERC), Canadian Institutes of Health Research (CIHR), Canada Foundation for Innovation (CFI), Canada Research Chairs, other federal sources, and provincial, municipal, other provincial, and foreign sources. Private funding sources include: a) donations and bequests from individuals, business enterprises, foundations, and non-profit organizations and b) non-government grants and contracts from individuals, business enterprises, foundations, and non-profit organizations.
- According to CAUT's Senior Research Officer Larry Dufay, prior to 2000, CAUBO did not disaggregate the data for private funding by type of source. Therefore, prior to 2000, private funding is presented as a total for the sector.[31]
- By definition, sponsored research is from sources external to the universities themselves. Therefore, Figure 11-11 above does not include research funding provided by the universities.

11.6. Basic adult literacy: trends in prose and document literacy

Data sources: 1994 International Adult Literacy Survey (IALS) and 2003 International Adult Literacy and Skills Survey (IALSS).

Result: Despite higher rates of postsecondary graduation, there was no real improvement in the basic literacy profiles of Canadians between 1989 and 2003.

The four domains of basic literacy skills measured in the 1994 International Adult Literacy Survey (IALS) and the 2003 International Adult Literacy and Skills Survey (IALSS) are prose literacy, document literacy, numeracy, and problem solving skills. Due to methodological and definitional issues, the 1994 IALS and the 2003 IALSS are not fully comparable, and only the prose and document literacy sections in both rounds of testing are sufficiently similar that they can be compared.[32] Thus, trend lines are only presently possible for prose and document literacy, which are defined as follows:

- *Prose literacy* measures the knowledge and skills needed to understand and use information from texts such as news stories, instruction manuals, poems, and fiction
- *Document literacy* measures the knowledge and skills needed to locate and use information in formats such as job applications, maps, transportation schedules, tables, and charts[33]

In both surveys, literacy skills are divided into five levels of difficulty, from the lowest proficiency at level 1 to the highest proficiency at level 5. Level 3 is the "desired threshold," or the "minimum for persons to understand and use information contained in the increasingly difficult texts that characterize the emerging knowledge society and information economy."[34,35] In 1994, 53% of Canadians scored level 3 or higher in prose literacy and 52% scored level 3 or higher in document literacy, compared with 52% and 51% in 2003, respectively, indicating a possible marginal, though not statistically significant, decline in prose and document literacy nationwide.

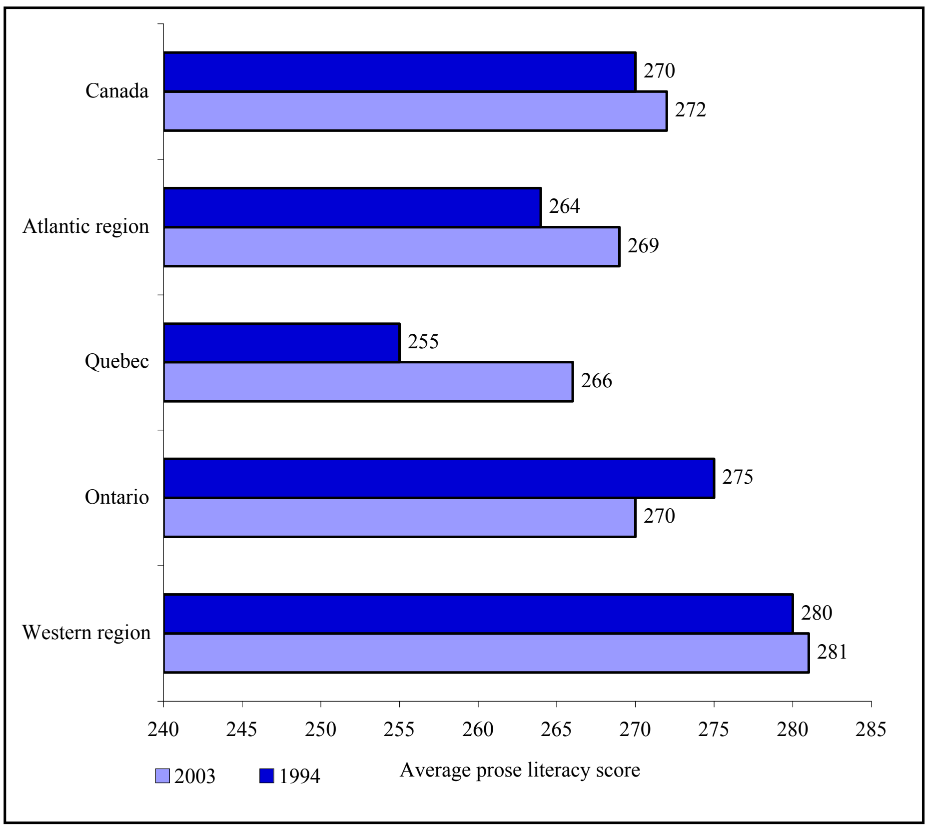
When average scores are examined by region, there was little change in the prose and document literacy profiles of Canadians between the 1994 IALS and 2003 IALSS. In fact, the only statistically significant changes in the nine-year period were in Quebec, where there was an increase in average prose literacy from 255 to 266 and in document literacy from 254 to 263, and in the Atlantic region, where there was an increase in document literacy from 259 to 267 (see Figures 11-12 and 11-13 below for average prose and document literacy scores by region).[36]

Furthermore, when earlier Statistics Canada literacy data are adjusted for methodological changes and analyzed, it is apparent that literacy levels in Canada have not improved substantially since 1989—the first available observation.[37] Thus, over a nearly 15-year period, literacy levels have remained stable despite rising levels of formal educational attainment in the Canadian populace.

According to Statistics Canada, literacy levels were expected to improve between 1994 and 2003 based on the retirement of older, less educated workers; the tendency of new immigrants to be more highly educated; and the growth in the proportion of the Canadian-born population with postsecondary education.[38]

The lack of improvement was also surprising to the Canadian Council on Learning (CCL), which stated "We urgently need to understand why our current literacy and learning programs are not succeeding in order to develop more effective approaches.[39]

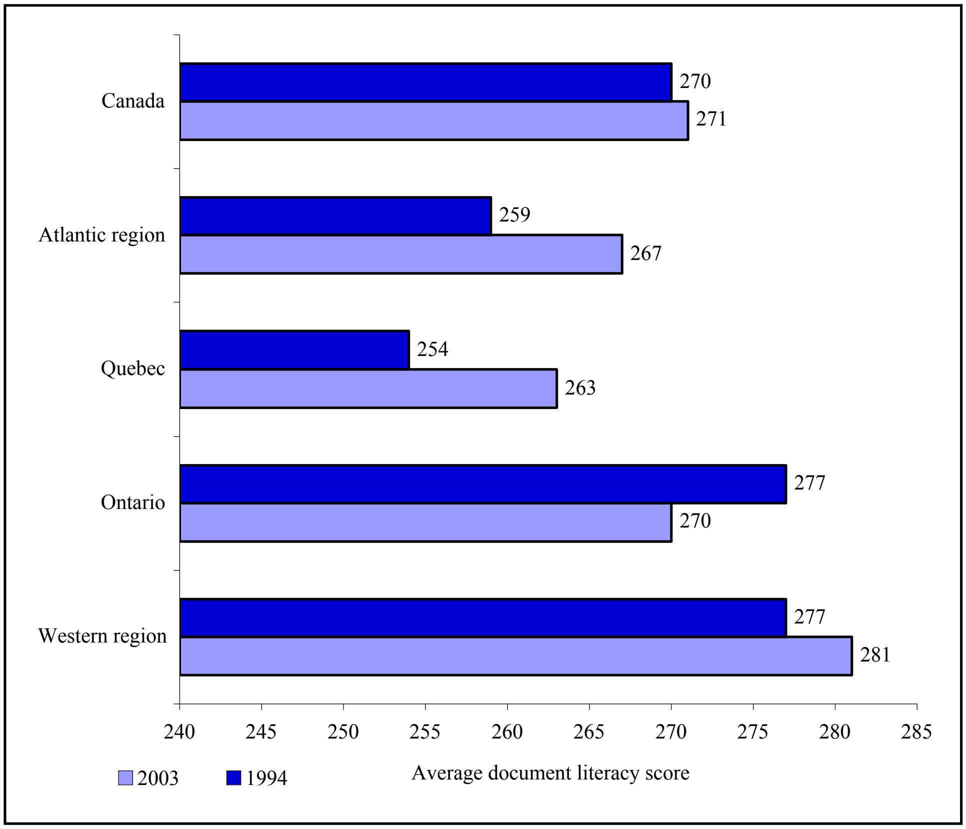
Figure 11-12. Average prose literacy scores, population aged 16 and over, Canada and selected regions, 1994 and 2003



Sources: International Adult Literacy Survey, 1994; International Adult Literacy and Skills Survey, 2003.

Notes: In this comparison, the territories are excluded from the Canadian average. The western region includes Manitoba, Saskatchewan, Alberta, and British Columbia. The Atlantic region includes Newfoundland and Labrador, Nova Scotia, New Brunswick, and Prince Edward Island. Except for Quebec, the differences in prose literacy scores are not statistically significant.

Figure 11-13. Average document literacy scores, population aged 16 and over, Canada and selected regions 1994 and 2003



Sources: International Adult Literacy Survey, 1994; International Adult Literacy and Skills Survey, 2003.

Notes: In this comparison, the territories are excluded from the Canadian average. The western region includes Manitoba, Saskatchewan, Alberta, and British Columbia. The Atlantic region includes Newfoundland and Labrador, Nova Scotia, New Brunswick, and Prince Edward Island. Except for the Atlantic region and Quebec, the differences in document literacy scores are not statistically significant.

11.7. Civic literacy: trends in general political knowledge by age cohort

Data source: 1984, 1993, 1997, and 2000 Canadian Election Study (CES) surveys.

Result: The political knowledge of Canadians is in general decline. This decline is particularly marked among younger people, who tend to have considerably less political knowledge today than younger people did a generation ago.

Henry Milner, of the Université Laval in Quebec, defines civic literacy simply as "the knowledge and capacity of citizens to make sense of their world," or the "knowledge to be effective citizens."[40] Explaining the value and importance of civic literacy, Milner argues that, because knowledge of the world and of civic processes inevitably points to needed actions, civic literacy encourages political participation as well as more equitable societies "based on sustainable wellbeing."[41] Milner also notes that, "Informed individuals can better identify the effects policy options have upon their own interests and those of others in their community and make their votes count toward attaining desired long-term [. . .] outcomes."[42]

Researchers have found political knowledge to be highly correlated with voter turnout and political engagement, especially among young adults. Well-informed citizens are more likely to follow and be interested in politics, to participate in politics by voting, to work for a political party, and to attend community meetings.[43] Research also shows that people who are more informed in one area of politics (such as foreign affairs) are more likely to be informed in other areas of politics (such as domestic policies and political processes).[44] Therefore, even a very limited and partial assessment of political knowledge might serve to indicate broader political knowledge and to predict levels of civic engagement.

Paul Howe, of the University of New Brunswick, has analyzed results from selected Canadian Election Study (CES) surveys. He notes that the CES is "the only [Canadian study] on which a reasonable selection of knowledge-based items appear."[45]

Howe has constructed a knowledge scale, based on 29 questions used in the 1984, 1993, 1997, and 2000 CES surveys, in order to measure general political knowledge across time and by age-group distribution. The questions include knowledge of the names of premiers, party leaders, and the federal finance minister, and knowledge of party positions and campaign promises. Howe's composite scale allows a comparison of levels of political knowledge over time despite the different questions asked in the different CES surveys.[46] While results for a wide range of specific questions are provided in the GPI *Education Indicators* report, we reproduce only one table here, based on Howe's composite political knowledge scale.

In order to help identify general trends over time, "sub-par levels" of knowledge (below 50th percentile) are located to the left of the zig-zag line in Table 11-1 below, and "above-average" levels of knowledge (above 50th percentile) are located to the right of the zig-zag line.[47]

Table 11-1 indicates that, in general, younger people have considerably less political knowledge than older people, and that the political knowledge of younger people is decreasing over time and at a faster rate than for any other group.[48] Thus, between 1984 and 2000, scores fell by 20% for the youngest group (aged 18–23), by 17% for the next youngest group (24–29), by 8% for those aged 30–34, and by between 4% and 6% for middle-aged Canadians, while knowledge scores improved for those 50 and over.

The results show clearly that political knowledge generally increases with age, with those 50 and older being considerably (and increasingly) more knowledgeable than those younger than 30. For example, in 1984, the 18- to 23-year-old age group was in the 39th percentile, whereas the 60 and older age group was in the 52nd percentile—a difference of 13 percentage points. By 2000, this gap had increased sharply, so that 18- to 23-year-olds were in the 31st percentile and those 60 and older were in the 58th percentile—a difference of 27 percentage points. Thus, the gap between the political knowledge levels of the youngest and oldest age groups grew by 14 percentage points between 1984 and 2000.

The gap between the 18- to 23-year-olds and 50- to 59-year-olds also increased during this period—from a gap of 18.6 percentage points in 1984 to a gap of 28.3 percentage points in 2000—an increase of 9.7 percentage points. The gap between the political knowledge of the next youngest group (aged 24–29) and those 60 and older also grew sharply during this period—from a gap of 8.7 percentage points in 1984 to a gap of 22.1 percentage points in 2000—an increase of 13.4 percentage points.

In comparing the political knowledge of young people in 2000 with the political knowledge of young people in previous years, there is evidence of a fairly steady decline in knowledge. In 1984, the 18–23 and 24–29 age groups were in the 39th and 43rd percentiles, respectively. By 2000, these scores had dropped to the 31st and 36th percentiles, respectively, representing drops of 8 and 7 percentage points, respectively, between 1984 and 2000.

Again, it must be emphasized that the results here contradict the conventional wisdom that graduation indicates educational attainment and that higher rates of graduation should, therefore, predict higher levels of knowledge. In this case, we see that the very age cohort that has the highest levels of formal education in Canadian history also has the lowest levels of political knowledge ever recorded.

Finally, the number of age groups falling below the 50th percentile has also increased steadily over time, as the zig-zag line in Table 11-1 demonstrates—indicating that the decline in political knowledge is becoming more widespread. In 1984, only the youngest groups (those aged 18–29) had percentile scores under 50. In 1993, these two groups were joined by 30- to 34-year-olds; by 1997, the 35–39 age group had also fallen into the lower half of the scores. This decline in political knowledge among younger Canadians over time is largely confirmed again by the 2000 results, in which (despite marginal improvements in the scores of those aged 30–39) Canadians under 40 again fell below the 50th percentile.

Indeed, the 1984–2000 CES results appear to indicate that, except for those 50 and older, the level of political knowledge in the Canadian populace is in general decline.

Table 11-1. Percentile scores of correct answers to general political knowledge questions, by age group, Canada, 1984, 1993, 1997, and 2000

	AGE GROUP						
Year	18–23	24–29	30–34	35–39	40–49	50–59	60 +
1984	39.3	43.7	51.9	51.4	54.4	57.9	52.4
1993	36.7	46.7	47.1	50.3	55.5	53.1	56.0
1997	37.8	41.0	46.1	47.7	53.2	58.4	57.0
2000	31.4	36.2	47.6	49.5	51.4	59.7	58.3

Source: Adapted from Howe, Paul. "Political Knowledge and Electoral Participation in the Netherlands: Comparisons with the Canadian Case." Paper presented at the Annual conference of the Canadian Political Science Association, Winnipeg, June 3–5, 2004; accessed July 2005; Available from http://www.cpsa-acsp.ca/template_e.cfm?folder=conference&page_name=agm-papers-2004.htm, based on the 1984, 1993, 1997, and 2000 CES surveys.

Note: Knowledge scores for each election year are based on the number of questions respondents answered correctly in each year, with results then converted to percentile scores. Relative knowledge levels of the different age groups were calculated based on the mean percentile scores within each age group.

11.8. Ecological Footprint by educational attainment

Data sources: Estimates developed by Hans Messinger, HFM Consulting, are based on source data from Statistics Canada's Social Policy Simulation Database, National Accounts Analytical Studies Branch, and Global Footprint Network / International Institute for Sustainable Development data for the National Ecological Footprint and Biocapacity Accounts, 2005 edition.

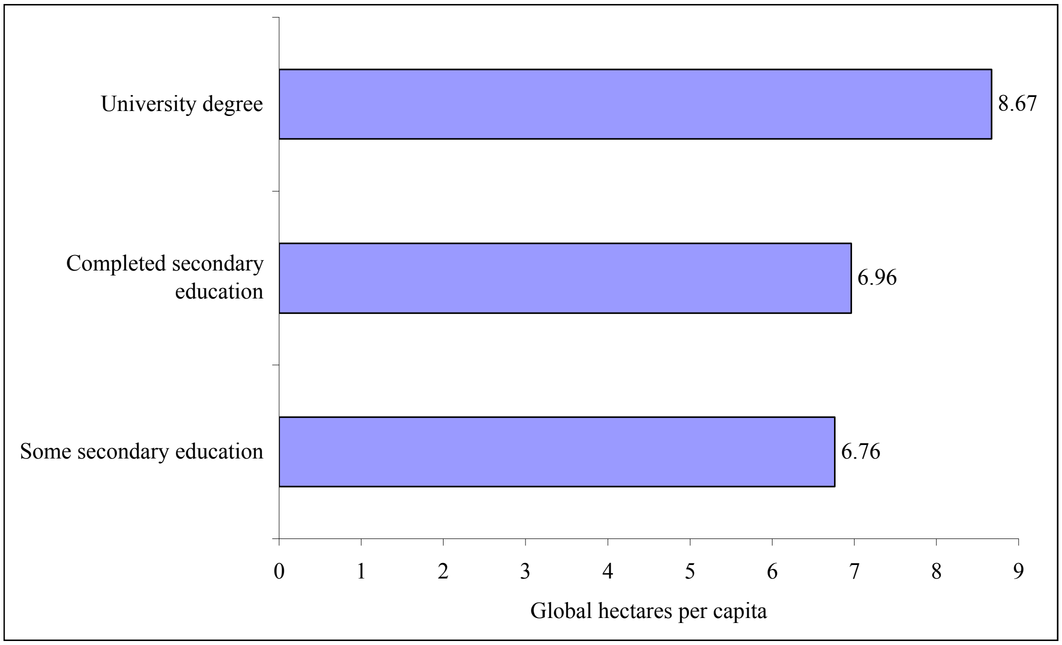
Result: Those with the highest levels of educational attainment have the greatest impact on the environment.

According to the Global Footprint Network, the average Ecological Footprint per Canadian resident is 7.6 global hectares (gha), signifying the biologically productive land and sea area required to support the average Canadian's lifestyle and resource consumption.[49] This is far in excess of the 1.8 gha/capita of bioproductive area globally available to the world's population, and indicates that if everyone in the world were to consume resources at the rate that Canadians do, we would require more than three additional planets Earth to provide the necessary resources.

According to educator and ecologist David Orr: "We may reasonably surmise that, on average, those whose lifetime earnings are enhanced by [higher education] degrees do more damage to the planet than those less encumbered."[50]

For the first time, in GPI Atlantic's *Education Indicators* report (2008), data are now available on the Ecological Footprints of Canadians based on their educational attainment. These results support Orr's observation that higher levels of formal education lead to more unsustainable lifestyles. Thus, those Canadians who have only some secondary education use 6.76 gha per capita, those who have completed secondary education use 6.96 gha, and those who have a university degree use 8.67 gha each in order to sustain their lifestyles (see Figure 11-14 below).[51]

Figure 11-14. Ecological Footprint by educational attainment (gha), Canada, 2005



Source: Estimates developed by Hans Messinger, HFM Consulting, are based on source data from Statistics Canada's Social Policy Simulation Database, National Accounts Analytical Studies Branch, and Global Footprint Network / International Institute for Sustainable Development data for the National Ecological Footprint and Biocapacity Accounts, 2005 edition.

Note: The ecological footprints by education illustrate the gha consumed per person for the individual with the highest income in each household disaggregated by that person's level of formal educational attainment. Global hectares are an area weighted by productivity or "the amount of biological material useful to humans that is generated in a given area."[52]

This evidence has important implications for the content and processes of formal education in the future. If the Canadian populace is to practice sustainable living in daily life, then—in line with the goals and objectives of the United Nations Decade of Education for Sustainable Development (2005-2014)—higher education should support rather than undermine sustainability. The Footprint data by educational level, assembled in detail for the first time in GPI Atlantic's *Education Indicators* report, will be a useful tool to monitor progress and suggest educational policy options in this area.

NATURAL CAPITAL

12. Soils and Agriculture

For the original GPI Atlantic reports on agriculture, please see the following:

Towards a Healthy Farm and Food Sector: Indicators of Genuine Progress (2008)
http://gpiatlantic.org/pdf/agriculture/thffs.pdf

Farm Economic Viability in Nova Scotia and Prince Edward Island (2008)
http://gpiatlantic.org/pdf/agriculture/farmviability08.pdf

Land Capacity in Nova Scotia (2008)
http://gpiatlantic.org/pdf/agriculture/landcapacity.pdf

The Nova Scotia GPI Soils & Agriculture Accounts Part 1: Farm Viability and Economic Capacity in Nova Scotia (2001)
http://gpiatlantic.org/pdf/agriculture/farmviability.pdf

The Nova Scotia GPI Agriculture Accounts Part 2: Resource Capacity and Use: The Value of Agricultural Biodiversity (2002)
http://gpiatlantic.org/pdf/agriculture/biodiversity.pdf

The Nova Scotia GPI Agriculture Accounts Part 2: Resource Capacity and Use: Soil Quality and Productivity (2002)
http://gpiatlantic.org/pdf/agriculture/soilqp.pdf

Headline Indicators

1. Net farm income
2. Expense to income ratio
3. Debt to net farm income ratio
4. Solvency ratio
5. Percentage of Nova Scotia consumer dollar going back to Nova Scotia farmers
6. Number of soil cover days
7. Ratio of productive value of agricultural land to market land value
8. Intensity of synthetic input use
9. Proportion of farm land occupied by forest and wetland

Note to Reader

The nine headline indicators considered in this summary update have been chosen from seven reports comprising the GPI Agriculture Accounts: *Farm Viability and Economic Capacity in Nova Scotia* (2001), *The Value of Agricultural Biodiversity* (2002), *Soil Quality and Productivity* (2002), *Farm and Community Viability: Report on Interview Results* (2003), *Land Capacity in Nova Scotia* (2008), *Farm Economic Viability in Nova Scotia and Prince Edward Island* (2008), and *Towards a Healthy Farm and Food Sector* (2008). Needless to say, there were dozens of indicators to choose from in those reports, and the following were chosen as a representative and meaningful sample intended to provide some measure of biodiversity, soil quality, land capacity, and economic viability in the Nova Scotia agriculture sector. For a more comprehensive assessment, please see the original reports listed above.

The Nova Scotia GPI Soils and Agriculture Accounts consist of three basic components:

- Economic Viability—consisting of the two farm economic viability reports (2001 and 2008);
- Resource Capacity and Use—consisting of three reports on land capacity, soil quality and productivity, and biodiversity; and
- Human and Social Capital—the 308-page 2008 report on a healthy farm and food sector which, among other things, assesses the contribution of farms to rural community viability in Nova Scotia.

As well, it should be noted that three additional reports were originally intended to be part of the Resource Capacity and Use component of the full Nova Scotia GPI Soils and Agriculture Accounts—water use and impacts, input use efficiency, and livestock. However, resources have not allowed these studies to be conducted to date.

12.1. Introduction

In this introduction, we briefly review four key components of a healthy farm and food system—agricultural biodiversity, soil quality, land capacity, and economic viability—addressed by the nine indicators considered here. If Nova Scotia farms have a high level of biodiversity, healthy soils, ample good quality land suitable for agriculture, and a high degree of economic viability, then we can conclude both that Nova Scotia agriculture is healthy and viable, and that the province has rich natural capital in its agricultural soils.

12.1.1. Biodiversity

Agricultural production first and foremost depends on a healthy, fully functioning ecosystem. In other words, the production of food depends on the services nature provides, such as soil formation, nitrogen fixation, nutrient cycling, pollination, waste decomposition, pest control, bioremediation of toxins, and many others.

Biodiversity includes the diversity of living organisms and the interactions between those organisms. In order to understand biodiversity and its importance for maintaining healthy, functioning ecosystems—including agricultural ecosystems—we need to study those organisms, and ascertain their numbers, their diversity, and their preferred habitats. We also need to understand and value the productive work that these organisms do, and how that work may be supported, nurtured, and encouraged on farms to produce ample, high quality farm products. In fact, biodiversity is the foundation upon which the earth's productive capacity is based. Humankind might be able to produce food with diminished biodiversity, but it would become a progressively more expensive enterprise—both financially and ecologically—as it would increasingly depend on costly synthetic inputs that are likely further to undermine soil quality. Thus, an evaluation of progress in agriculture must also include evaluations of the state of biodiversity on farms.

To a limited extent, ecosystem services provided freely by earth's biodiversity can be replaced by using purchased inputs of energy, built structures, synthetic fertilizers, pesticides, irrigation systems, and pharmaceuticals. On the one hand, these purchased inputs may possibly help to make agriculture more predictable in the short term, and may even increase short-term yields. On the other hand, some inputs used to replace ecosystem services may be harmful to biodiversity, thus reducing the capacity to generate further ecosystem services. This can create a spiral of increasing needs for inputs, and reduced capacity of agriculture to tap into "free" services. Depletion or degradation of ecosystem services, like the depreciation of any other critical resource, can be self-defeating, expensive, and ultimately reduce long-term net productivity and farm viability.

One way to assess the health of agricultural biodiversity is to monitor the habitats of organisms that we know are beneficial. Certain types of land use can create critical and excellent habitat for a myriad of organisms. In return, these organisms can be harnessed to provide vital, productive ecosystem services for the farm—a remarkable symbiotic relationship. In this update, trends in farm land composition (see Indicator #9: Proportion of farm land occupied by forest and wetland) and farm practices (see Indicator #8: Intensity of synthetic input use)—both of which have been demonstrated to have a significant impact on habitat and species biodiversity on farms—have been used to shed light on agricultural biodiversity.

12.1.2. Soil quality and productivity

In addition to biological diversity, soil is the key natural capital asset in which our agricultural system is rooted and without which it cannot function. It is vital to maintain healthy and productive soil if our agricultural system is to continue to function optimally.

And yet, although its importance is obvious, soil is currently undervalued in our food production system. Methods of agriculture that degrade the soil are profitable in the short term under our current system of accounting. This perverse outcome occurs because losses of natural capital due to soil erosion or degradation are invisible in conventional economic accounts, and their costs—

though very real and scientifically demonstrable—are therefore not included directly in the costs of food production.

As with biodiversity loss, soil degradation that results in soil compaction and reductions in the soil's inherent fertility can be compensated for in the short term by increases in purchased agricultural inputs, such as fertilizer. These inputs can mask and apparently compensate for the degradation of our soils by allowing crop yields to be sustained and profitable in the short term, at the expense of long-term productivity. By contrast, the GPI natural resource accounts explicitly recognize the *long-term* value of our soil assets, and they count their depletion or degradation as depreciation in natural capital.

Soil quality is more than the sustained capability of a soil to accept, store, and recycle water, nutrients, and energy. It is the capacity of soil to sustain *ecological productivity*, maintain *environmental quality*, and *promote plant and animal health*. Farmers face an important challenge in their attempts to maintain, restore, and enhance soil quality and productivity. This is not an easy or straightforward task, particularly when faced with an uncertain climate, sloping topography, shallow soils, and/or narrow economic margins—all of which are frequently the case in Nova Scotia.

In order to assess and achieve genuine progress in agriculture, society as a whole must have a measurable way of ensuring that soil quality is maintained or improved. To that end, two soil quality and productivity indicators are proposed and updated here—*Soil cover days* (Indicator #6) and *Intensity of synthetic input use* (Indicator #8)—with the latter shown scientifically to affect both agricultural biodiversity and soil quality.

12.1.3. Land capacity

Farming and food production require a special combination of elements to be successful—including the best and most fertile available land; clustered farming communities; farming infrastructure nearby; people knowledgeable about farming and willing to take risks; financial resources; adequate water and stable climatic resources; and favourable market conditions. GPI Atlantic's extensive 2008 report, titled *Towards a Healthy Farm and Food System,* examined a wide range of human, social, and other conditions of successful farming. Here we deal with land capacity as one key element required for effective food production.

GPI Atlantic found that scarce fertile land in Nova Scotia is being converted to residential and commercial development at the very time that the need and demand for local fresh farm produce is increasing. Recent sharp increases in global food prices and (just prior to the current economic downturn) in the price of fuel, commodity price fluctuations due to storms, climate change, drought, and other events, and recent serious safety concerns related to imported food, have together led to renewed insecurity about food supplies and to interest in reducing dependence on imported food supplies that may be uncertain and subject to increasingly expensive transportation costs. As well, natural security experts warn that secure local food supplies may be more essential to national security than large armies. These circumstances give new importance to the issue of land capacity, and to the question of whether Nova Scotia has sufficient farm land to enhance food self-reliance.

In order to address this issue of land capacity, this summary update examines the ratio of the productive value of agricultural land to the market value of the land (see Indicator #7), since this indicator can directly juxtapose the availability of fertile land against the temptation to develop that land for other than agricultural uses.

12.1.4. Economic viability

Farms in Nova Scotia also generate significant economic benefits both for the rural communities in which they are situated and for the provincial economy as a whole. They are currently generating approximately $460 million in direct business spending annually by virtue of their farm operating expenses. These farm operating expenses (and thus business activity generation) grew by 26% in real terms in Nova Scotia between 1971 and 2006. Since 1995 alone, farm operating expenses have increased by 13% in Nova Scotia—indicating that farm economic contributions continue to grow significantly.[1]

Multiplier studies have shown that, when indirect and induced economic benefits are added, the economic benefits generated by farms are actually much larger than indicated above. Thus, for every $100 direct contribution of agriculture to the Nova Scotia GDP, about $200 is actually added to the provincial GDP and more than $400 is added to the national GDP. As well, annual farm expenditures in Nova Scotia generate more than 10,000 person years of employment—including 6,600 full-time equivalent jobs in agriculture, and nearly 3,700 additional indirect and induced jobs. They also generate more than $150 million in tax revenues.

One study found that 60% of farm related expenditures in Nova Scotia are made locally within the rural communities where farms are located, and 92.5% are made provincially. Other studies have found that smaller farms generally purchase a higher proportion of goods locally while larger scale farms trend to travel further for farm inputs and to bypass local community suppliers.

Despite the very considerable economic benefits generated by farms both for the rural communities in which they are situated and for the larger economy, these benefits are now seriously endangered, because all key indicators of farm economic viability in Nova Scotia are trending sharply downward.

In this update,four key economic indicators are explored: net farm income, expense to income ratio, debt to net farm income ratio, and solvency ratio. These *net* indicators allow a far more accurate assessment of farming viability than the *gross* indicator of total farm cash receipts conventionally used in GDP-based measures. While the latter has continued to trend upward, all four net indicators of viability have trended downward.

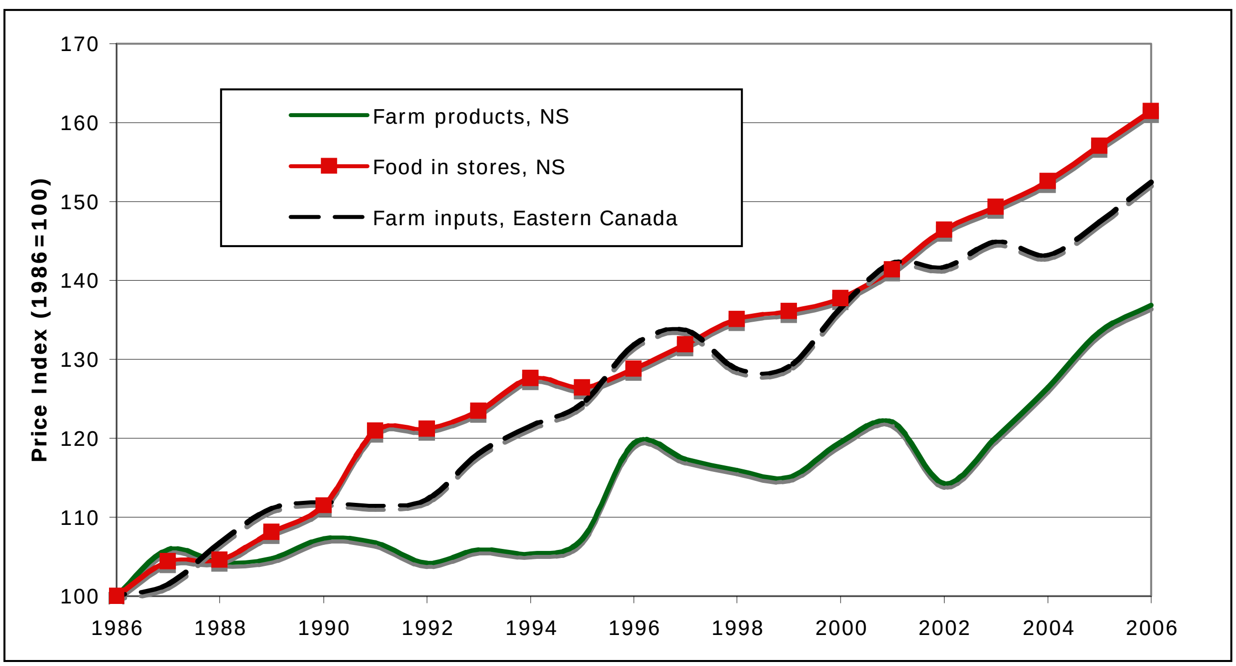
The results indicate clearly that—except in supply managed sectors like dairy and poultry—farming is no longer economically viable in Nova Scotia, and is now in a state of serious crisis—

in actual danger of demise as an economic, social, and cultural institution not only in Nova Scotia but throughout the Maritimes. That, in turn, will have serious economic and social consequences for rural communities in the Maritimes.

While the number of farms in Nova Scotia continues to decline, the land in crops has remained relatively stable over the last 35 years. Nova Scotia now has only 3,795 remaining farms (out of the nearly 50,000 that existed 85 years ago). Many analysts have questioned whether these numbers are sufficient to keep farming infrastructure, support businesses, and farm communities viable.

A key cause of declining farm viability is depressed farm product prices. In Nova Scotia, farm input and grocery food prices have gone up much faster than farm product prices, so it is costing farmers considerably more to farm without a commensurate gain in income. Yet, remarkably, depressed farm product prices are not proportionately reflected in cheaper food prices for consumers, indicating that profit-taking is happening in other parts of the food supply chain rather than at the farm gate. Thus, when farm product, input, and grocery store prices are indexed over a 20-year period (1986=100), farm product prices in Nova Scotia in 2006 were 15 percentage points below farm input prices relative to 1986 levels, and 24 percentage points below grocery store prices relative to 1986 levels (Figure 12-1 below).

Figure 12-1. Price indices for farm products, farm inputs, and food in stores, Nova Scotia, 1986–2006 (1986 = 100)



Sources: Derived from Statistics Canada. 2008. *Farm Product Price Index,* Cat. No. 21-007; McLaughlin and Robinson, 1999 Agricultural Statistics, 1995 Agricultural Statistics, 1992 Agricultural Statistics; Statistics Canada. CANSIM tables 002-0022 Farm Product Price Index, 328-0014 Farm Input Price Index, 328-0001 Farm Input Price Index, 326-0020, Consumer Price Index, Food Purchased from Stores. Indices converted to 1986 base year.
Note: Please refer to the appendix at the end of this chapter for data tables.

Reasons for depressed farm product prices include global commodity pricing and trade agreements, consumer demand for the cheapest price for food regardless of its origin or actual cost of production, and continued consolidation among retailers and processors. As well, reliance on GDP-based indicators like gross farm cash receipts, which rose by an average of 6.7% in Nova Scotia from 1971–2006, send misleading signals to policy makers, businesses, and the general public, since they obscure changes in the cost of farming and therefore do not reveal the *net* income, expense, and debt levels that determine viability.

As a result of declining viability, farms have had to cut back their costs and even to sell off land—affecting not only on-farm jobs but also upstream local businesses. Since 2001 alone, jobs in agriculture have dropped by 36% in Nova Scotia—from 7,300 to 4,700, the lowest number ever recorded. Furthermore, as farming becomes less viable, it also becomes less attractive to young people. The proportion of young farmers in Nova Scotia is now at its lowest level in recorded history—only 7% of Nova Scotia farmers today are under the age of 35—less than half the proportion just 15 years ago. At the same time, 45% of Nova Scotia farmers are now 55 years of age and older.

In 2001, GPI Atlantic reported in *Farm Viability and Economic Capacity in Nova Scotia*—based on the most recent data available at the time—that all key indicators of farm viability were in serious decline. Among other results, the 2001 GPI report noted that net farm income had declined by 46% since 1971. At the time that original GPI farm viability report was published, the data did not yet show net farm income in negative territory, though the trends were certainly headed in that direction. Thus, while the *absolute* figures at the time still showed marginal economic viability for Nova Scotia farms (on average), the *relative* trends pointed towards a developing crisis.

The 2001 GPI reported warned explicitly that:

> All five indicators of farm economic viability [. . .] in the Nova Scotia farm sector show that farm viability in Nova Scotia is being seriously eroded, and independence is being undermined. These disturbing trends are occurring even while farm cash receipts are growing, and while standard economic growth measures fail to signal problems. Yet, if current trends continue unabated, the future of Nova Scotia agriculture is clearly at risk [. . .].
>
> Nova Scotia farmers are spending more to produce food and getting less for their products. They are going deeper into debt and having more trouble making payments on their debt. In many cases farmers are no longer breaking even, are working other jobs to keep their farms, and may be forced to sell their land. Put simply, many Nova Scotia farmers can no longer afford to farm [. . .]. If current trends continue [. . .] major parts of the province's agriculture sector will disappear.

As this update indicates, these and other troubling trends noted in the 2001 report have indeed continued unabated, as have the underlying causes of these trends. A key purpose of the Genuine Progress Index is to provide an early warning system of potentially troubling trends so that corrective interventions and remedial action can be undertaken before development of a real (and potentially irreversible) crisis. Unfortunately, the adverse trends reported in the 2001 GPI farm viability report did not spur sufficient public, government, industry, and corporate action to reverse those trends and enhance the economic viability of farming in Nova Scotia. Instead, those adverse trends have been allowed to continue to the point where recovery is no longer an option for many farmers, who are now being forced either to abandon farming or to sell off portions of their farms.

Extensive GPI Atlantic interviews with Nova Scotia farmers produced a number of recommendations to improve farm economic viability, including:

- Market diversification to improve competition (and therefore prices) for food products.
- Regulation to prevent excessive mergers of companies in the food system.
- Greater supply management to ensure that food prices not fall below a reasonable cost of production.
- Stimulation of increased demand for local products, for example through local procurement policies by businesses, retail stores, universities, schools, hospitals, and government agencies. This solution may be aided by escalating gas prices, if transportation becomes more expensive and local food thus more competitive.

Such actions, including shifts from reliance on food imports to local food, will require the collaboration of all economic, government, and social sectors, including the media and a public more discerning and determined to buy and eat local food and to support Maritime farmers. A positive development that may help initiate actions to restore farm economic viability before it is too late is the new awareness and understanding of these issues that has emerged within government in recent years. Thus, the potential for positive, corrective action is now very much greater than it was at the time of the original 2001 GPI report on this subject.

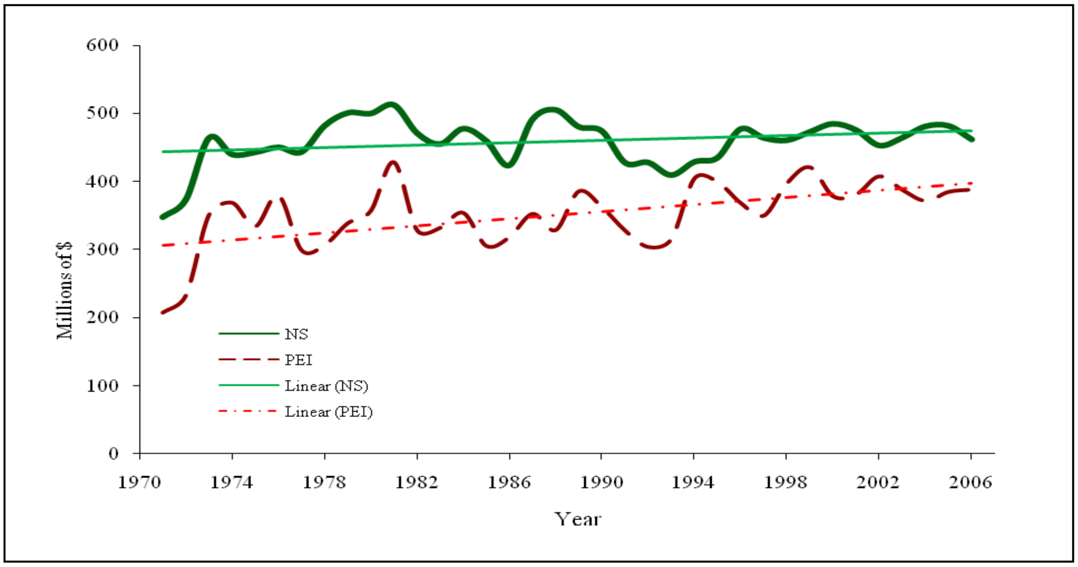
12.2. Net farm income

Data source: Results derived from Statistics Canada. *Agriculture Economic Statistics*. Net Farm Income. Cat. No. 21-010-XIE

Results: Net farm income has dropped an average of 91% in Nova Scotia since 1971, and in 2007 reached the lowest levels ever recorded in the province. Nova Scotia farms have recorded negative net farm income in four of the last six years.

While the number of farms in Nova Scotia has been in decline (only 3,795 remaining farms out of the nearly 50,000 that existed 85 years ago), the area of land in crops has remained relatively stable over the last 35 years. As well, total farm cash receipts earned—or the *gross* income generated on the remaining farms—have, on average, gone up when the overall trend is observed. They rose very substantially in the 1970s, fell in the early 1980s, and then rose again to remain fairly stable in the last decade (Figure 12-2 below).

Figure 12-2. Total farm cash receipts, Nova Scotia and Prince Edward Island farms, 1971–2006 (millions of $2007), with trendlines[2]



Sources: Derived from Statistics Canada, 2007. *Agriculture Economic Statistics*. Farm Cash Receipts. Cat. No. 21-011 and CANSIM tables 002-0005.

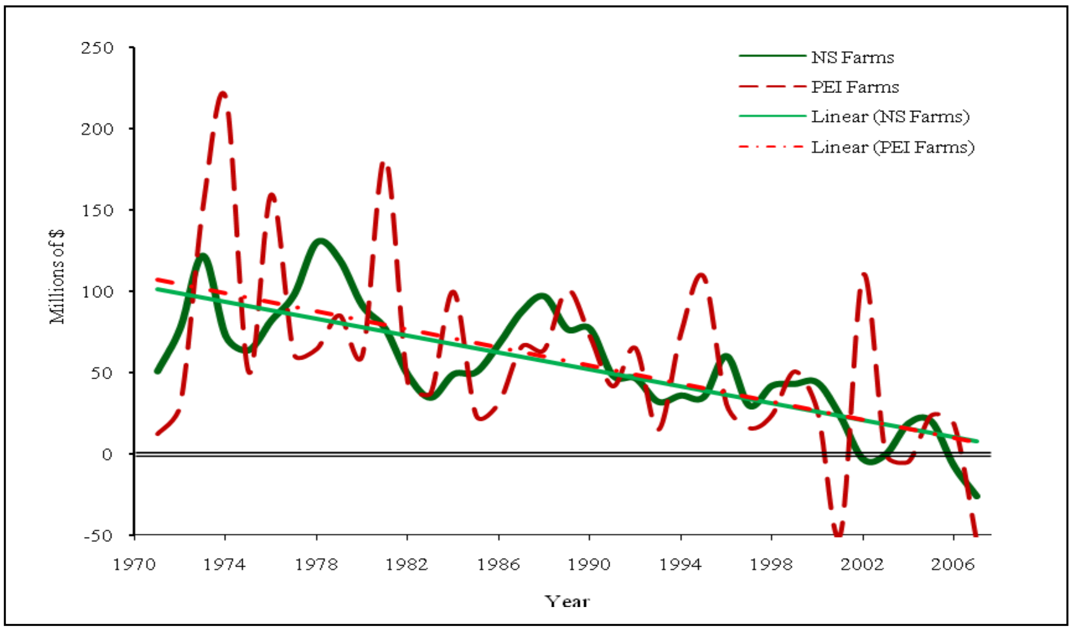
Note: Please refer to the appendix at the end of this chapter for data tables.

As previously noted, reliance on GDP-based indicators like gross farm cash receipts, which rose by an average of 6.7% in Nova Scotia from 1971–2006, sends misleading signals to policy makers, businesses, and the general public, since they obscure changes in the cost of farming and therefore do not reveal the *net* income, expense, and debt levels that determine viability.

In sharp contrast to total farm cash receipts presented above, which have risen in the past 35 years, total net farm income shows a serious downward trend for the 1971–2007 period—so serious in fact that net farm income in Nova Scotia is now hovering at the zero mark where income no longer covers expenses (Figure 12-3 below).[3] Indeed, Figure 12-3 shows negative net farm income for Nova Scotia in 2002, 2003, 2006, and 2007—with all negative net income results having occurred in the last six years for which data are available. Preliminary figures released in 2008 show negative average net incomes in Nova Scotia at their lowest levels ever for 2006 and 2007.[4]

Though farm income necessarily fluctuates according to weather patterns, commodity prices, and other factors, the 36-year trend lines show a clear and steep downward trend in net farm income. Thus, while total farm cash receipts rose by an average of 6.7% in Nova Scotia in the 35-year period since 1971, net farm income in the province has gone down by an average of 91% during the same period.[5] The stark contrast between the gross and net income trends indicates clearly how misleading the former (conventional) indicator of agriculture sector health can be and how these conventional indicators presently obscure serious economic threats to farming in the Maritimes.

Figure 12-3. Total net farm income, Nova Scotia and Prince Edward Island, 1971–2007 (millions of $2007), with trendlines



Source: Derived from Statistics Canada. 2007. *Agriculture Economic Statistics—Net Farm Income*. Cat. No. 21-010-XIE (latest update May 2007).

Note: Please refer to the appendix at the end of this chapter for data tables.

Between 2001 and 2006, total net farm income in Nova Scotia averaged about $10 million per year ($2007). This translates into an average annual per farm income of only $2,635, based on the 3,795 remaining farms in Nova Scotia as reported in the 2006 Census of Agriculture.

An average net farm income of just $2,600 is clearly well below what is required to support a reasonable livelihood, and so far below the threshold of viability that this level of operation cannot be sustained over time. As noted above, even this minimal income has now been eroded, with net farm income in the last two years (2006–07) now below zero.

12.3. Expense to income ratio

Data sources: Results derived from Statistics Canada, Agriculture Economic Statistics. Cat. Nos. 21-011-XIE; 21-012-XIE

Results: The expense to income ratio on Nova Scotia farms increased from an average of 82% in the 1970s to an average of 97% in the last decade—far exceeding the 80% threshold estimated as needed for a healthy farm sector. In 2006, the expense to income ratio reached 100% for Nova Scotia farms.

The ratio of farming expenses to agricultural income is an important indicator of farm economic viability because it highlights the margin that farmers have to work with if they are not to go further into debt. Like the previous indicator on net farm income, the expense to income ratio also represents a *net* assessment rather than a *gross* one. Thus, the expense to income ratio tells us how much farmers are spending to operate their farms (e.g., the costs of labour, feed, fuel, pesticides, fertilizers, etc.) plus the costs of capital depreciation relative to their income from farm products. Operating expenses do not include operator wages.[6]

The expense to income ratio is determined using the following formula:

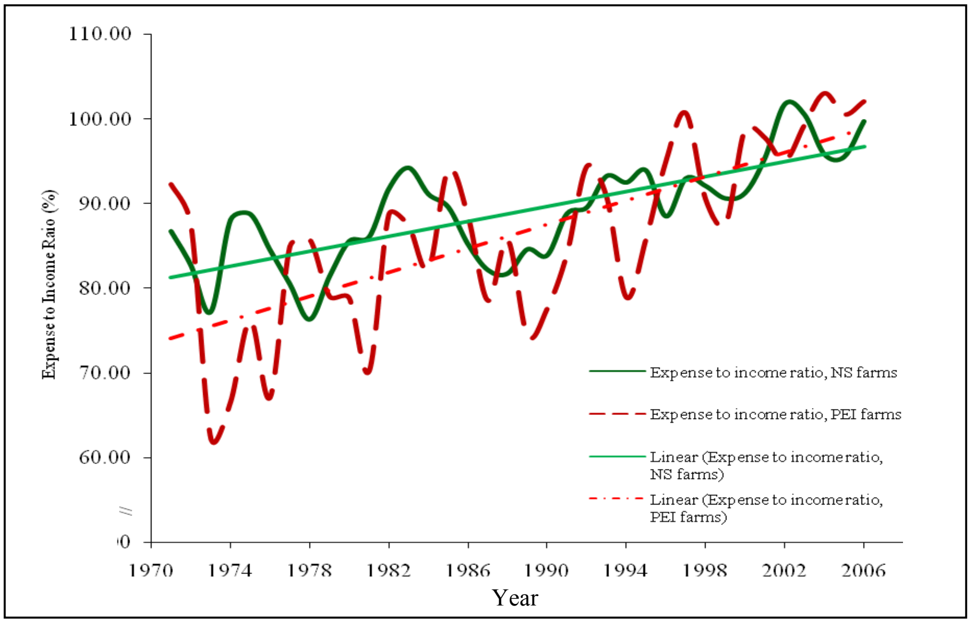
$$\text{Expense to income ratio (\%)} = \frac{\text{total farm operating expenses and depreciation}}{\text{total farm cash receipts}} * 100$$

The higher the expense to income ratio is, the narrower producer margins will be, and the more risky farming tends to become.

The minimum sustainability threshold for the expense to income ratio of a healthy farming sector is here estimated to be 80%, based on comparable estimates by the Nova Scotia Department of Agriculture and Fisheries (NSDAF).[7] An expense to income ratio of 100% would indicate a zero margin and no effective return on investment or on the farmer's time. An expense to income ratio higher than 100% indicates negative margins and absolute losses.

The expense to income ratio for Nova Scotia farms increased from an average of 82% in the 1970s to an average of 97% in the last decade—far exceeding the 80% threshold estimated as needed for a healthy farm sector (Figure 12-4 below). In 2006, the expense to income ratio reached 100% for Nova Scotia farms. This indicates that the prices paid to producers for their products are inadequate relative to rising input costs, and are not keeping pace with farm expenses.

Figure 12-4. Expense to income ratio (%), Nova Scotia and Prince Edward Island farms, 1971–2006, with trendlines



Source: Derived from Statistics Canada, 2007. Agriculture Economic Statistics Cat. No. 21-011-XIE; 21-012-XIE. Latest update May 2007.

Note: Please refer to the appendix at the end of this chapter for data tables.

Whatever the case for higher or lower assessments of the sustainability threshold, the trend line over a 35-year period clearly indicates that farming in Nova Scotia is becoming less economically viable over time, and is reaching the 100% mark where negative margins and absolute losses are forcing many farmers out of business.[8] Unless rapid and urgent action is taken to reverse the trends of the last 35 years, as they are dramatically illustrated in Figures 12-3 and 12-4 above, farmers will abandon farming at increasing rates. Farmers will literally become an "endangered species" in this region.

12.4. Debt to net farm income ratio

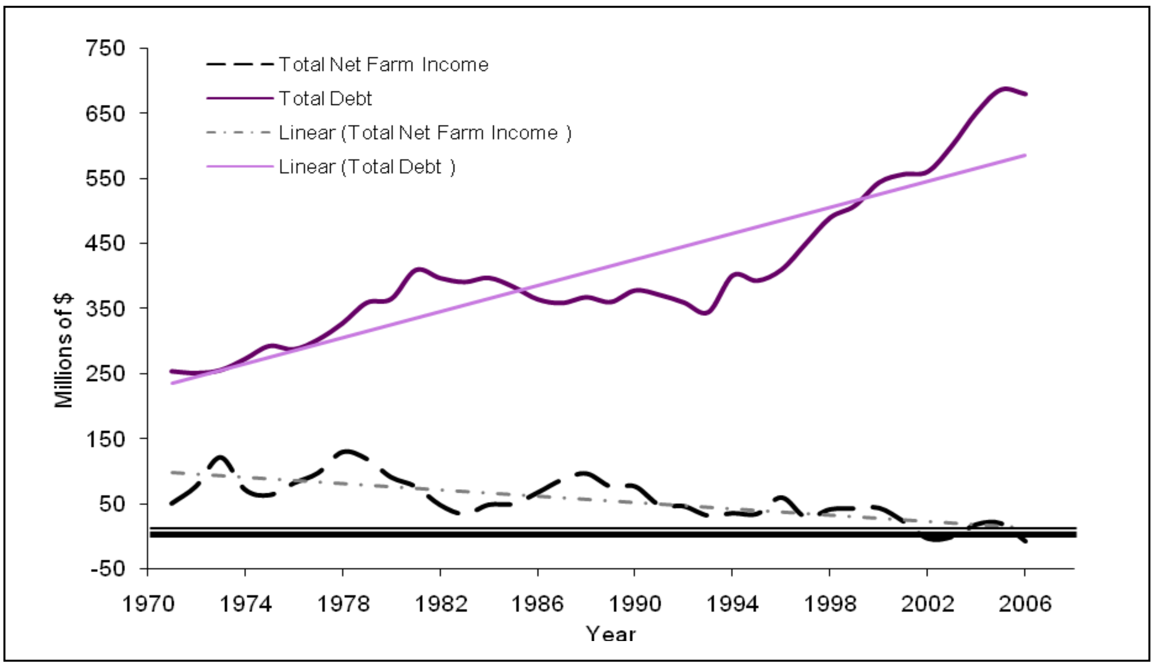
Data sources: Results derived from Statistics Canada, Agriculture Economic Statistics. Cat. No. 21-010-XIE; 21-014-XIE

Results: Total farm debt increased by 146% in Nova Scotia between 1971 and 2006. It is not mathematically possible to calculate a ratio of debt to net income for Nova Scotia when the latter is zero or less.

While total net income for farms in Nova Scotia has been declining over time (as already seen in Figure 12-3 above), total debt has been rising. For the first time since data collection for this time series began 35 years ago, negative total net farm incomes (less than zero) have been reported for Nova Scotia farms in four of the last six years.

While net farm income has been declining, total farm debt has risen very sharply indeed in Nova Scotia, particularly since the early 1990s. Over the 35-year period from 1971 to 2006, debt increased by 146% in Nova Scotia, and it has increased by 87% since the early 1990s alone (Figure 12-5 below).[9]

Figure 12-5. Total net farm income and total debt, Nova Scotia farms, 1971–2006 (millions of $2007), with trendlines



Source: Derived from Statistics Canada. 2007. *Agriculture Economic Statistics.* Cat. No. 21-010-XIE; 21-014-XIE (latest update May 2007).

Note: Please refer to the appendix at the end of this chapter for data tables.

Sharply increased debt levels at a time of declining net incomes could indicate either that the industry is not robust, that production is suffering, that Nova Scotia farms may be over-capitalized, or that farmers are suffering from income-depressing prices that are not keeping pace with farm input costs, thus forcing them to borrow more in order to pay expenses and keep farming. It is likely that a combination of several of these factors has been responsible for raising the debt to net income ratio of Nova Scotia farmers over time.

The total debt to net farm income ratio is derived using the following formula:

$$\text{Total debt to net farm income ratio (\%)} = \frac{\text{total farm debt}}{\text{total net income}} * 100$$

The debt to income ratio is an indicator of capacity to service debt loads, so that escalating debt to income ratios may signal major potential problems in making regular payments on outstanding balances and in managing debt.

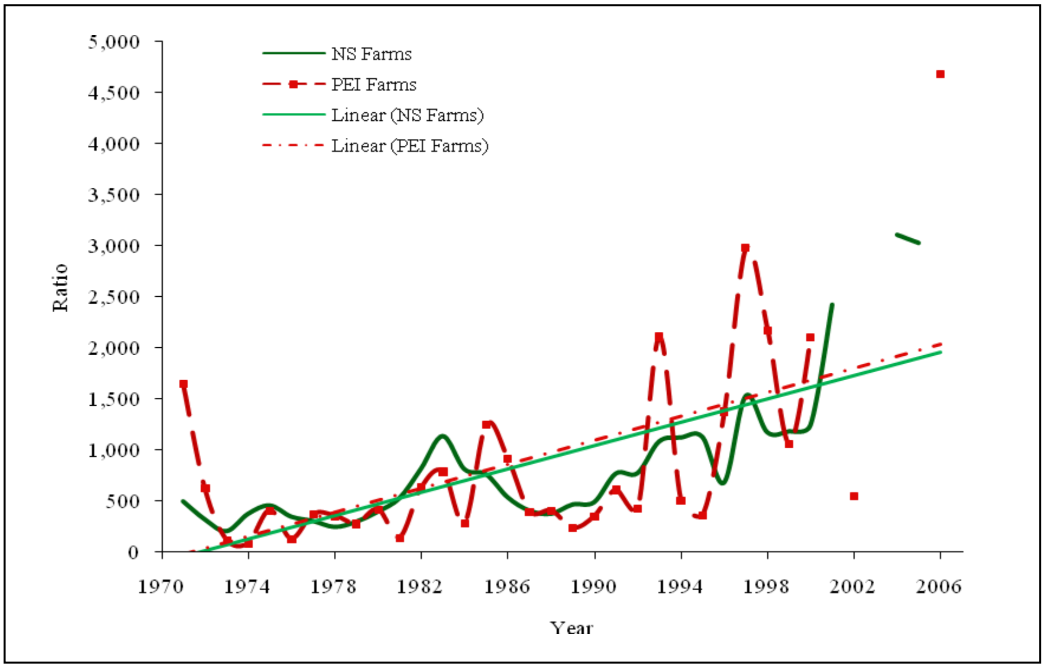
Based on historical records, the ratio of debt to net income for a healthy farming sector is here estimated to average 600% or less. In other words, total outstanding farm loans in any given year would not exceed six times total net farm income in that year. This 600% threshold was achieved in Nova Scotia in the 1970s and in part of the 1980s, but has been far exceeded on a continuous basis since the early 1990s (see Figure 12-6 below). In Nova Scotia, the debt to net income ratio more than doubled in the 1990s and appears to have doubled again in recent years.

Unfortunately, however, the debt to net income ratios for 2001 to 2006 cannot be shown consistently because net farm incomes in Nova Scotia for many of those years (2002, 2003, and 2006) were negative, as they also were in 2007. This inability to chart farm debt to net farm income ratios illustratively in recent years obscures how sharply the gap between debt and income has continued to grow, though the 2006 data point shown for Prince Edward Island in Figure 12-6 below gives at least some indication of how huge the gap has become and of the depths of the present farm debt crisis in the Maritimes.

Thus, the farm debt to net farm income ratio in PEI for the most recent available year (2006) was an astonishing 4700%—nearly 8 times the recommended 600% threshold for a healthy farm sector. It was not mathematically possible to calculate a ratio of debt to net income for the Nova Scotia farm sector for that year because net income was less than zero in 2006. But for 2004 and 2005—the latest years for which the ratios can be calculated in Nova Scotia—the farm debt to net farm income ratios for Nova Scotia exceeded 3000% in both years—more than five times the recommended 600% threshold for a healthy farm sector. Ratios of this dimension not only point to clear lack of financial health and economic viability, but can even be characterized as "out of control."

In the long run, an ascending debt to income ratio over time indicates that farmers are accepting higher risks (and going deeper into debt) in order to bring in the same amount of net income. As noted above, it also points to potential problems in servicing and managing debt if income becomes inadequate to make payments on debt. The risk-prone nature of farming particularly dictates that total debt should not be too high relative to income, as unpredictable fluctuations due to weather, pests, crop and livestock diseases, trade decisions, and sudden commodity price changes may further imperil farmers' ability to make payments.

Figure 12-6. Debt to net income ratio, Nova Scotia and Prince Edward Island farms, 1971–2006, with trendlines



Source: Derived from Statistics Canada. 2007. Agriculture Economic Statistics. Cat. No. 21-010-XIE; 21-014-XIE (latest update May 2007).

Note: The ratios for 2001 to 2006 cannot be shown consistently because net incomes for those years were sometimes negative. Please refer to the appendix at the end of this chapter for data tables.

12.5. Solvency ratio[10]

Data sources: Results derived from Statistics Canada, Agriculture Economic Statistics. Cat. No. 21-013-XIE; 21-014-XIE

Results: The solvency ratio (liabilities : assets) increased by 106% in Nova Scotia between 1971 and 2006, indicating that Nova Scotia farms are becoming much less sustainable, with the rate of farm debt increase rapidly outstripping any appreciation in the capital value of farms.

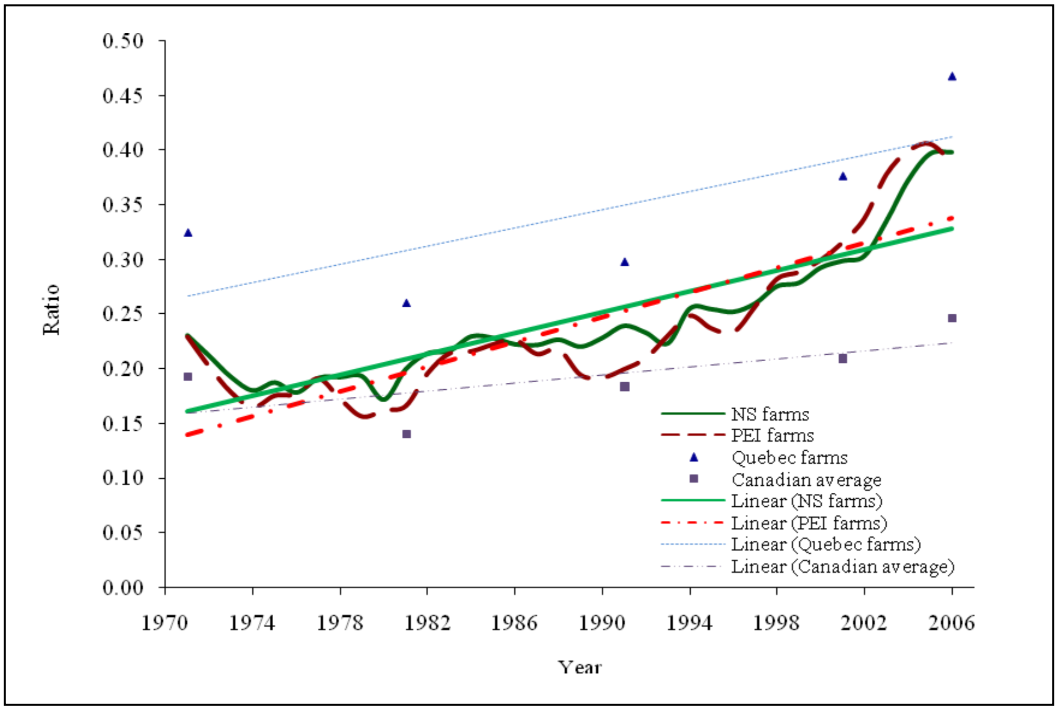
From a capital accounting perspective such as that adopted in the Genuine Progress Index, the "solvency ratio" is a good indicator of the long-term health of the agriculture sector and of the economic viability of farming, because it is essentially a stock measure that assesses the net accumulated market value inherent in the sector. (Non-market natural, human, and social capital values in agriculture are separately discussed in other components of the GPI Soils and Agriculture Accounts.)

Here, the solvency ratio is obtained by dividing total liabilities (debt) by total assets (capital value of farms). The capital value of farms here includes the value of farm land and buildings, machinery and equipment, and livestock. If the solvency ratio is high or is increasing in the long term, this indicates that farms are becoming less viable. For those farms where the ratio exceeds 1.0, it indicates that liabilities exceed assets to such an extent that farmers cannot get out of debt even if they sell everything they own.

In 2006, Nova Scotia farms had an average solvency ratio of 0.399—up by 106% over the 35-year period since 1971.[11] Figure 12-7 below shows that, during the time period under examination, the solvency ratio began rising from 1980, but has been rising particularly sharply since 1990. Solvency ratios in 2006 in Nova Scotia were 160% higher than in 1980 and double the 1990 level. This clearly indicates that Nova Scotia farms are becoming much less sustainable over time, with the rate of farm debt increase rapidly outstripping any appreciation in the capital value of farms.

Figure 12-7 also shows that farms in Quebec have even higher debts relative to capital value than farms in Nova Scotia and PEI. However, the average Canadian farm solvency ratio for 2006 of 0.247 is much lower than for farms in Nova Scotia, PEI, and Quebec—38% lower than in Nova Scotia. The Canadian solvency ratio—while it has also risen, reflecting economic challenges faced by farmers nationwide—has increased much less sharply since 1990 than in Nova Scotia. Time and resources did not permit a thorough investigation of this disparity and its causes.

Figure 12-7. Solvency ratio, Nova Scotia, Prince Edward Island, Quebec, and Canadian farms 1971−2006, with trendlines



Source: Derived from Statistics Canada, 2007. Agriculture Economic Statistics. Cat. No. 21-013-XIE; 21-014-XIE.

Note: Please refer to the appendix at the end of this chapter for data tables.

12.6. Percentage of Nova Scotia food consumer dollar that goes back to Nova Scotia farmers

Data source: Statistics Canada, *Agriculture Economic Statistics*

Result: In Nova Scotia, it appears that only about 7% of the consumer food dollar is returned to Nova Scotia farmers—down from 10% in the 1990s.

Preliminary estimates based on data collected for the Food Miles Project of the Ecology Action Centre and Nova Scotia Federation of Agriculture show that over time, an increasingly small share of the money spent on food in grocery stores and restaurants in Nova Scotia is finding its way back to farms.

In Nova Scotia, it appears that only about 7% of the consumer food dollar is returned to local farmers—down from 10% in the 1990s. Since the following estimates in Table 12-1 below are preliminary and designed primarily to initiate an investigation into the ultimate disposition of consumer food spending, it is recommended that follow-up studies be conducted to incorporate additional variables and data sets, to identify the relevant variables that need to be incorporated into these calculations, and to investigate the reasons for the apparent changes over time.

In the meantime, based on the available literature and evidence, it can be estimated—by way of setting goals and targets—that a food system that could properly be characterized as "self-reliant" would have more than 50% of the consumer food dollar going back to local farms.

Table 12-1. Estimate of Nova Scotia farm cash receipts as a percentage of food spending in Nova Scotia (%), 1991–2006

Yr.	A NS Farm Cash Receipts[12]	B Inter-national Exports[13]	C Inter-provincial Exports[14]	D Total Exports (B + C)	E NS Cash Receipts, Domestic Sales (A – D)	F Amount Nova Scotians Spend On Food[15]	G Proportion of Food Spending That Goes To Farms (E/F)
1991	309,225,000	23,073,670	113,300,000	136,373,670	172,851,330	1,705,223,585	10.14%
1996	367,046,000	27,629,329	138,700,000	166,329,329	200,716,671	1,927,902,184	10.41%
2001	402,363,000	38,439,229	209,500,000	247,939,229	154,423,771	2,048,940,468	7.54%
2006	433,127,000	44,064,178	223,400,000	267,464,178	165,662,822	2,301,799,113	7.20%
Genuine Progress Target							**At least 50%**

Sources: Statistics Canada. *Agriculture Economic Statistics—Food Consumption in Canada*, Parts I and II, 2002.

Notes:

- Figures reported in the table are in current dollars.
- Payments (subsidies) are subtracted from Farm Cash Receipts.
- The latest inter-provincial export data available are for 2004, and are used here instead of 2006 data to complete the estimate. Only 30% of the "meat, fish, and dairy products" category is used, because we have assumed here that about 70% of that category is comprised of fish and seafood products, which are excluded here because we are specifically concerned with land-based farms in the GPI Soils and Agriculture Accounts.
- Food spending for 2006 is estimated based on 2005 figures from Statistics Canada, *Spending Patterns in Canada*.

Although most of the information in Table 12-1 above is taken directly from Statistics Canada data, there are assumptions built into the calculations in columns B and C, as indicated below, while the column F results are based on self-reported data from Statistics Canada's *Food Consumption in Canada* survey. The resulting uncertainties render the column G percentages "estimates" rather than conclusive results.

For example, columns B and C provide estimates of the value of Nova Scotia farm product exports, in order to subtract that value from total farm cash receipts in Nova Scotia, for the purpose of estimating the amount of Nova Scotia farm cash receipts attributable to local (Nova

Scotia) sales. Unfortunately, however, the reported export categories do not differentiate adequately between farm products, processed products, and fish products, which makes it difficult to identify clearly the portion of farm cash receipts deriving from out-of-province sales. As a result, assumptions must be made, based on other data sets, on the appropriate proportions of food exports to be included in these calculations. Also, the amount spent on food reported in column F is based on a survey of household spending that depends on respondent recall that may not be accurate. These and other unknowns may skew the results in column G.

As noted above, this estimate must therefore be regarded as simply a preliminary effort to raise awareness of an issue vital to any assessment of food self-reliance, and to identify the enhancement of such self-reliance as a policy priority. An indicator that assesses the proportion of provincial food spending returned to local (in-province) farms is recommended here as a key indicator of such self-reliance. It is therefore hoped that this preliminary effort—with all its caveats—will spur Statistics Canada and provincial agencies to investigate the issue carefully, to collect appropriate data, to differentiate reporting categories more precisely, and to report regularly on this important indicator.

12.7. Soil cover days

Data sources: Lefebvre, A., W. Eilers, and B. Chunn (eds.), 2005. *Environmental Sustainability of Canadian Agriculture: Agri-Environmental Indicator Report Series—Report #2*. Agriculture and Agri-Food Canada. Available from http://www.agr.gc.ca/env/naharp-pnarsa/index_e.php. Accessed December 6, 2006; Statistics Canada. 2006 Census of Agriculture.

Results: According to the most recent available data for 2001, the average number of soil cover days in Nova Scotia has remained fairly steady since 1991, but has increased slightly since 1981. The average number of soil cover days in Nova Scotia has remained consistently higher than the Canadian average.

Soil is the natural capital asset upon which our agricultural system is based. It is vital to maintain healthy and productive soil if our agricultural system is to function optimally.

Soil is currently undervalued in our food production system. Thus, methods of agriculture that degrade the soil are profitable in the short term under our current system of accounting. This is because losses of natural capital due to soil erosion or degradation are invisible in conventional economic accounts, and not included directly in the costs of food production.

Soil degradation that results in soil compaction and reductions in the soil's inherent fertility may temporarily be compensated for by increases in purchased agricultural inputs, such as fertilizer. These inputs can mask or appear to compensate for the degradation of our soils by allowing crop yields to be sustained and profitable in the short term at the expense of long-term productivity. By contrast, the GPI natural resource accounts explicitly recognize the *long-term* value of our soil assets and account for the costs of their depreciation as a result of either depletion (e.g., erosion) or degradation (e.g., compaction or diminution of soil organic matter / carbon content).

Soil quality is more than the sustained capability of a soil to accept, store, and recycle water, nutrients, and energy. Soil quality is also the capacity of soil to sustain *ecological productivity*, maintain *environmental quality*, and *promote plant and animal health*. Soil ecological productivity minimizes the need for both non-renewable inputs and polluting outputs, while ensuring optimal production over the long term.

Farmers face an important challenge in their attempts to maintain soil quality and productivity. This is not an easy or straightforward task, particularly when faced with an uncertain climate, sloping topography, shallow soils, and/or narrow economic margins—all of which are frequently the case in Nova Scotia.

Ideally, we would track soil organic matter as a key indicator of soil quality and productivity, as is possible in Prince Edward Island, where this indicator is regularly tracked and reported through systematic monitoring and testing of soil samples. Unfortunately, these data are not available for Nova Scotia. In their absence, one highly indicative measure—soil cover days—has been chosen here to point to potential soil quality and productivity, since the number of soil cover days has been well documented as an effective measure for indirectly tracking both soil and water quality in agriculture. The more a soil is covered—either by a crop or sod or mulch—the more likely that the soil will be conserved, and that water quality will be protected. This indicator was explored for Nova Scotia in the 2002 GPI Atlantic report *Soil Quality and Productivity* and was updated in the 2008 GPI report *Towards a Healthy Farm and Food Sector*.

Scientists at Agriculture and Agri-Food Canada have developed this indicator to assess comparatively how many days of the year agricultural soils are covered. Nova Scotia ranked highest in the nation with 330 days in 2001, while PEI had an average of 291 soil cover days, and the national average was 286.[16] The estimate for Nova Scotia is high because of the high percentage of land used for pasture and forage. According to these data, the average number of soil cover days in Nova Scotia has remained fairly steady since 1991, increasing slightly since 1981. The average number of soil cover days in Nova Scotia has remained consistently higher than in Canada overall in the 20-year period from 1981 to 2001 (see Table 12-2 below).

Table 12-2. Average number of soil cover days, Nova Scotia and Canada, 1981–2001

YEAR	NOVA SCOTIA	CANADA
1981	326	272
1986	329	275
1991	330	281
1996	331	285
2001	330	286

Source: Lefebvre, A., W. Eilers, and B. Chunn (eds.), 2005. *Environmental Sustainability of Canadian Agriculture: Agri-Environmental Indicator Report Series—Report #2*. Agriculture and Agri-Food Canada. Available from http://www.agr.gc.ca/env/naharp-pnarsa/index_e.php. Accessed December 6, 2006.

Field tests clearly demonstrate that a soil area that is covered with vegetation will be less likely to suffer erosion problems than a soil area that is bare for parts of the year. Because annual crops in agricultural watersheds are cultivated to produce food, some of the land area will inevitably be bare before the crop is fully established, and it will sometimes be bare after harvest as well. Wind and rainfall will often cause soil on bare or partly bare fields to move into watercourses. This soil, in and of itself, may cause sedimentation problems, but it may also compromise water quality in other ways as well by bringing with it pollutants such as nutrients or pesticides.

Crops that cover soil—particularly those that cover soil for the entire year or for several years—are therefore very beneficial for both the soil itself and for surrounding water quality. Pasture and hay land used in some livestock systems, in particular, is good for keeping soil covered all year, and for preventing erosion or other soil loss. On the other hand, while soil cover is essential to prevent erosion, society does also need food crops to be grown, so some periods of relatively bare soil—particularly as crops become established and immediately after harvest—are virtually unavoidable in most cropping systems. Therefore, sustainability goals that seek to achieve economic objectives within environmental constraints inevitably have to promote a balance between annual crops (like wheat, beans, potatoes, etc.) and perennial crops (like hay, pasture, orchards, etc.) in order to reduce the number of bare soil days in any watershed.

Permanent grass cover is considered to be ecologically desirable because it reduces soil erosion, enhances soil productivity, reduces sedimentation, improves water quality, and enhances wildlife habitat.[17] These ecological benefits in turn have been shown to produce economic cost savings and benefits.

The share of farm land used for cultivated crops gives an indication of how much land might be bare of any cover at certain times of the year—most likely in the fall, winter, or spring, as the crop is generally covering the soil in the summer and thus providing some protection against erosion at that time. Table 12-3 below shows that between 1981 and 2006 the proportion of farm land being cultivated in Nova Scotia increased in from 25% to 29%, while the proportion in pasture land in Nova Scotia fell from 20% to 14%. From the perspective of soil cover and consequent ecological benefits like protection against soil erosion, this can be considered a negative trend, since cultivated land tends to have a high proportion of bare soil days while pasture land has none.

Despite the adverse trend signified in Table 12-3 below, Nova Scotia still compares favourably with the national average, which shows the national share of farm land in cultivation holding steady at 61%, compared to less than half that in Nova Scotia (29%). As well, in the most recent period for which statistics are available (2001–2006), the share of farm land under cultivation in Nova Scotia actually fell for the first time in 20 years from 32% to 29%. It is too early to tell whether this recent drop signifies a real reversal of the previous 20-year trend and a genuine movement towards greater soil cover, or whether it is an anomaly.

It would also be important to break down the three broad categories in Table 12-3 more finely in order to assess the full implications of these results for soil cover. For example, cultivated land on average certainly produces far more bare soil days than pasture land that is under continuous cover. However, certain types of cultivation produce far more bare soil days than others. Thus, it is noteworthy that forages occupy 58% of the land under cultivation in Nova Scotia (compared to a national average of just 21%). Since forages often cover the soil continuously for two or three years before being rotated into another crop, this high proportion of cultivated farm land dedicated to forages in Nova Scotia is a good sign for soil cover in the Province. This may also help explain why Table 12-2 above shows an increase rather than diminution in soil cover days from 1981 to 2001 despite the increasing share of farm land under cultivation and the declining share in pasture shown in Table 12-3 below.

Table 12-3. Share of farm land in various land uses (%), Nova Scotia, 1981–2006

`	**Nova Scotia**		
	Cultivated	Pasture	Other land[18]
1981	25	20	55
1986	27	16	56
1991	27	17	56
1996	29	14	59
2001	32	14	57
2006	29	14	57

Source: Lefebvre, A., W. Eilers, and B. Chunn (eds.), 2005. *Environmental Sustainability of Canadian Agriculture: Agri-Environmental Indicator Report Series—Report #2*. Agriculture and Agri-Food Canada. Available from http://www.agr.gc.ca/env/naharp-pnarsa/index_e.php. Accessed December 6, 2006; Statistics Canada. 2006 Census of Agriculture.

While Nova Scotia growers are, therefore, on average, minimizing the number of days that soil is left bare, they often have a high proportion of sloped land, and are historically subject to high levels of precipitation, making their soils inherently more vulnerable to erosion and degradation than in most other farming areas in Canada.

12.8. Ratio of productive value of agricultural land to market land value

Data source: Statistics Canada, Agriculture Economic Statistics.

Result: The net productive capacity value of Nova Scotia's farm land has declined significantly relative to market land values, with the most dramatic decline occurring between 1996 and 2006 when net farm income plunged dramatically.

Nova Scotia can *potentially* feed its own population, but it cannot afford to lose any more of its best agricultural land if it is to attain that capacity even partially in practice. A 2008 GPI Atlantic Land Capacity study estimated that Nova Scotia farmers would need to access half a million hectares of crop and pasture land to feed all Nova Scotians. But only 138,000 ha is currently in crops and pasture in the Province, even though soil classification data indicate that about 1.1 million ha of land is potentially appropriate for crops and pasture in Nova Scotia, *if* it has not already been converted irreversibly to other purposes. Accessing sufficient agricultural land to feed a larger proportion of Nova Scotians is a daunting prospect given the increasing pressure to develop farm land, coupled with lucrative land prices that make it tempting for farmers to sell off their land when they can no longer earn a living by selling farm products.

The highest class of farm land in Nova Scotia—used for growing high value crops—is in very short supply, particularly in the Annapolis Valley, where increased competition with housing and commercial developments threatens to shrink rather than expand available farm land.

GPI Atlantic found that scarce fertile land is being converted at the very time that the need and demand for local fresh produce is increasing. Recent sharp rises in the price of fuel—only temporarily stemmed by the current global economic downturn, global food price increases, commodity price fluctuations due to storms, climate change, drought, and other events, increased safety concerns related to imported food, and general global insecurities have all led to renewed insecurity about our food supply and to interest in reducing dependence on imported food supplies that may be uncertain and subject to increasingly expensive transportation costs. These circumstances give new importance to the issue of land capacity, and to the question of whether Nova Scotia has sufficient farm land to improve food self-reliance.

In a special study of land value, Statistics Canada (1996) explored the idea that farm land value might actually be more closely related to its *productive capacity* or "economic rent" than to its estimated resale or *market* value. Productive capacity is determined by subtracting expenses from actual farm cash receipts generated on farms. This provides an estimate of the ability of the land to generate net income in any given year and will therefore vary from year to year according to revenues, expenses, and income in each year. Based on this premise, the productive capacity value of Nova Scotia farm land for the 1971–2006 Census years is estimated in the Table 12-4 below.

Results indicate that the net productive capacity value of Nova Scotia's farm land has declined significantly relative to market land values, with the most dramatic decline occurring between 1996 and 2006 when net farm income plunged dramatically. From 1981 to 1996, the net productive capacity value of Nova Scotia farm land averaged just 7.2% of its estimated market value, and since 2001 it has dropped below 1% of that value. The value of annual net productive capacity averaged about $55 per hectare between 1981 and 2006 (Table 12-4 below).

There are many flaws with the "productive capacity" approach to land values presented in Table 12-4 below. Some greenhouse operations and hog or mink farms are not strictly "land-based," and would be considered more like production plants than land-based farms in which land is the primary means of production. Productive capacity figures based on non land-based farms would therefore not reflect the land's actual productive capacity. Also, fluctuations in farm product prices and in the prices of inputs like fossil fuels, feeds, capital improvements, pesticides, and fertilizers have a large impact on the productive capacity figure, but have nothing to do with the actual capacity of the land.

Table 12-4. Estimated productive value of agricultural land, Nova Scotia, 1981–2006

Year	Estimated annual net productive value (000s of $2007)[19]	Ratio of productive value to market land value (return on land value) (%)[20]	Net productive capacity/ha (2007$/ha)[21]
1981	41,842	6.6	89.8
1986	47,881	8.8	115.0
1991	34,042	6.6	85.7
1996	38,999	6.8	91.3
2001	1,814	0.3	4.5
2006	-23,807	-4.2	-59.1
Average	**23,461**	**4.15**	**54.5**

Source: Derived from Statistics Canada, 2008. *Agriculture Economic Statistics*.

The productive capacity figures do, however, give an estimate of the ability of the farmer to generate income from the land. The productive capacity figures also take into consideration many other variables such as distance to markets, climatic factors, product prices, and flexibility of crop and livestock options. In addition, they provide a more holistic picture of land value than just the estimated market values generally used to assess land values.

GPI Atlantic recommends that the best and most threatened working farm land be removed from the speculative or real estate market by purchase of development rights. This is because good farm land is needed to produce food—an essential human need and security consideration—and therefore should not be subject to real estate markets that often price the best land out of reach of farmers.

Buying development rights—or purchase of Working Land Conservation Easements—would guarantee the land's continued use for farming while compensating farmers for potential losses incurred by being unable to sell it for other uses. GPI Atlantic calculates the average provincial value of such conservation easements at $1,339 per hectare, based on the difference between the real estate value of fertile land and its productive value (the ability of the land to generate net income for farmers).

12.9. Intensity of synthetic input use

Data sources: Statistics Canada, 2001 and 2006 Census of Agriculture

Result: The intensity of synthetic input use has decreased in Nova Scotia since 2000, but insecticide, fungicide, and herbicide spraying still appear to be more widespread than in the previous three decades.

"Habitat" is the word generally used to describe the place and conditions in which an organism lives, or has a home. Whether it is hawks that control rodents, insect-eating birds in orchards, beneficial bacteria and fungi that maintain soil health, or the lowly dung-beetle that takes care of breaking down manure from grazing animals, an important part of land stewardship is to make sure there is adequate habitat for organisms beneficial to farming. The existence of habitat for species that have a vital role in ensuring crop productivity is therefore a key indicator of food security, farm viability, and genuine progress in agriculture.

On the other hand, the expansion of agricultural production and intensive use of inputs can contribute to the loss of such habitat and, hence, of the biodiversity necessary for a healthy farm and food system.[22] Many studies report reduced habitat quality, species diversity, and ecosystem services as a result of synthetic pesticide use and synthetic fertilizer use—particularly when rates of nitrogen application exceed 50 kg N/ha.[23] Monoculture (i.e., growing the same crop on the same land several years in a row or in 'short rotations' with other crops), the use of synthetic inputs (e.g., pesticides and fertilizers), and wetland drainage can all reduce habitat for beneficial organisms.

In 2002, GPI Atlantic reported that Nova Scotian farms were apparently being managed in a more intensive manner over time. Substantially higher proportions of farm area were being fertilized and treated with pesticides in 2000 than in earlier years, and there was also a slight increase in the area used for annual crops—all of which seemed to indicate a definite increase in intensity. The 2002 study also explored farming practices in Kings County, Nova Scotia, and it was discovered that farms in Kings County were also more intensively managed than the average Nova Scotian farm.

On the whole, however, Nova Scotian farms at the time were in the fortunate position of generally being managed much less intensively than Canadian farms in general. Based on the data available at that time, it appeared that Nova Scotian farms still offered a significant quantity and quality of habitat in which beneficial organisms could live, and for beneficial ecosystem services to occur, although trends over time also indicated that these advantages were being increasingly compromised.

Table 12-5 below updates that evidence and reports Census data on the area and percentage area of farms in Nova Scotia that are fertilized, sprayed with insecticides and fungicides, and sprayed with herbicides. In terms of this indicator, the higher the proportion of total farm area subject to fertilizer and pesticide use, the more likely that habitat and ecosystem services provided by beneficial organisms will be compromised.

Between 2000 and 2006, the percentage of farm area fertilized in Nova Scotia decreased from 21.7% to 20.3%, the area sprayed with insecticides and fungicides decreased from 7% to 5.7%, and the area sprayed with herbicides decreased from 7.3% to 7.1%.

Although the area sprayed with insecticides, fungicides, and herbicides has declined since 2000, it still appears to be higher than in the previous three decades. This observation is subject to the caveat that changes in the survey question on insecticide and fungicide spraying prevent proper comparability of the 1970–1990 data with those of later years (see note below Table 12-5). Yet the magnitude of difference between the 1970–85 data on the one hand and the 2006 results on the other, as indicated in Table 12-5 below, makes it likely that the observation still holds.

Table 12-5. Intensity of synthetic input use, Nova Scotia farms, 1970–2006

Year	Mean kg N fertilizer per ha cropland	Area fertilized		Area sprayed with insecticides or fungicides		Area sprayed with herbicides	
		ha	% area of farms	ha	% area of farms	ha	% area of farms
1970	25.0	38,150	7.1	9,971	1.9	15,567	2.9
1980	37.7	88,537	19.0	11,109	2.4	20,863	4.5
1985	41.8	85,042	21.1	12,165	2.9	24,744	5.9
1990	46.1	82,267	20.7	13,466	3.4	22,383	5.6
1995	n/a	88,552	20.7	22,618	5.3	26,621	6.2
2000	n/a	88,376	21.7	28,217	7.0	29,686	7.3
2006	n/a	81,917	20.3	22,921	5.7	28,523	7.1

Sources: Statistics Canada. 1982. *Census of Canada: Agriculture 1981*. 96-904; Statistics Canada. 1997. *Agricultural Profile of the Atlantic Provinces 1996*. 95-175-XPB; Statistics Canada. 1997b. *Historical Overview of Canadian Agriculture 1996*. 93-358-XPB; Statistics Canada. 2002. Initial Release of Agriculture Census 2001 data; Statistics Canada. 2006 Census of Agriculture. Selected land management practices, Canada and provinces, census years 1976 to 2006. Table 2.17. Available from http://www.statcan.ca/english/freepub/95-632-XIE/2007000/tables/table2.17-en.htm. Accessed October 7, 2008. In 2006, Nova Scotia farm area was 403,044 ha. Farm area data for 2006 are from the 2006 Census of Agriculture. Farm land area by tenure, Canada and Provinces. Table 2.4. Available from http://www.statcan.ca/english/freepub/95-632-XIE/2007000/tables/table2.4-en.htm#12. Accessed October 7, 2008.

Note: In Table 12-5 above, data on insecticides and fungicides for 1995, 2000, and 2006 are comparable with each other, but not with previous years. Data for 1995, 2000, and 2006 represent the sum of the area sprayed with insecticides and the area sprayed with fungicides. Some areas may be sprayed with both, and therefore counted twice. Previous to this, only one question was asked—is the area sprayed with insecticides or fungicides?—which eliminated double counting. However, the 1995, 2000, and 2006 data reflect more accurately the intensity of use.

Table 12-6 below reports the comparative intensity of synthetic input use for 2000 and 2006 for Nova Scotia as a whole, for Kings County NS in particular, and for Canada. In 2000, an average of 22% of total farm area in Nova Scotia was fertilized, compared to 36% in Kings County (the province's most intensively-farmed county), and 36% in Canada. By 2006, an average of 20% of total farm area in Nova Scotia was fertilized, compared to 32% in Kings County and 38% in Canada. The percentage of farms sprayed with insecticides/fungicides and herbicides decreased for all Nova Scotia jurisdictions reported in the six-year period, but this was not the case in Canada as a whole, where the percentage of total farm area sprayed with insecticides and fungicides increased from 7.1% to 7.8% in the six-year period.

In sum, between 2000 and 2006, the proportion of Nova Scotia farm area subject to synthetic input use has decreased and remains significantly lower than in Kings County and in Canada as a whole. The intensity of all forms of synthetic input use—fertilizers, insecticides, fungicides, and herbicides—has also declined significantly in Kings County. Kings County still likely has higher input use intensities—as measured by proportion of farm area sprayed and fertilized—because of the intensive nature of farming and the high proportion of fruits and vegetables grown in that region of the province.

Table 12-6. Intensity of synthetic input use, Nova Scotia, Kings County, and Canadian farms, 2000 and 2006

Location	% area of farms fertilized		% area of farms sprayed with insecticides or fungicides		% area of farms sprayed with herbicides	
	2000	2006	2000	2006	2000	2006
Nova Scotia	21.7	20.3	7.0	5.7	7.3	7.1
Kings County	36.2	31.9	27.5	17.8	21.3	19.2
Canada	35.6	37.5	7.1	7.8	38.4	36.7

Source: 2000 data from Statistics Canada. 2002. Initial Release of Agriculture Census 2001 data. Cat. No. 95F0301XIE; 2006 data from Statistics Canada. 2006 Census of Agriculture. Selected land management practices, Canada and provinces, census years 1976 to 2006. Table 2.17. Available from http://www.statcan.ca/english/freepub/95-632-XIE/2007000/tables/table2.17-en.htm. Also, 2006 Census of Agriculture. Farm land area by tenure, Canada and Provinces. Table 2.4. Available from http://www.statcan.ca/english/freepub/95-632-XIE/2007000/tables/table2.4-en.htm#12. Accessed October 7, 2008. 2006 Census of Agriculture data for Kings County from Statistics Canada. Farm and farm operator statistics, Kings; Land inputs, Kings. Available from http://www26.statcan.ca:8080/AgrProfiles/cp06/TableList.action?prov=12&geog_id_amal=120207001&tab_id=1&letter=K&placename=Kings&loccode=4881&geog_id=120207001&offname=Kings. Accessed October 7, 2008.

Note: Data for Kings County are for 2005—the calendar year prior to the Census.

These data should ideally be combined with information on rates of use, which is presently unavailable, to determine more accurately the trends in intensity of farming over time. It is important to know both the amount of a nutrient or active ingredient used, and how benign or toxic these substances might be relative to each other. It is also difficult to know how accurate Agriculture Census information is, given that it is based on answers to a questionnaire rather than on empirical evidence. Thus, some farmers may hesitate to acknowledge use of synthetic inputs, because they are increasingly aware that it has undesirable consequences. Data for amounts of synthetic inputs sold to farms within the province would be required to double-check the figures from Census questionnaires.

12.10. Percentage of farm land occupied by forest and wetland

Data source: Statistics Canada, 2006 Census of Agriculture

Results: In 2006, 49% of Nova Scotia farm land was occupied by forest and wetland, compared to 34% of Kings County farm land, and 8% of Canadian farm land. Due to changes made in the 2006 Census of Agriculture, it is not possible to assess a trend at this time.

Farms are generally collections of crops, livestock, buildings, fields, ponds, streams, patches of trees, and woodland, and can be ideal homes for many creatures. In assessing the proportion of farm land occupied by forest and wetland, habitat or ecosystem diversity is used as a proxy for species diversity. From a GPI accounting perspective, it would be ideal to track directly the actual value of ecological services offered by biodiversity to farm productivity. Since existing data do not allow this, we therefore use this indirect habitat indicator. However, it is important to summarize briefly the deeper underlying meaning of the indicator and the value to which it points.

Healthy and flourishing populations of beneficial organisms provide us with ecological services that we take for granted and therefore may not even notice until they are gone. Some examples of ecological services provided by beneficial organisms to farms are pest and disease control, nutrient cycling, pollination, decomposition of wastes, buffering the effects of disturbance, and water purification. A very important ecological service of biological diversity is to provide competition against aggressive species that create harm (i.e., reduce productivity or induce ill-health) when their populations get out of control.

When ecological services are somehow impaired, they become very difficult and expensive to correct or to replace, thus threatening future productivity. For example:

1. If soil organisms were eliminated, it would be impossible to grow crops in the field. Growing food and feed hydroponically would be a very expensive technological replacement.
2. If beneficial pest predators in an orchard are eliminated, the cost of pesticides used to take over the job of controlling pests becomes prohibitively expensive.
3. If the beneficial bacterial layer on a crop leaf surface is eliminated, pathogens move in and must be controlled with expensive fungicide applications.
4. If we eliminate natural pollination services, beekeepers will have to be hired to replace the lost service.
5. If we eliminate natural water purification systems, they must be replaced with expensive water treatment facilities that attempt to mimic ecological water filtration processes often with limited success.

Ultimately, if biodiversity on farms is not carefully nurtured and maintained, we are faced with the prospect of replacing more and more ecological services (normally provided for free) with expensive technological solutions. In the long run, this is not a sustainable option, either economically or ecologically.

The OECD (2001) proposes to evaluate ecosystem diversity in agriculture based on the quantity of intensively managed, semi-natural, and uncultivated natural areas on farms.[24] It is useful to evaluate the amount of intensively farmed area compared to the quantity of more natural areas within farms and regions. But ultimately the *effectiveness* of having natural areas on farms will depend on *how* these areas are interspersed with crops, cropping patterns, and other adjoining landscapes (e.g., urban, wetland, industrial).

Forests and wetlands provide 1) habitat that enhances the range and diversity of beneficial organisms; 2) numerous ecological services performed by beneficial organisms (from fungi to forests), effectively maintaining and even enhancing their interactions to optimize agricultural productivity and reduce pollution; and 3) ecological services that do not have to be replaced (due to the loss of biodiversity) with expensive man-made solutions that generally further reduce ecological services.

In 2002, GPI Atlantic noted, in *The Value of Agricultural Biodiversity* study, that the portion of farm land in "woodland" was reported in Census of Agriculture data up to 1986, when it occupied 48% of farm land in Nova Scotia. The *quality* of forested or wooded land habitat was not reported (as indicated by the method of harvesting, age structure, or diversity of species, for example), making the data difficult to interpret in terms of habitat quality and the value of this habitat for generating ecosystem services.

Based on 2006 Census of Agriculture data, Statistics Canada reported that 49% of Nova Scotia farm land was occupied by forest and wetland, compared to 34% of Kings County farm land, and just 8% of Canadian farm land.[25] Unfortunately, due to changes in the Census of Agriculture, 2006 data are not comparable to earlier Census data and it is therefore not possible to assess a trend at this time. However, the 2006 data can be used as baseline data for future updates of this indicator to assess whether ecosystem and habitat diversity on farm land in Nova Scotia has expanded and improved.

12.11. Appendix tables

Appendix Table 12-1. Price indices for farm products, farm inputs, and food in stores, Nova Scotia, 1986–2006 (1986=100)

Year	Farm products, NS	Food in stores, NS	Farm inputs, Eastern Canada
2006	136.9	161.4	152.4
2005	133.5	157.1	147.4
2004	126.4	152.5	143.2
2003	120.1	149.3	144.9
2002	114.3	146.4	141.7
2001	122.1	141.4	142.2
2000	119.5	137.7	136.5
1999	115.1	136.1	129.1
1998	116.0	135.1	128.8
1997	117.4	131.9	133.7
1996	119.4	128.8	131.8
1995	107.2	126.4	124.4
1994	105.4	127.6	121.6
1993	105.9	123.5	118.1
1992	104.2	121.2	112.3
1991	106.8	121.0	111.4
1990	107.3	111.5	111.9
1989	104.8	108.1	111.1
1988	104.3	104.6	106.7
1987	105.9	104.4	101.5
1986	100.0	100.0	100.0

Sources: Derived from Statistics Canada. 2003. *Farm Product Price Index*, Cat. No. 21-007-XIB 3(11); McLaughlin and Robinson, 1999, 1995, 1992; Statistics Canada. 2003; CANSIM tables 002-0022; 328-0014; 328-0001; 326-0020.

Note: Indices constructed by author based on raw data from the sources listed.

Appendix Table 12-2. Total farm cash receipts and operating expenses, Nova Scotia and Prince Edward Island farms, 1971–2006 (millions of $2007)

Year	Cash receipts of NS farms	Cash receipts of PEI farms	Operating expenses of NS farms	Operating expenses of PEI farms
1971	347.75	207.51	301.72	191.56
1972	373.76	232.78	309.17	203.88
1973	464.50	351.00	358.53	218.90
1974	440.20	368.99	387.72	245.58
1975	443.38	334.32	393.66	254.96
1976	450.74	379.98	380.96	254.99
1977	443.76	299.43	357.12	254.45
1978	482.52	306.90	368.15	263.38
1979	501.44	338.77	408.06	267.88
1980	500.52	357.05	428.35	281.53
1981	513.16	428.57	441.63	300.96
1982	471.65	328.80	432.84	291.76
1983	455.49	332.10	429.39	290.26
1984	478.25	354.12	435.87	291.39
1985	460.01	305.55	412.27	287.37
1986	424.32	318.56	400.92	281.96
1987	492.15	352.64	404.35	277.07
1988	505.91	328.87	413.56	282.03
1989	480.90	385.69	411.95	287.08
1990	474.64	362.58	398.26	281.48
1991	427.98	328.23	380.19	276.05
1992	428.40	304.00	383.72	287.06
1993	409.75	315.44	382.27	286.52
1994	429.27	404.47	397.23	319.29
1995	435.30	399.65	408.94	343.38
1996	477.75	368.69	422.90	350.48
1997	464.57	349.98	432.10	352.60
1998	461.03	397.24	424.68	359.73
1999	473.44	421.06	429.14	368.50
2000	485.44	378.58	443.18	374.43
2001	476.05	381.21	454.40	372.84
2002	453.37	407.78	461.56	387.73
2003	464.91	387.81	467.52	385.36
2004	481.58	371.72	461.72	383.13
2005	482.36	385.01	461.00	387.26
2006	462.38	388.21	461.39	396.36

Sources: Derived from Statistics Canada, 2007. *Agriculture Economic Statistics*. Farm Cash Receipts. Cat. No. 21-011 and CANSIM tables 002-0005.

Appendix Table 12-3. Total net farm income, Nova Scotia and Prince Edward Island, 1971–2007 (millions of $2007)

Year	Total net farm income NS farms	Total net farm income PEI farms
1971	50.73	12.08
1972	77.43	30.13
1973	121.95	152.16
1974	72.26	218.33
1975	63.69	50.16
1976	82.04	159.22
1977	97.95	60.93
1978	130.26	64.37
1979	119.36	84.97
1980	91.18	60.51
1981	76.95	181.64
1982	48.47	43.39
1983	34.43	36.99
1984	48.86	99.48
1985	50.18	23.48
1986	67.57	31.14
1987	87.44	65.69
1988	96.93	64.00
1989	76.70	100.73
1990	76.90	72.14
1991	48.15	41.35
1992	46.44	64.85
1993	31.84	14.59
1994	35.76	73.96
1995	34.80	108.75
1996	60.11	30.43
1997	29.48	15.65
1998	41.73	23.67
1999	42.93	50.49
2000	43.67	26.29
2001	23.00	-49.90
2002	-3.45	109.85
2003	-0.64	-0.30
2004	18.55	-5.01
2005	19.83	23.49
2006	-7.71	18.06
2007	-26.37	-53.77

Source: Derived from Statistics Canada. 2007. *Agriculture Economic Statistics. Net Farm Income*. Cat. No. 21-010-XIE (latest update May 2007).

Note: The definition of net income is: total cash receipts - operating expenses after rebates + income in kind - depreciation charges (on buildings and machinery) + value of inventory change.

Appendix Table 12-4. Expense to income ratio (%), Nova Scotia and Prince Edward Island farms, 1971–2006

Year	Expense to income ratio NS farms	Expense to income ratio PEI farms
1971	86.75	92.32
1972	82.72	87.58
1973	77.19	62.36
1974	88.08	66.55
1975	88.79	76.26
1976	84.52	67.12
1977	80.48	84.98
1978	76.30	85.82
1979	81.38	79.07
1980	85.58	78.85
1981	86.06	70.22
1982	91.77	88.74
1983	94.27	87.40
1984	91.14	82.29
1985	89.62	94.05
1986	85.21	88.51
1987	82.16	78.57
1988	81.75	85.76
1989	84.61	74.43
1990	83.91	77.63
1991	88.83	84.10
1992	89.57	94.43
1993	93.29	90.83
1994	92.54	78.94
1995	93.94	85.92
1996	88.52	95.06
1997	93.01	100.75
1998	92.12	90.56
1999	90.64	87.52
2000	91.30	98.90
2001	95.45	97.80
2002	101.81	95.08
2003	100.56	99.37
2004	95.88	103.07
2005	95.57	100.56
2006	99.78	102.11

Source: Derived from Statistics Canada, 2007. *Agriculture Economic Statistics.* Cat. No. 21-011-XIE; 21-012-XIE. Latest update: May 2007.

Appendix Table 12-5. Total net farm income and total debt, Nova Scotia and Prince Edward Island farms, 1971–2006 (millions of $2007)

Year	Total farm net income, NS	Total farm debt, NS	Total farm net income, PEI	Total farm debt, PEI
1971	50.73	254.90	12.083	199.38
1972	77.43	252.09	30.13	188.48
1973	121.95	256.61	152.16	182.13
1974	72.26	273.56	218.325	189.87
1975	63.69	293.67	50.157	206.23
1976	82.04	288.45	159.218	207.98
1977	97.95	303.50	60.927	227.94
1978	130.26	328.38	64.367	230.20
1979	119.36	360.04	84.974	239.07
1980	91.18	365.75	60.513	253.33
1981	76.95	410.06	181.64	263.46
1982	48.47	397.79	43.387	274.95
1983	34.43	391.77	36.987	292.39
1984	48.86	398.11	99.484	286.35
1985	50.18	384.42	23.478	293.77
1986	67.57	365.24	31.142	285.21
1987	87.44	359.52	65.694	260.51
1988	96.93	368.32	64.001	260.57
1989	76.70	361.03	100.731	238.95
1990	76.90	378.83	72.141	255.56
1991	48.15	372.01	41.346	253.49
1992	46.44	360.30	64.85	276.37
1993	31.84	345.46	14.586	307.77
1994	35.76	401.94	73.964	373.25
1995	34.80	393.65	108.745	396.26
1996	60.11	410.71	30.431	418.87
1997	29.48	450.71	15.646	465.64
1998	41.73	490.48	23.666	514.49
1999	42.93	508.45	50.49	533.96
2000	43.67	544.28	26.29	553.41
2001	23.00	556.74	-49.9	575.72
2002	-3.45	561.01	109.85	607.07
2003	-0.64	601.26	-0.302	659.09
2004	21.01	651.82	-2.963	684.14
2005	22.71	686.57	-21.205	686.75
2006	1.33	679.82	13.81	645.67

Source: Derived from Statistics Canada. 2007. *Agriculture Economic Statistics.* Cat. No. 21-010-XIE; 21-014-XIE (latest update May 2007).

Notes: Author uses the same scale for each province to make comparisons easier. Nova Scotia shows a net income value below 0 for 2002, 2003, and 2006. PEI shows a net income value below 0 for 2001, 2003, 2004, and 2005. Both provinces also had net income below zero in 2007 (not included in this table).

Appendix Table 12-6. Debt to net income ratio, Nova Scotia and Prince Edward Island farms, 1971–2006

Year	Debt to net farm income ratio NS	Debt to net farm income ratio PEI
1971	502	1650
1972	326	626
1973	210	120
1974	379	87
1975	461	411
1976	352	131
1977	310	374
1978	252	358
1979	302	281
1980	401	419
1981	533	145
1982	821	634
1983	1138	791
1984	815	288
1985	766	1251
1986	541	916
1987	411	397
1988	380	407
1989	471	237
1990	493	354
1991	773	613
1992	776	426
1993	1,085	2110
1994	1,124	505
1995	1,131	364
1996	683	1376
1997	1,529	2976
1998	1,175	2174
1999	1,184	1058
2000	1,246	2105
2001	2,421	--
2002	--	553
2003	--	--
2004	3,102	--
2005	3,023	--
2006	--	4675

Source: Derived from Statistics Canada. 2007. *Agriculture Economic Statistics*. Cat. No. 21-010-XIE; 21-014-XIE (latest update May 2007).

Note: The ratios for 2001 to 2006 cannot be shown consistently because net incomes for those years were sometimes negative, making it mathematically impossible to calculate ratios for those years (indicated above by --).

Appendix Table 12-7. Solvency ratio, Nova Scotia, Prince Edward Island, Quebec, and Canadian farms, 1971–2006

Year	NS farms	PEI farms	Quebec farms	Canadian average
1971	0.231	0.230	0.325	0.193
1972	0.212	0.202	--	--
1973	0.193	0.179	--	--
1974	0.180	0.165	--	--
1975	0.188	0.176	--	--
1976	0.178	0.177	--	--
1977	0.192	0.191	--	--
1978	0.193	0.172	--	--
1979	0.193	0.156	--	--
1980	0.172	0.162	--	--
1981	0.200	0.166	0.261	0.140
1982	0.214	0.196	--	--
1983	0.217	0.214	--	--
1984	0.230	0.216	--	--
1985	0.228	0.223	--	--
1986	0.223	0.227	--	--
1987	0.222	0.214	--	--
1988	0.227	0.218	--	--
1989	0.221	0.195	--	--
1990	0.229	0.192	--	--
1991	0.240	0.200	0.299	0.184
1992	0.233	0.210	--	--
1993	0.224	0.231	--	--
1994	0.255	0.249	--	--
1995	0.255	0.237	--	--
1996	0.252	0.234	--	--
1997	0.260	0.257	--	--
1998	0.276	0.283	--	--
1999	0.279	0.289	--	--
2000	0.293	0.300	--	--
2001	0.299	0.316	0.377	0.210
2002	0.304	0.338	--	--
2003	0.335	0.378	--	--
2004	0.373	0.400	--	--
2005	0.397	0.406	--	--
2006	0.399	0.390	0.468	0.247

Source: Derived from Statistics Canada, 2007. *Agriculture Economic Statistics*. Cat. No. 21-013-XIE; 21-014-XIE.

13. Forests

For the original GPI Atlantic report on forests, please see the following:

The GPI Forest Headline Indicators for Nova Scotia (2008)
http://gpiatlantic.org/pdf/forest/forestupdate.pdf

The Nova Scotia GPI Forest Accounts Volume 1:
Indicators of Ecological, Economic & Social Values of Forests in Nova Scotia (2001)
http://gpiatlantic.org/pdf/forest/forest1.pdf

The Nova Scotia GPI Forest Accounts Volume 2:
A Way Forward: Case Studies in Sustainable Forestry (2001)
http://gpiatlantic.org/pdf/forest/forest2.pdf

Headline Indicators

1. Forest age class distribution: a measure of ecosystem diversity
2. Number of known forest-dependent species at risk
3. Protected areas as percentage of total land harvested
4. Value added per cubic metre of wood harvested
5. Jobs per unit of biomass

Note to Reader: Please see Section 23.1 for additional references.

The lesson I read in the past is this: that the health of land and water—and of woods, which are the keeper of water—can be the only lasting basis for any civilization's survival and success.

– Ronald Wright (A Short History of Progress)[1]

A forest makes things slowly; a good forest economy should therefore be a patient economy. It would also be an unselfish one, for good foresters must always look toward harvests that they will not live to reap.

– Wendell Berry[2]

Our forest industries are in danger. [. . .] *We're overcutting, seriously overcutting. We're clearcutting on steep hillsides that cause erosion.* [. . .] *You get a heavy rain in the spring, it's like flushing a toilet, and then in the summer there's not enough water, the salmon get sunburned.* [. . .] *In the past ten years, the crown lands have been raped and the crown land should show other people how the forests should be managed.*

–Wilfrid Creighton (1998)
former Deputy Minister, NS Department of Lands and Forests[3]

13.1. Introduction: counting the true value of our forests

Economic estimates ignore the fact that many ecosystem services are literally irreplaceable.
– Costanza et al., 1997

How do we put a price tag on clean air and water, biodiversity, and healthy forests and societies? We often call these "priceless," because we recognize their enormous inherent value and the reality of our complete dependence on their effective functioning. By that logic, when a forest ecosystem is degraded and no longer able to provide essential goods and services, our economy should count that loss as a cost, not a gain. In our current national accounting system and GDP-based measures of progress, however, the intrinsic value of the natural environment is ignored, and forests are only given a monetary value when they are cut down and the timber sent to market. Forests are not valued for the essential services they provide when left standing.

Our natural world provides and performs a wide range of ecological, social, and economic functions, providing people with both direct goods and services like wood, food, and recreational opportunities, and indirect goods and services that enable human society and the economy to function. For example, an intact, optimally functioning forest ecosystem provides, at no cost, a long list of vital services, including climate regulation, habitat and watershed protection, flood and natural pest control, prevention of soil erosion, formation of topsoil, nutrient recycling, and long-term storage of carbon. It also provides us with high quality wood, wild foods, and a place to relax and rest our minds.

Preservation of the capacity of nature to yield a full range of economic, ecological, social, and cultural benefits is sometimes called "holistic" forest use because this approach seeks to optimize the full range of forest functions. It also recognizes that long-term timber productivity is itself dependent on the preservation of healthy forest soils, age and species diversity, and other vital non-timber functions. This approach contrasts markedly with the current and historical "industrial" approach to forestry in Nova Scotia, in which the primary focus of forest management is to harvest enough wood fibre to meet all available and desired markets. "Sustainability," in an industrial model, is largely measured in terms of how much forest land is regenerated to commercial species. Water resources, wildlife, biodiversity, and ecosystem services receive only token consideration, if at all.

When a forest is degraded, its ability to provide vital "free" services is compromised. Such services may be lost irreplaceably or diminished in effectiveness, or efforts may be made to replace them through often expensive feats of human engineering (as when a water filtration plant is built to replace the lost natural filtration function that healthy forests perform for free). An accurate accounting system would recognize and count such losses as depreciation of natural capital, just as a factory owner currently counts a depletion or degradation in plant and equipment as depreciation of produced capital.

In 1997, an international team of scientists headed by Robert Costanza of the Maryland Institute of Ecological Economics conservatively estimated the average annual value of many of the world's key ecosystem services to be $33 trillion—almost twice the total annual GDP of all the countries on earth. It should be noted, however, that putting a price tag on the value of forests is highly problematic, in large part because there are many forest values that simply cannot be quantified. How, for example, can a dollar value be put on a forest species, or on the habitat provided to that species by the forest? Money was not designed to assess such non-market values and simply cannot adequately capture the intrinsic value of the natural world.

Yet, GPI Atlantic does often use monetary values for strategic purposes and as a tool to communicate with the world of conventional economics, while recognizing fully that profound human, social, and environmental values cannot properly be reduced to monetary terms. Thus, monetization is seen as a temporary but necessary step in order to overcome the conventional tendency to attribute no value to natural capital like standing natural forests. Despite the limitations of monetization, therefore, GPI Atlantic does use the technique to make the intrinsic values of natural forests more clearly visible, and to ensure that these values are duly and properly considered and taken into account in the policy arena. In other words, monetization can be seen as necessary as long as the values of standing natural forests are ignored by policy makers and these forests continue to be assigned a value of zero in conventional accounting mechanisms.

For the sake of convenience, the evidence that follows is presented in the form of six indicators that, at first sight, may appear to be separate from one another. However the value—and indeed the power—of the Genuine Progress Index lies in its capacity not just to present a wide range of social, economic, and environmental indicators but to show the linkages and interdependence between social, economic, and environmental factors, and thereby, to demonstrate the interrelated nature of reality. In fact, the six key indicators presented here were chosen from among a very large set of indicators in the 2001 *GPI Forest Accounts* precisely because they clearly reflect these intricate and intimate relationships.

In order to restore the health of Nova Scotia's forests and their capacity to perform their functions optimally, it is essential to restore their age diversity (indicator 1). Those forest functions include protection of soils, watersheds, biodiversity, and aesthetic quality, climate regulation and carbon sequestration, and provision of high quality timber and habitat for species (indicator 2).

Restoration of forest health and age diversity, in turn, require both an expansion of protected areas (indicator 3) and shifts in forestry policy and harvest practices (indicators 4-6). The latter include a greater reliance on selection harvesting rather than clearcutting (indicator 4) and a greater emphasis on value-added production (indicator 5) rather than export of raw timber and the current over-reliance on production for pulp and paper manufacturing. These changes will produce more jobs and more value per unit of biomass harvested (indicators 6 and 5), thus ensuring both the resilience of forest industries and enabling a reduction in current rates of over-harvesting.

In sum, the recommendations that flow directly from the key indicators and evidence presented here are inter-related aspects of a single reality. They represent win-win solutions that can restore forest health and provide adequate habitat for forest-dependent species, while ensuring a vibrant forest industry that provides longer term, sustainable jobs in forest-dependent communities.

13.2. Forest age class distribution: a measure of ecosystem diversity and health

Data sources: Nova Scotia Department of Lands and Forests. 1958. “The Forest Resources of Nova Scotia.” Prepared by L.S. Hawboldt and R.M. Bulmer; Nova Scotia Forest Inventory Provincial Summaries 1965-1971, 1970-1978, 1975-1982, 1976-1985, and 1979-1989; Nova Scotia Department of Natural Resources (NSDNR) GIS 1995 Inventory Data (September 1999 update); NSDNR GIS Unpublished Inventory Data (1997-2003); NSDNR. 2000. “Nova Scotia Forest Inventory Based on Forest Inventory Permanent Sample Plots Measured Between 1994 and 1998.” Report FOR 2000-1. Table 3; NSDNR. 2004. “Nova Scotia Forest Inventory Based on Permanent Sample Plots Measured Between 1999 and 2003.” Report FOR 2004-3. Table 3.

Result: There has been a sharp and significant loss of old forests in Nova Scotia since the province’s first major forest inventory in 1958, with no significant improvements in age class distribution in recent times, and a continuing shift to ever younger forests.

Old forests with wide age diversity perform many vital functions that younger even-aged forests are less able to perform. To provide just a few examples, old forests provide habitat to many species that are dependent on old growth; they provide a canopy that more effectively intercepts precipitation and thus protects against soil erosion; they store more carbon—vital in an era of climate change; and they increase resilience against certain diseases and pest infestations. These and other functions, in turn, improve timber productivity and increase the timber value of forests. Trees grown in open-grown conditions (i.e., following a clearcut) tend to be smaller in diameter, knotty and of poorer quality, while trees grown in closed canopy conditions (i.e., old forests) tend to be wider in diameter, of higher quality and clear (not knotty)—characteristics that fetch higher market prices.

In 2001, GPI Atlantic reported that—based on NSDNR forest inventory data dating back to 1958—there had been a sharp decline in the percentage of forests aged 61 and over, a significant loss in age diversity, and a sharp shift from older to younger age classes during the roughly 40-year period. For example, the GPI report found that, in 1958, one-quarter of Nova Scotia's forests were over 80 years of age, with this percentage declining dramatically to just 1% four decades later. By contrast, young forests (up to 40 years old) more than doubled in this time period from just 12% of the total in 1958 to 32% at the end of the 1990s. In a single generation, therefore, the age composition of Nova Scotia's forests changed dramatically, and the province lost almost all its remaining old forests—with true old growth (forests more than 100 years old) now virtually non-existent.[4]

However, the recent 40-year decline in forest age diversity should not be overstated, simply because Nova Scotia's forests in 1958 were by no means pristine or unspoiled, and were already far removed from the natural Acadian forest that prevailed prior to European settlement. In fact, the Nova Scotia Government's 1958 report on its own first-ever forest inventory stated bluntly that "the forests standing in 1958 [were] the end result of the building up and tearing down of trees over the centuries."[5] Even as far back as 1910, observations of the liquidation of the province's forests were being recorded:

> [The forest] is now largely in poor condition, and is being annually further deteriorated by abuse and injudicious use, because those owning it are mostly not concerned in its future, or do not realize its potentialities. To arrest further deterioration and to begin restoration is the present duty of those who have the continued prosperity of the Province at heart.[6]

In the early 1900s, forests were regularly cut before they were mature. By 1958, the year the first provincial forest inventory was published by the Department of Lands and Forests, it was reported that decades of "high-grading" the larger trees to meet the demand for sawlogs had not only changed the forest structure but had "nearly exhausted" the supply of larger trees, making it "necessary to accept smaller and smaller stock." In other words, nearly 50 years ago, government documents were already warning that forest conditions had "deteriorated considerably [. . .] making the conservative and recuperative measures even more imperative now."[7]

These warnings and recommendations—even from government agencies—went unheeded by the forest industry, and clear-cutting, over-harvesting, and the loss of old forests and age diversity continued unabated, and even accelerated with the advent of highly mechanized logging equipment. Thus, a 1997 NSDNR position paper made observations similar to those four decades earlier, particularly with regard to cutting on private lands, acknowledging that: "forest stands are being harvested while they are still immature"; "softwood harvests have exceeded the sustainable supply level"; and "overharvesting is a potentially serious problem demanding immediate attention."[8]

While the 1997 warnings are similar in some ways to those of earlier years, there is a significant difference in the way in which the warnings were framed. In the early 1900s, and even in 1958, the observations centred on the ecology and condition of the province's forests and on the ways in which forest structure and health were being affected by harvesting methods and levels. Today, discussions about Nova Scotia's forests focus on how to ensure that the forests can sustain harvest levels—which have increased by nearly 60% since the early 1980s alone.[9] The goal of having "sustainable" harvests has replaced the goal of ensuring sustainable forests and ecosystems.

In order to update the data and trends in age class distribution since its 2001 report for this present key indicator summary, GPI Atlantic obtained the most recent unpublished GIS inventory data based on aerial photography from the NSDNR, as well as the most recent Permanent Sample Plot (PSP) data, of which only two sets of age class data are publicly available. A summary of the trends in age class are presented below in Figures 13-1 through 13-7. Figures 13-1 through 13-6 are based on the GIS inventory data (reported publicly for the first time here), and Figure 13-7 is based on the PSP data.[10]

As previously noted, the figures below demonstrate a sharp decline since the 1950s in the percentage of provincial forest aged 61 and older, and a simultaneous sharp increase in younger forest stands.

According to the most recent GIS inventory data provided by NSDNR, the youngest age class (0–20 years), which includes those stands that have been clearcut, has increased considerably as a proportion of total forest cover since GPI Atlantic's 2001 report—from 16.3% of the province's forests in 1999 to 23.9% in the 1997-2003 inventory. In the early 1970s, such very young forest stands constituted only 3.8% of the province's forests, and this proportion has been increasing ever since—with the largest percentage point increase in the most recent period (Figures 13-1 and 13-3 below).[11]

The forest area represented in the 61- to 80-year-old age class has not changed much in recent years, representing 11.5% of total forest area in 1999 and 11.9% in the 1997-2003 inventory. However, when viewed from a longer historical perspective, this age class has shrunk by two-thirds since 1958, when it comprised 34.3% of the province's forests.

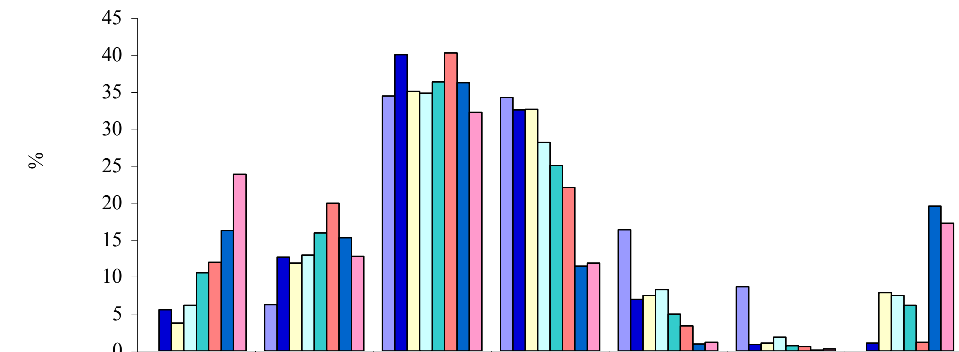
The forest area represented in the older age classes (80 years plus) decreased dramatically between 1958 and 1999, from 25% in 1958 to 1.2% in 1999 and 1.5% in the 1997-2003 GIS inventory. The oldest forests (101+) have virtually disappeared—declining from 8.7% of all forests in 1958 to 0.3% in the latest 1997-2003 inventory (Figure 13-2 below).

Expressed as percentage declines, the 61- to 80-year-old age class dropped by 65% between 1958 and 2003; the 81- to 100-year-old age class by 93%; and the 101+ year-old age class by 97%. Considering the province's older forests as a whole, those over 60 years constituted 59.4% of all provincial forests in 1958, and only 13.4% in the latest 1997-2003 GIS inventory—a decline of 77.5% (Figure 13-4 below). At the same time, the percentage of young forest up to age 20 increased by a remarkable 327% over roughly the same time period,[12] and the 21- to 40-year-old age class increased by 103%.

Despite increasing talk of sustainability in both industry and government circles, the available data show no evidence of effective forest restoration or increased age diversity. On the contrary, they indicate that Nova Scotia's forests continue to become ever younger, thus forfeiting the substantial benefits, services, and values of older forests and compromising forest sustainability. For GPI Atlantic, these results are of particular concern, since they indicate that the warnings and recommendations of the 2001 GPI report—which for the first time documented the decline in old forests and age diversity quantitatively—have not been heeded by the forest industry any more than have the consistent warnings from government agencies.

The results should be of even greater concern to the provincial government, since the lack of substantial positive change undermines the government's new commitment to "sustainable prosperity" and its stated intention to "demonstrate international leadership by having one of the cleanest and most sustainable environments in the world by the year 2020" (Bill 146: Environmental Goals and Sustainable Prosperity Act, 2007). The latest available statistics indicate that the "recuperative measures" called for half a century ago are even more urgently required today if the government is to meet its stated goals.

Figure 13-1. Forest area (% of total forest area), by age class, Nova Scotia, 1958–2003



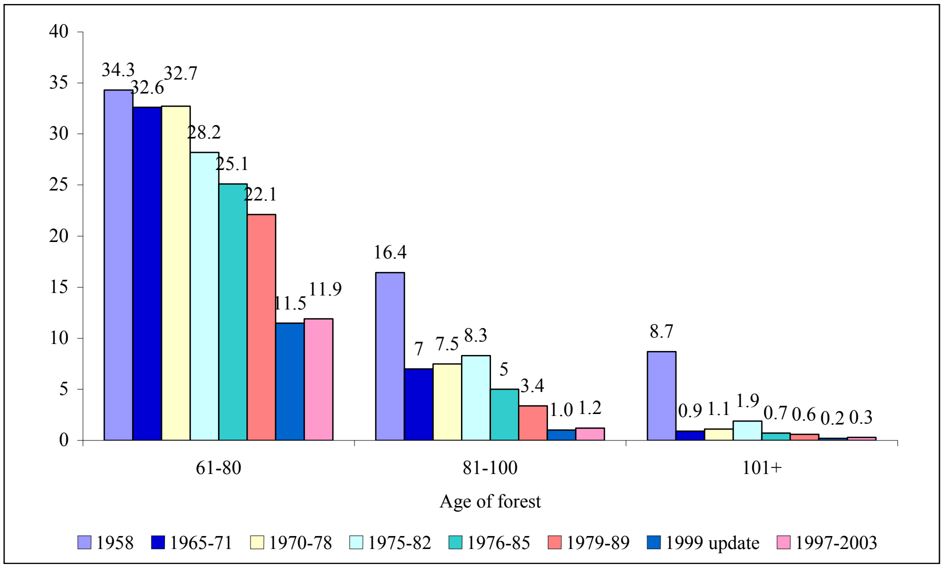
	Up to 20 yrs.	21 to 40 yrs.	41 to 60 yrs.	61 to 80 yrs.	81 to 100 yrs.	101 + yrs.	All aged
1958		6.3	34.5	34.3	16.4	8.7	
1965-71	5.6	12.7	40.1	32.6	7	0.9	1.1
1970-78	3.8	11.9	35.1	32.7	7.5	1.1	7.9
1975-82	6.2	13	34.9	28.2	8.3	1.9	7.5
1976-85	10.6	16	36.4	25.1	5	0.7	6.2
1979-89	12	20	40.3	22.1	3.4	0.6	1.2
1999 update	16.3	15.3	36.3	11.5	1.0	0.2	19.6
1997-2003	23.9	12.8	32.3	11.9	1.2	0.3	17.3

Sources: The Forest Resources of Nova Scotia (1958); Nova Scotia Forest Inventory Provincial Summary 1965-1971, 1970-1978, 1975-1982, 1976-1985, 1979-1989; DNR GIS 1995 Inventory Data (September 1999 update); DNR GIS Unpublished Inventory Data (1997-2003).

Notes:

- Figures may not add up to 100 due to rounding.
- The age classes cited in the 1958 inventory were reported differently than in the subsequent inventories. Instead of 20-year intervals, such as 21–40, 41–60 etc., they were classified in 10-year intervals—30, 40, 50, etc. In 1958, age class 30 (26–35 years) roughly corresponds with the 21-40 age class category used in subsequent inventories; age classes 40 and 50 (36-55 years) roughly correspond with the 41-60 age class; age classes 60 and 70 (56-75 years) roughly correspond with the 61-80 age class; age classes 80 and 90 (76-95 years) roughly correspond with the 81-100 age class; age classes 100, 110, 120, and 126+ (96 + years) roughly correspond to the 101+ age class. In addition, it should be noted that, in 1958, there was no mention of an age class between 0-20 years or of an all aged category, and these cells have, therefore, been left blank in the figure above.
- The "all-aged" category is defined by NSDNR as those stands with three or more distinct canopy layers visible on a photograph. For inventory purposes, the "all height" stands, which here are called "all-aged," are given an average height in order to calculate volume. According to Ken Snow, Manager of Forest Inventory at NSDNR, "the average height of the All-height (All-Age) softwood stands are comparable to the average height of the softwood forest (11 metres) indicating that all height stands are not just young stands. In fact a stand must have a layer at least 9 metres tall (based on merchantable stems) to be classed as an All-height stand. A softwood stand at an average height of 9 metres on an average site (LC 5), would have an age of approx 35 years, 11 metres—43 years."[13] The reasons for the sharp increase in this category in recent years are unclear. Ken Snow says that "all aged" stands could result from high-grading, partial blow-down, or insect and disease kill of certain species. (Personal communication, November 26, 2007).

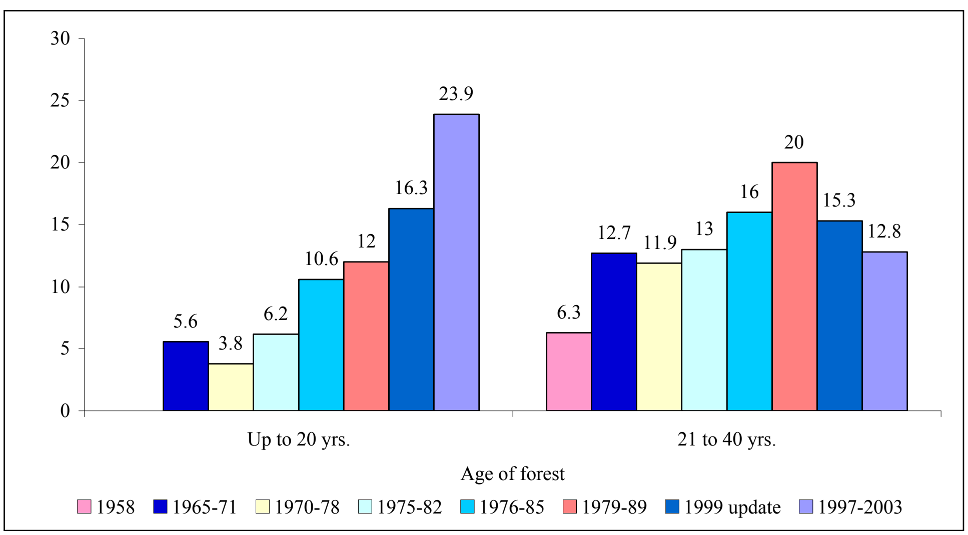
Figure 13-2. Forest area (% of total forest area), by age classes over 60 years, Nova Scotia, 1958–2003



Sources: The Forest Resources of Nova Scotia (1958); Nova Scotia Forest Inventory Provincial Summary 1965-1971, 1970-1978, 1975-1982, 1976-1985, 1979-1989; DNR GIS 1995 Inventory Data (September 1999 update); DNR GIS Unpublished Inventory Data (1997-2003).

Note: Figures have been rounded.

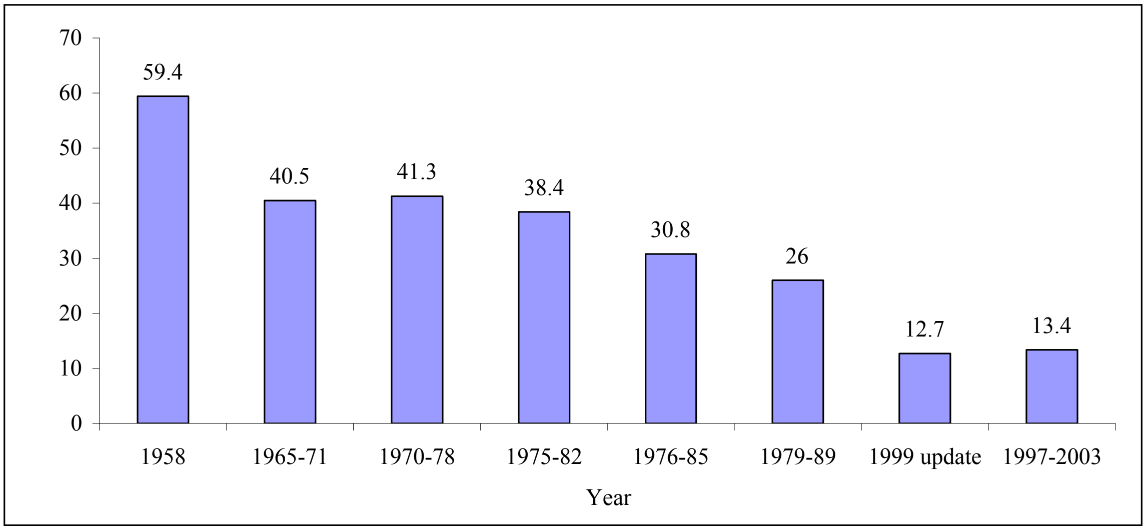
Figure 13-3. Forest area (% of total forest area), by age classes up to 40 years of age, Nova Scotia, 1958–2003



Sources: The Forest Resources of Nova Scotia (1958); Nova Scotia Forest Inventory Provincial Summary 1965-1971, 1970-1978, 1975-1982, 1976-1985, 1979-1989; DNR GIS 1995 Inventory Data (September 1999 update); DNR GIS Unpublished Inventory Data (1997-2003).

Note: Figures have been rounded.

Figure 13-4. Forest area over 60 years old (% of total forest area), Nova Scotia, 1958–2003



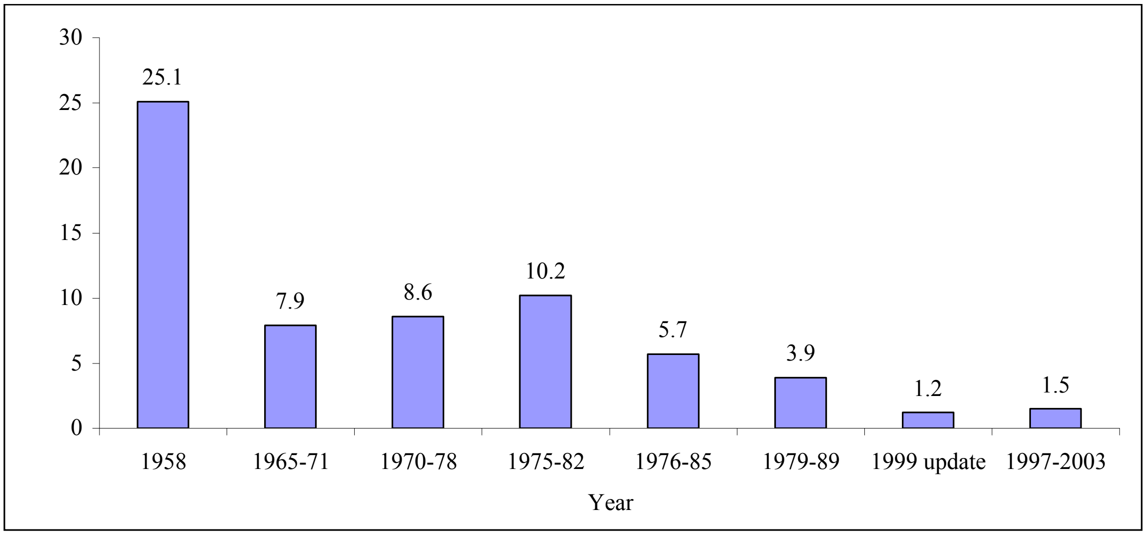
Sources: The Forest Resources of Nova Scotia (1958); Nova Scotia Forest Inventory Provincial Summary 1965-1971, 1970-1978, 1975-1982, 1976-1985, 1979-1989; DNR GIS 1995 Inventory Data (September 1999 update); DNR GIS Unpublished Inventory Data (1997-2003).

Note: Figures have been rounded.

Remnant old-growth forests are extremely rare in the province and are typically found in small, isolated stands often of questionable ecological integrity. These are far too small and scattered to contribute in any real way to the overall biodiversity of the province, which is defined as the variety of life in all of its forms, levels, and combinations. Remarkably, however, even these tiny, isolated stands do still provide increasingly rare habitat for many species of old-growth dependent wildlife and plants, and they contribute—at least on a local level—to the biodiversity of the regions in which they remain. GPI Atlantic's 2001 forest accounts describe some of the species that depend on old growth for their survival.

Figures 13-5 and 13-6 demonstrate the sharp decline in the percentage of forests over 80 years old in Nova Scotia. As noted above, in 1958, roughly one-quarter of the province's forests were more than 80 years of age. Forty-five years later, only 1.5% of provinces forests now fall into these older age categories (Figure 13-5 below). While the dominant forest type that would have existed in Nova Scotia prior to European settlement would have been classified as "old growth" with an average age of well over 100 years, centuries of logging and high-grading had reduced those old forests to just 8.7% of the total by 1958, with even these virtually eliminated in the last 45 years—constituting just 0.3% of all the province's forests in the latest 1997-2003 inventory (Figure 13-6 below). Please see the 2001 *GPI Forest Accounts* for details on the average natural life span of Nova Scotia's forest species.

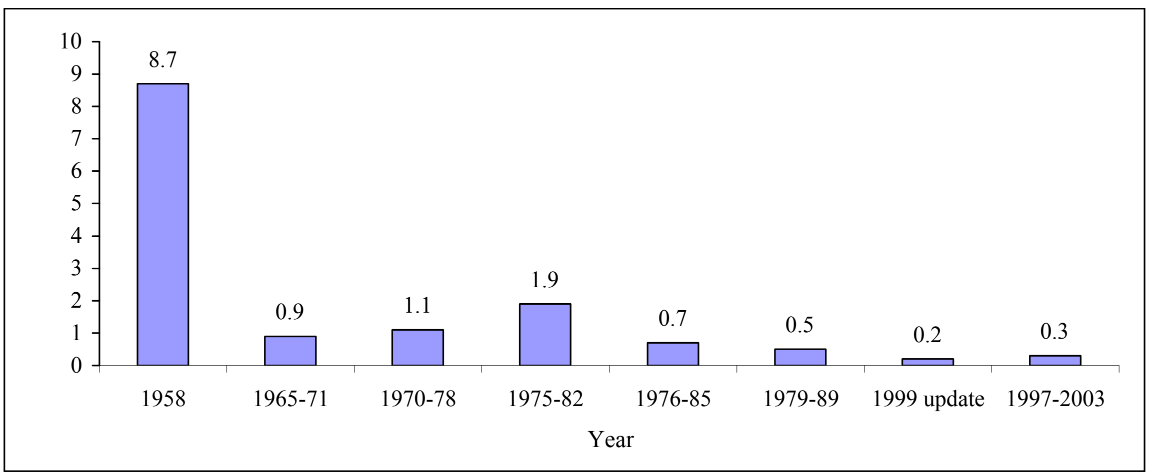
Figure 13-5. Forest area over 80 years old (% of total forest area), Nova Scotia, 1958–2003



Sources: The Forest Resources of Nova Scotia (1958); Nova Scotia Forest Inventory Provincial Summary 1965-1971, 1970-1978, 1975-1982, 1976-1985, 1979-1989; DNR GIS 1995 Inventory Data (September 1999 update); DNR GIS Unpublished Inventory Data (1997-2003).

Note: Figures have been rounded.

Figure 13-6. Forest area over 100 years old (% of total forest area), Nova Scotia, 1958–2003



Sources: The Forest Resources of Nova Scotia (1958); Nova Scotia Forest Inventory Provincial Summary 1965-1971, 1970-1978, 1975-1982, 1976-1985, 1979-1989; DNR GIS 1995 Inventory Data (September 1999 update); DNR GIS Unpublished Inventory Data (1997-2003).

Note: Figures have been rounded.

Despite NSDNR's 1999 policy to set aside 8% of crown land in each of the province's 38 EcoDistricts as old growth and old forest, the province is still clearly far from those targets.[14]

Forest inventory data for age class distribution are also collected from permanent sample plots (PSPs) randomly placed throughout the province. Despite the fact that PSP data have been collected since 1965, NSDNR has only published forest age class data from these plots twice: in 2000, based on measurements of 1,923 plots between 1994 and 1998, and in 2004, based on measurements of 3,250 plots between 1999 and 2003.[15] Despite requests made by GPI Atlantic for the earlier PSP data, they have not been provided. In addition, while NSDNR has stated that it may undertake the task of analyzing the full range of PSP data for age class trends at some time in the future, to date it has not done so.[16]

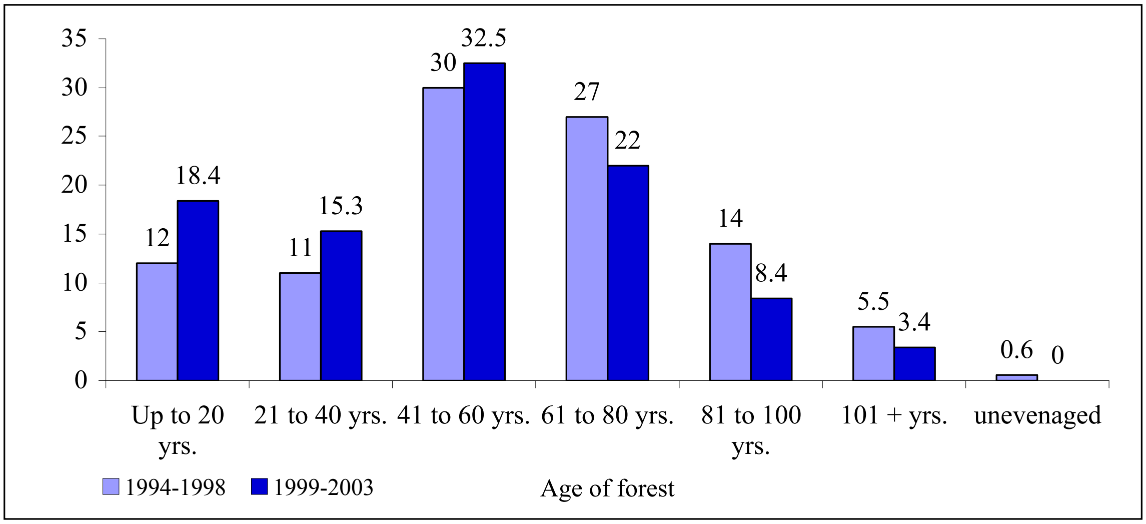
Therefore, with only two sets of PSP age class data available, it is not currently possible to develop a long-term historical trend for this indicator using the PSP data. Furthermore, as stated, NSDNR does not have any current plans to analyze or publish these historical data, although it does acknowledge that, "It would be a very interesting research project to calculate provincial age class distributions in five year periods from 1965-1970 to 2003-2008 when the 2008 field season is completed."[17]

The age class data that are currently available from the 1994-1998 and 1999-2003 PSP measurements are presented below in Figure 13-7. Between 1994-1998 and 1999-2003, the PSP data indicate a "shift to a younger forest,"[18] thus confirming the trends based on the GIS data outlined above. Indeed, in a relatively short time period, the PSP data show the percentage of total forest area more than 60 years of age decreasing from 46.5% in 1994-1998 to 33.8% in 1999-2003, while the percentage of younger forests—less than 60 years of age—increased from 53% to 66.2% in the same time period.[19] The percentage of forests between 0 and 40 years of age increased from 23% of all forests to nearly 34%.

Thus, the PSP data also indicate and confirm that older age classes are in decline and have continued to decline, despite repeated warnings and admonitions about the loss of benefits and value that accompany the destruction of old forests. According to the limited PSP data available, stands more than 80 years of age decreased from 19.5% of the total provincial forest area in 1994-98 to 11.8% in 1999-2003.

According to Ken Snow of NSDNR, increases in harvesting account for a "significant portion of the decline in the number of stands older than 81 years."[20] Despite this apparent understanding of the direct link between increased harvests and loss of old forests, NSDNR has continued to support forest industry objectives to increase forest harvest levels in Nova Scotia. Thus, in 1999, the department projected that by 2070, the softwood net merchantable volume of timber in Nova Scotia forests would double to more than 11 million cubic metres—up from about 5.5 million cubic metres in 1996.[21] Increased harvests were expected to be possible as a result of increased silviculture efforts, even though silviculture cannot replace old forests.

Figure 13-7. Forest area based on permanent sample plots (%), by age class, Nova Scotia, 1998 and 2003



Sources: Nova Scotia Department of Natural Resources. 2000. Nova Scotia Forest Inventory Based on Forest Inventory Permanent Sample Plots Measured Between 1994 and 1998. Report FOR 2000-1. NSDNR. Truro. Table 3.; Nova Scotia Department of Natural Resources. 2004. Nova Scotia Forest Inventory Based on Permanent Sample Plots Measured Between 1999 and 2003. Report FOR 2004-3. NSDNR. Truro. Table 3.

Note: Figures have been rounded.

While the trends in Figure 13-7 above—including the decline in old forests and the shift to younger forests—mirror the longer term trends from the GIS data described above, the absolute numbers and percentages are clearly very different. For a more in-depth analysis of the conflict between the GIS age class data and the PSP age class data please refer to Section 6.3.1 of the 2001 *GPI Forest Accounts, Volume 1*. There, it was noted that any tendency to preserve permanent sample plots or exclude them from clearcuts may well lead to the PSP data reflecting a more optimistic and less dire picture than the GIS data.

It is recommended that the DNR undertake the task of calculating provincial age class distributions in five-year periods from 1965-1970 to 2003-2008 when the 2008 field season is completed.

13.3. Number of known forest-dependent species at risk

Data sources: Legally listed species: Nova Scotia Department of Natural Resources. 2006. NS Endangered Species Act: Legally Listed Species as of 2006. Available from http://www.gov.ns.ca/natr/wildlife/biodiv/specieslist.htm. Accessed October 12, 2007; Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2007. Schedule 1. List of Wildlife Species at Risk. Available from http://www.sararegistry.gc.ca/species/default_e.cfm. Accessed October 12, 2007.

Forest-dependence of yellow-, red-, and blue-listed species of flora and fauna was provided by the following experts: *Vascular plants*: Sean Blaney, Botantist and Assistant Director, Atlantic Canada Conservation Data Centre; *Lichens*: Stephen Clayden, Research Curator, Botany and Mycology Section, New Brunswick Museum; *Dragonflies*: Paul Brunelle, Research Associate, New Brunswick Museum and Regional Coordinator for Atlantic Dragonfly Inventory Program; *Fish:* John Gilhen, Curator Emeritus, Nova Scotia Museum of Natural History; *Birds, butterflies, and mammals*: Mark Elderkin, Provincial Species at Risk Biologist, Nova Scotia Department of Natural Resources.

Result: There has been an increase in the number of known forest-dependent species at risk in Nova Scotia since 2001.

Biodiversity cannot be assessed simply by the counting of species. Biodiversity is the variety of life and all its processes, and includes the range of living organisms within an ecosystem, their genetic differences, and the communities in which they naturally occur. The diversity that makes up a natural forest, for instance, includes not only trees, but also soil bacteria, earthworms, flowers, ferns, lichens, shrubs, insects, fish, stream invertebrates, resident and migratory birds, mammals, amphibians, moulds and fungi, and humans. Within a forest system, thousands of different species interact, and all of them are interconnected in dynamic ways.

A 1994 study in the journal *Nature* found that ecosystems with losses in plant and animal biological diversity showed significant losses in ecosystem performance in a number of ecosystem functions and in the provision of essential ecosystem services. Thus, a highly diverse forest system is a key marker of its health and resilience, and a vital indicator of its capacity to perform its manifold functions effectively and optimally.[22]

There is also growing evidence that conserving the natural biological diversity of ecosystems provides stability for these ecosystems by buffering against natural and artificial stresses, and that this diversity also maintains productivity.[23] For example, forests with greater tree species diversity have been shown to be more resilient to disease and insect infestation. Su et. al. studied 25 mixed balsam fir–hardwood stands in New Brunswick between 1989 and 1993 in areas with moderate to severe defoliations by spruce budworm. They found that defoliation by spruce budworm was significantly related to the hardwood content of a forest. As the hardwood content increased, the defoliation of the balsam fir within the stands decreased.[24] In that way, a healthy, diverse forest also has a direct impact on timber productivity and value.

Old-growth forests, in particular, are rich in biodiversity, and are home to many different plants and animals that have specialized needs.[25] On the other hand, young softwood plantations are low in biodiversity—simple places with only a few tree and animal species. Studies have indicated that natural species diversity is a vital indicator of forest health, and of the capacity of a forest to perform a variety of ecosystem functions and to provide essential ecosystem services.

Nova Scotia has already lost much of its original biodiversity. Since European colonization, almost every stand of old-growth forest in the province has been cut and/or burned. As a result, the habitat of plants and animals that depend on old-growth forests, including large cavities in large standing or fallen dead trees, has almost disappeared, causing declines in many species. Protection of forest-dependent species clearly depends on protection of their habitats.

In this province, many forest-dependent species are vulnerable to “edge effects,” which, in turn, result from the fragmentation of forests caused by clearcutting and roads. Fragmentation can have severe impacts on species that require large territories, and/or large uninterrupted tracts of forest; that are susceptible to predation or parasitism by edge-loving species; that are sensitive to human contact; that are frequently killed on roads; or that are unlikely or unable to traverse large openings. Such “edge effects” have already taken their toll on the province’s forest-dependent flora and fauna. At current harvesting rates, and given current harvesting practices, almost all provincial forests outside protected areas will continue to be degraded in this manner.

As noted, biodiversity cannot be assessed through counting species. And yet, listing species at risk is presently one of the only ways we have of even approaching this complex dimension of forest health from an indicator and assessment perspective. To that end, Tables 13-1 and 13-2 below list plant and animal species in Nova Scotia that are dependent on forests and are currently at risk.

Since 2001—the first time GPI Atlantic reported the number of known forest-dependent species at risk—the situation has worsened, and the list of endangered species has grown longer.[26] The Nova Scotia population of Blandings turtle, listed as “threatened” in 2001, is now currently listed as “endangered.” In addition, eight more forest-dependent species of flora and fauna have since been listed as endangered: ram’s head lady slipper, moose (mainland population), Boreal felt lichen, Canada lynx, American marten (Cape Breton population), Atlantic salmon (Inner Bay of Fundy population), Atlantic whitefish, and chimney swift.

Recently listed as “vulnerable,” the eastern white cedar and rusty blackbird now join the ranks of the wood turtle and Bicknell’s thrush—whose status has not improved since the last GPI report. Extirpated species include the grey wolf and the woodland caribou. In addition, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) lists “candidate species,” which are species not yet assessed by COSEWIC, but which have been identified by COSEWIC as potentially being at risk. Known forest-dependent species in Nova Scotia listed by COSEWIC as candidates for detailed status assessment are the eastern cougar and lake trout.[27] Species listed in Table 13-1 are legally protected.

Table 13-1. Known forest-dependent species (flora and fauna) classified as vulnerable, threatened, endangered, or extirpated, federally and/or provincially, Nova Scotia, 2007

VULNERABLE / SPECIAL CONCERN	THREATENED	ENDANGERED	EXTIRPATED
• eastern white cedar (2006) • Bicknell's thrush (2002) • rusty blackbird (2006) • wood turtle (2000) • Gaspe shrew (2002)	• common nighthawk (2007)	• ram's head lady slipper (2007) • moose (mainland population) (2003) • Boreal felt lichen (2007) • Canada lynx (2002) • American marten (Cape Breton population) (2001) • Blandings turtle (NS population) (2000) • Atlantic salmon* (Inner Bay of Fundy population) (2001) • Atlantic whitefish* (2002) • chimney swift (2007) • eastern cougar†	• frey wolf • woodland caribou • eastern cougar†

Sources: Nova Scotia Department of Natural Resources. 2006. Nova ScotiaEndangered Species Act: Legally Listed Species as of 2006. Available from http://www.gov.ns.ca/natr/wildlife/biodiv/specieslist.htm. Accessed October 12, 2007; COSEWIC. 2007. Schedule 1. List of Wildlife Species at Risk. Available from http://www.sararegistry.gc.ca/species/default_e.cfm. Accessed October 12, 2007.

Notes:
- Under the Nova Scotia Endangered Species Act, there are five categories of risk: Vulnerable, Threatened, Endangered, Extirpated, and Extinct.[28] Only those categories with listed Nova Scotia species are included in the table above.
- The criteria for forest dependence include whether particular species require forests for food, shelter, breeding, or other critical aspects of their life cycles.
- *Atlantic salmon populations are affected by acid rain, climate change, over-fishing, sedimentation, and loss of forest canopy cover. Sandy stream bottoms are also essential for salmon spawning to be successful. Water temperature is another critical factor that influences the growth rate of salmon. When stream temperatures increase, salmon are adversely affected. Salmon like cool, well-oxygenated, shaded streams that are relatively free of sediment. When a nearby forest is cut down or a steam-side forest canopy is removed, the salmon habitat changes dramatically: the water gets warmer during the day, the oxygen concentration decreases, and the stream beds become plugged with sediment. For these reasons, Atlantic salmon are considered a forest-dependent species. Atlantic whitefish are also threatened by acid rain, pollution, over-fishing, and deforestation.
- † The eastern cougar is not listed at all in the Nova Scotia Species at Risk, and, therefore, is not legally protected in the province. As noted above, however, it is listed by COSEWIC as a candidate for detailed status assessment in the future. As is apparent in Table 13-2 below, the eastern cougar is also not listed as being red, yellow, or blue in the Nova Scotia General Status of Wild Species classifications. However, according to biologist Bob Bancroft, the eastern cougar is a contentious subject, with some scientists maintaining that populations do still inhabit parts of Nova Scotia, and others arguing that they do not. Bancroft himself believes that eastern cougars still roam the province and should be listed as endangered as their numbers would be very small indeed. If they are no longer found here, then the species should be listed as extirpated. In either case, based on the precautionary principle—which would certainly make a case for its protection if it still exists in Nova Scotia—it seems that the species should certainly be listed. Therefore, eastern cougar has been included in both the "endangered" and "extirpated" columns of Table 13-1 above, pending agreement on which of those two categories is most appropriate.
- In 2003, the southern flying squirrel was designated by COSEWIC as a species of "special concern." However, in 2006, COSEWIC re-assessed the southern flying squirrel as "not at risk." However, Amanda Lavers, whose 2004 thesis was about this species, concluded that we currently do not know enough about it to determine that it is not at risk.[29]

The species at risk listed in Table 13-1 above are classified at the federal level through COSEWIC and the Species at Risk Act (SARA). At the provincial level, species of concern are protected by the Nova Scotia Endangered Species Act, and—in the absence of listing under law—they are assessed using the Nova Scotia General Status of Wild Species classifications. Thus, the species listed in Table 13-1 above, are supposed to receive legal protection. However, there are additional species of Nova Scotia flora and fauna that are considered rare or potentially at risk and that are, therefore, classified as either "yellow-listed"—sensitive to human activities or natural events—or "red-listed"—known or believed to be at risk. These species are not legally protected but are sometimes taken into consideration, particularly when environmental assessments are required for projects or developments to go ahead.[30] Table 13-2 below presents those forest-dependent species that are listed as yellow, red, or blue (extirpated) in Nova Scotia. Table 13-2 does not include those species that are legally protected, which can be found in Table 13-1 above.

Table 13-2. Yellow-, red-, and blue-listed forest-dependent species not protected under legislation, Nova Scotia, 2007

YELLOW-LISTED	RED-LISTED	BLUE-LISTED
Flora:		
Vascular plants:		
Highly forest-dependent:		
• smoother sweet cicely • common alexanders • Lindley's aster • white snakeroot • Boreal American aster • pale jewel weed • squashberry • black ash • halberd-leaf tearthumb • lesser wintergreen • wood anemone • alderleaf buckthorn • Boreal bedstraw • northern comandra • heart-leaved foam flower • wood nettle • pubescent sedge • yellow Canada lily • giant rattlesnake plantain • dwarf rattlesnake plantain • large round-leaved orchid • northern holly fern • meadow horsetail • lance-leaf grape fern • least grape fern • false mermaid weed	• northern white cedar • blunt-fruited sweet cicely • black snake-root • pussytoes • blue cohosh • northern wild comfrey • large toothwort • coffee tinker's weed • large tick-trefoil • green ash • squaw root • purple clematis • round-leaved liverleaf • bristly crowfoot • Nantucket shadbush • eastern leatherwood • foxtail sedge • chestnut-coloured sedge • slender wood-sedge • loose-flowered sedge • necklace spike sedge • plantain-leaved sedge • Tuckerman sedge • Wiegand's sedge • narrow-leaved wild leek • small white leek	• great laurel • Canada violet

YELLOW-LISTED	RED-LISTED	BLUE-LISTED
• large yellow lady's slipper • small yellow lady's slipper	• long-bract green orchid • showy lady's slipper • downy rattlesnake plantain • southern twayblade • white adder's mouth • broad-glumed brome • stout wood reed-grass • Wiegand's wild rye • bottlebrush grass • nodding fescue • northern maidenhair fern	
Flora:		
Vascular plants:		
Moderately forest-dependent:		
• hemlock parsley • Philadelphia fleabane • hairy wild lettuce • cut-leaved coneflower • coast pepper-bush • dwarf huckleberry • spurred gentian • Canada anemone • river anemone • marsh marigold • hawthorn • common buttonbush • bog bedstraw • thyme-leaved speedwell • hair-like sedge • ebony sedge • swan sedge • slender sedge • southern rein orchid • Canada mountain ricegrass • slender wedge grass • maidenhair spleenwort • green spleenwort • netted chainfern • fragrant fern • smooth woodsia • Adder's tongue • short-awn foxtail • wavy-leaf American aster • purple-stem swamp beggar-ticks • purple-leaf willow-herb	• Nuttall's small reedgrass • northern bedstraw • large marsh bedstraw • umbellate bastard toad-flax • cloud sedge • porcupine sedge • greenish-white sedge • sparse-flowered sedge • tinged sedge • slender dichanthelium • fragile rockbrake • northern woodsia • Bebb's sedge	• swamp beggar-ticks • northern dewberry
Flora:		
Lichens:		
• Degelia plumbea • Collema nigrescens	• Erioderma pedicellatum • Fuscopannaria ahlneri	

YELLOW-LISTED	RED-LISTED	BLUE-LISTED
• Sticta fuliginosa • Fuscopannaria leucosticta • Leptogium corticola • Leptogium laceroides • Leptogium saturninum • Pannaria conoplea • Pannaria rubiginosa • Peltigera leucophlebia • Coccocarpia palmicola	• Leptogium milligranum • Leptogium subtile • Leptogium tenuissimum • Meolleropsis nebulosa ssp. frullaniae • Pannaria lurida • Sticta limbata • Erioderma mollissimum	
Fauna:		
Butterflies:		
	• early hairstreak • bog elfin • jutta Arctic	
Dragonflies:		
• little bluet • seaside dragonlet • clamp-tipped emerald (3) • muskeg emerald • prince basket-tail (2) • harlequin darner (1) • Zorro club-tail (3) • harpoon club-tail (3)	• taiga bluet • ebony boghaunter (1) • Williamson's emerald (3) • ringed emerald • rusty snake-tail (2) • twinhorned snaketail (3) • brook snake-tail (3) • skillet club-tail (2)	
Fish:		
• brook trout • lake trout • gaspereau	• striped bass • Atlantic sturgeon	
Birds:		
• olive-sided flycatcher • grey jay • Boreal chickadee • northern goshawk • Canada warbler • rusty blackbird • common loon		
Mammals:		
• fisher • eastern pipistrelle • northern long-eared bat • little brown bat • southern flying squirrel		

Sources: Forest-dependence of all yellow-, red-, and blue-listed flora and fauna was provided by the following experts. *Vascular plants*: Sean Blaney, Botantist and Assistant Director, Atlantic Canada Conservation Data Centre; *Lichens*: Stephen Clayden, Research Curator, Botany and Mycology Section, New Brunswick Museum; *Dragonflies*: Paul Brunelle, Research Associate, New Brunswick Museum and Regional Coordinator for Atlantic Dragonfly Inventory Program; *Fish*: John Gilhen, Curator Emeritus, NS Museum of Natural History; *Birds, butterflies, and mammals*: Mark Elderkin, Provincial Species at Risk Biologist, Nova Scotia Department of Natural Resources.

Notes:

- Not included in Table 13-2 are those species protected under legislation. Please refer to Table 13-1 for these.

- *Vascular plants*: The vascular plant species listed above are either highly forest-dependent or moderately forest-dependent, with the former including those most often found under a forest canopy in Nova Scotia and the latter including those that are fairly frequently found under a forest canopy, including forest edge species.
- *Lichens*: These mostly occur on the bark of trees and all are highly forest-dependent. Some lichens occur mainly on rock and soil, often in the shade of overhanging trees, or along shady brooks and rivers.
- *Dragonflies*: In addition to the red- and yellow-listed species provided above, there are also 19 species of dragonflies that are listed as “undetermined,” whose status cannot currently be assessed due to a lack of data. Among this group, the zebra clubtail is considered highly dependent on riparian forest cover. As well, an additional six species are listed as “undetermined” as a result of taxonomic (classification) issues. All dragonfly species are dependent on forest cover to some degree. In its absence, they are vulnerable to predators, and some species rely on breaks in forest canopy to find sun-lit patches that are preferred mating territory. In addition, where timber cutting has been extensive, the aquatic habitat of dragonflies can be negatively impacted. This tends to be more significant to the running waters (lotic) species. In Table 13-2 above, the numbers beside the dragonfly species indicate the significance of forest cover, where (1) indicates a species which requires forests for mating territory; (2) indicates a lotic species whose aquatic habitat characteristics are somewhat dependent on riparian forest cover; and (3) indicates a lotic species whose aquatic habitat characteristics are highly dependent on riparian forest cover. Absence of a number indicates that the species is vulnerable only in the sense that all Odonata (dragonflies) are vulnerable without cover.[31]
- *Fish*: Forests “dictate” water temperature and water levels, and are overall “very important for most fish species to thrive,” says John Gilhen, Curator Emeritus at the Museum of Natural History. Pearl dace and brook stickleback are also yellow-listed species but are not included in the table above because, according to Gilhen, they are “not necessarily” forest-dependent, thrive in boggy areas, and can withstand much higher temperatures than most fish.[32]
- *Birds, butterflies, and mammals*: Despite the fact that the southern flying squirrel was deemed “not at risk” by COSEWIC in 2006, it remains in the General Status of Wild Species in Nova Scotia classification as yellow-listed, or sensitive to human activities or natural events.

In a 2007 report analyzing US bird count data over a 40-year period, the Audubon Society found that many common birds are in decline. According to the Audubon report: “Since 1967 the average population of the common birds in steepest decline has fallen by 68%; some individual species nose-dived by as much as 80%. All 20 birds of the national Common Birds in Decline list lost at least half their populations in just four decades.”[33] The Audubon Society attributes some bird decline to a loss of forest habitat from “inappropriate logging.” In particular, the Audubon Society reports that the boreal forest of the northern US and Canada provides essential breeding territory for evening grosbeaks and Boreal chickadees, which have declined by 78% and 73%, respectively, since 1967.

13.4. Protected areas as percentage of total provincial landmass

Data sources: Provincial parks and park reserves: Brian Kinsman, Planner, NSDNR, personal communication, December 21, 2007. All other data: David Hopper, Private Land Conservation Coordinator, Nova Scotia Department of Environment and Labour, Protected Areas Branch, personal communication, November 29, 2007.

Result: There has been an increase in the percentage of Nova Scotia’s total landmass under protection from 8.1% in 2001 to 8.5% in 2007.

The very best forestry practices are no substitute for a network of protected areas in which no logging at all occurs. For reasons described in detail in the 2001 *Nova Scotia GPI Forest Accounts*, such a network is the only guarantee for adequate protection of vital natural assets at the landscape level.[34]

In Nova Scotia, the Department of Environment and Labour's protected areas program is based on a framework of 80 natural landscapes that have been identified based on the province's nine climatic regions, 47 geologic formations, and 84 major soil types.[35] The term *landscape ecosystem* refers to:

> a group of biotic communities, together with their environment, occurring over a particular portion over the landscape and held together by some common physical or biotic feature. Ecosystems contain climax and related successional communities within them and, as an assemblage, form distinct broad landscapes.[36]

In other words, each of the natural landscapes describes a full range of large-scale variations in landforms, vegetation, natural disturbance regimes, local climate, and biodiversity across Nova Scotia. The province has committed to protect representative examples of each natural landscape in a network of protected areas. This is a challenging task, given that nearly 70% of the land in the province is privately owned.

In 2001, GPI Atlantic reported that 8.1% of provincial land was under some form of protection. This was still well below the minimum of 12% recommended by the World Wildlife Fund (WWF) in its global protected areas campaign. The goal of the WWF campaign, which began in the late 1980s and was agreed to by the federal and all provincial and territorial governments, was to ensure that none of Canada's designated landscape and habitat types disappear.[37] In 2001, GPI Atlantic reported—based on the available data—that in 1998, 26 of the 80 landscape types, or 32.5% of all landscape types in Nova Scotia, had satisfactory representation in protected areas. This was an improvement from 1994, when only seven landscape types, or 8.7%, had satisfactory representation in protected areas.

Since 1998, the only significant change in terms of representation was the protected areas designation in 2005 of the Eigg Mountain–James River Wilderness Area and the Gully Lake Wilderness Area. According to Department of Environment and Labour staff, Eigg Mountain is located in the Pictou–Antigonish Hills landscape, and the new wilderness area gave that particular landscape a "near satisfactory" representation, increasing the number of landscapes with satisfactory representation to 27, or 34.6% of all landscape types in the province. Gully Lake is mainly in the Cobequid Hills landscape, which was already well represented. All other designations that have occurred since 1998 (except the most recent, discussed below) have not been enough to move any other landscape into the "satisfactory" category.[38]

Table 13-3 below provides the most recent data on the percentage of Nova Scotia that is currently protected—8.5% of the total landmass, up from 8.1%, reported in 2001.

Table 13-3. Protected areas, Nova Scotia, 2007

TYPE OF PROTECTED AREA	TOTAL HECTARES
34 Wilderness Areas	294,951
16 Nature Reserves	4,123
2 National Parks and 5 National Wildlife Areas	137,379
Provincial Parks and Park Reserves	33,000
National Heritage Rivers	N/A
Total Area Protected	**469,453**
Percentage of total provincial land (5.5 million ha)	**8.5%**

Sources: *Provincial parks and park reserves*: Brian Kinsman, Planner, NSDNR, personal communication, December 21, 2007. *All other data*: David Hopper, Private Land Conservation Coordinator, Nova Scotia Department of Environment and Labour, Protected Areas Branch, personal communication, November 29, 2007.

Notes:
- Shelburne River and Margaree River–Lake Ainslie are National Heritage Rivers, but they are only protected where they flow through a wilderness area.
- These numbers were accurate at time of writing. More recent wilderness area designations (see below) are not included.
- NSDNR did not have current information on the proportion of protected forested and non-forested property. Therefore, a calculation of protected forest area as a percentage of total forested land (4.27 million ha) was not possible.
- These figures only include lands protected by the province, and not lands protected by private land-owners or municipalities. For example, the Nova Scotia Nature Trust currently protects roughly 1,200 ha of private land in Nova Scotia.[39] In addition, there may be individual land-owners who are committed to protecting their land. Municipalities also have land holdings used as parks. Due to time constraints, these figures have not been included in Table 13-3 above.
- Numbers have been rounded.

In 2001, GPI Atlantic reported that Nova Scotia had 31 wilderness areas. Today, it has 34 designated wilderness areas, as seen in Table 13-3 above. However, this does not include recently announced wilderness areas and acquired land, yet to be designated, such as the Bowater Mersey Paper Company Ltd. land acquisition (10,050 ha) announced in July of 2007,[40] the Blue Mountain–Birch Cove Lakes (1,350 ha) wilderness area in Halifax Regional Municipality announced in October 2007, or the Ship Harbour–Long Lake wilderness area (14,000 ha) announced in December 2007.

Once these areas are officially designated and added to the network of protected areas in Nova Scotia, they will extend the proportion of provincial land that is protected from 8.5% to 9%. Further analysis will be required to assess the impact of these new designations on the percentage of landscape types then protected and “satisfactorily” represented.

13.5. Harvest methods and percentage of total land harvested annually

Data sources: National Forestry Database. Table 6.1. Silvicultural Statistics by Province/Territory, 1975–2006. Available from http://nfdp.ccfm.org/compendium/silviculture/tables_index_e.php.

Result: There has been a marginal increase in the use of selection harvesting in the province. However, clearcutting remains by far the predominant harvest method in use.

A forest may depreciate in value as a result of either depletion (over-cutting) or degradation (harvesting in such a way as to undermine forest health.) We have already referenced the 1997 NSDNR position paper, which acknowledged that "softwood harvests have exceeded the sustainable supply level" on private lands, and that "overharvesting is a potentially serious problem demanding immediate attention."[41] The total area harvested has fallen since peaking in 1997 at roughly 70,000 ha, but remains about 50% higher than levels 20 to 30 years ago (Figure 13-8 below).

As noted in the 2001 *GPI Forest Accounts*, clearcutting as a harvest method has generally adverse impacts on forest health—exacerbating soil erosion, for example, by removing the entire tree canopy that normally intercepts precipitation. By contrast to uneven-aged selection harvest methods, clearcutting also undermines forest age and species diversity, destroys wildlife habitat, and compromises the capacity of forests to protect watersheds, sequester carbon, and regulate the climate. Again in contrast to selection harvesting, clearcutting also reduces actual timber value by removing wide-diameter and clear lumber from the forest, and it undermines community resilience by failing to provide steady forestry jobs over extended periods of time.

In 2001, the GPI forest accounts reported that roughly 98% of harvesting in Nova Scotia in the late 1990s was by clearcutting (including shelterwood).[42] By 2005, this proportion was closer to 94%—the lowest percentage on record in the 30 years for which data are available (see Figures 13-8 and 13-9 below). Between 2000 and 2005, therefore, there appears to have been some improvement in this area, with an increased use of selection harvesting—in which single trees or groups of trees are selectively removed from a stand in such a way as to maintain the integrity, diversity, health, and value of the stand as a whole.

Thus, in 2005, 838 ha of forest in Nova Scotia were harvested through selection cutting, up from 509 ha five years earlier—a quite dramatic relative increase of 65%—while the amount of forest clearcut fell by 4% during the same time period. In absolute terms, however, the selection harvest total remains very small. Thus, the few hundred hectares selectively harvested is still in sharp contrast to the 52,874 ha clearcut in 2000 and the 50,864 ha clearcut in 2005. In other words, of the total forest area harvested in 2005, only 1.5% was cut using selection harvesting.[43]

Since 2000, there has also been a marked increase in the use of commercial thinning—from 1,050 ha in 2000 to 2,624 ha in 2005 (see Figure 13-10 below).

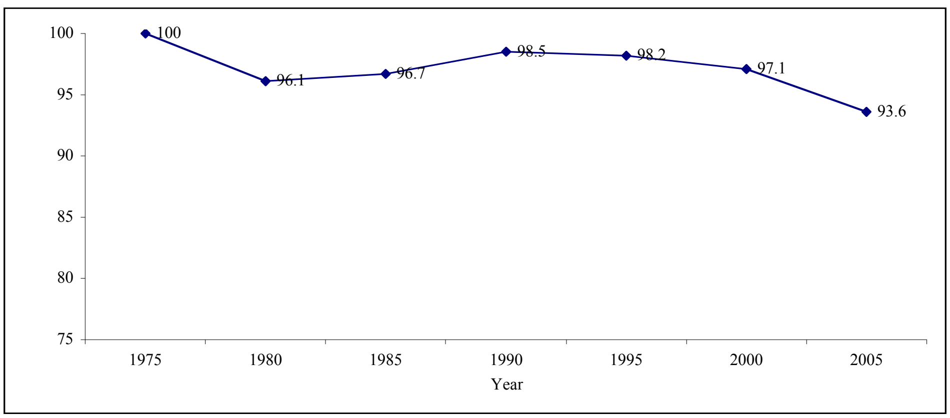
Figure 13-8. Total area harvested and area clearcut (hectares), Nova Scotia, 1975–2005

	1975	1977	1979	1981	1983	1985	1987	1989	1991	1993	1995	1997	1999	2001	2003	2005
Area clearcut	27.3	28.3	33.7	35.0	20.1	28.8	41.1	35.9	37.6	42.8	49.1	68.7	47.9	52.1	48.9	50.9
Total area harvested	27.3	28.3	33.7	36.4	20.7	29.8	42.3	36.7	38.2	43.6	50.0	69.8	49.7	53.2	52.9	54.3

Source: National Forestry Database. Table 6.1. Silvicultural Statistics by province/territory, 1975-2006. Available from http://nfdp.ccfm.org/compendium/silviculture/tables_index_e.php.

Notes: Data provided from this source for 2006 were identical to those for 2005, and were not included in this figure because they were based on an estimate. Numbers have been rounded.

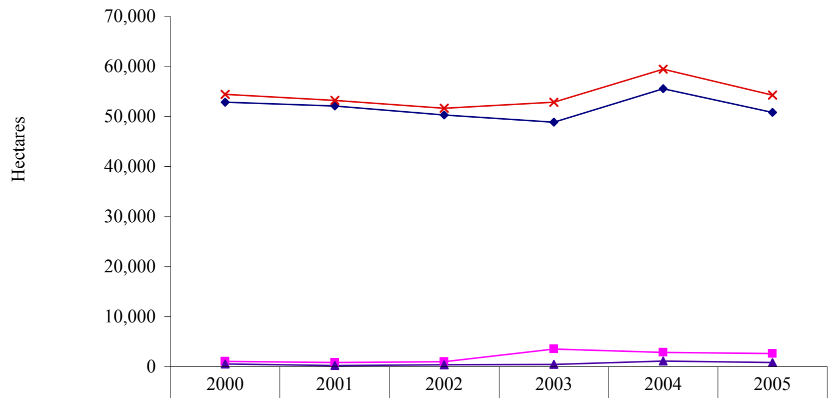
Figure 13-9. Percentage of area harvested by clearcutting, Nova Scotia, 1975–2005



Source: National Forestry Database. Table 6.1. Silvicultural Statistics by province/territory, 1975-2006. Available from http://nfdp.ccfm.org/compendium/silviculture/tables_index_e.php.

Note: Data for 2006 were identical to those for 2005 and were not included in this figure because they were based on an estimate.

Figure 13-10. Harvest methods by area, Nova Scotia, 2000–2005



	2000	2001	2002	2003	2004	2005
Area clearcut (even-aged mgmt systems inc. 1 & 2 stage, shelterwood and seed tree)	52,874	52,113	50,294	48,874	55,547	50,864
Commercial thinning	1,050	861	999	3,554	2,823	2,624
Selection	509	252	364	476	1,134	838
Total area harvested	54,433	53,226	51,657	52,858	59,504	54,326

Source: National Forestry Database. Table 6.1. Silvicultural Statistics by province/territory, 1975-2006. Available from http://nfdp.ccfm.org/compendium/silviculture/tables_index_e.php.

Note: Data for 2006 were identical to 2005 and were not included in the figure because they were based on an estimate.

In 2001, GPI Atlantic noted that the industrial model of forestry in use in Nova Scotia—with clearcutting as the predominant harvest method—impacts heavily on soil and water quality, degrades intrinsically valuable ecosystems that provide habitat for forest-dependent wildlife and aquatic species, and threatens forest-dependent communities in Nova Scotia. When used to the extent that it is in this province, clearcutting results in an overall loss of age diversity and tree species composition. In addition, the short-term removal of all commercial stands in an area for the sake of short-term economic expediency impacts negatively on communities that rely on stable long-term employment. In short, forest use based on clearcutting as the dominant harvesting method of choice cannot sustain natural forest ecosystems nor can it contribute to stable employment or long-term community vitality.

For this reason, the GPI forest accounts count any movement away from clearcutting and even-aged management and towards uneven-aged selection harvest methods as genuine progress. This is in accord with public perception in the province. Thus, in 1999, 98% of those surveyed in Central Nova Scotia said that sustainable forest management was an important goal to achieve and 91% said that the present rate of timber harvest was too high to sustain the forest for other values or uses. Furthermore, "the majority felt that clearcutting should not be used as a harvest method because it harms wildlife, ruins forests, causes erosion, looks bad and wastes wood."[44] Any move by the Nova Scotia government that encourages movement in this direction by the forest industry and woodlot owners (either by regulating harvest practices or through a system of incentives and penalties like enhancing silviculture credits for selection harvesting and diminishing them for clearcutting) will likely have wide public support.

13.6. Value added per cubic metre of wood harvested

Data sources: Value added for logging industry from 1990–2002 from Statistics Canada, CANSIM Table 301-0004 (Annual Survey of Forestry); Value added for logging industry from 2003–2005 from Statistics Canada, CANSIM Table 301-0007 (Annual Survey of Manufactures and Logging); Value added for paper, wood products, and wood furniture from 1990–2002 from Statistics Canada, CANSIM Table 301-0003 (Annual Survey of Manufactures); Value added for paper, wood products, and wood furniture from 2003–2005 from Statistics Canada, CANSIM Table 301-0006 (Annual Survey of Manufactures and Logging); Total Roundwood Harvested values from the National Forestry Database Program's Compendium of Canadian Forestry Statistics 2005, Table 5.1.

Result: Between 1998 and 2004, the rate of value-added forest product per cubic metre of wood harvested declined in Nova Scotia—giving it the second lowest ranking among the provinces in 2004.

Genuinely sustainable development effectively integrates social, economic, and environmental objectives. In the forest sector, then, the challenge is to extract the greatest economic and social value from the resource with the least damage to the forest. From this perspective, the more value that can be added to each unit of biomass harvested, the less timber needs to be cut in order to maximize the value of the wood, provide jobs, and ensure a viable forestry sector in the long term. Higher ratios of timber value per unit of biomass harvested are, therefore, a sign of genuine progress because they signal improved economic viability in living off the interest or services provided by natural capital stocks without depleting the stocks or capital assets themselves.

In 1998, Ontario had the highest rate of value-added product per cubic metre of wood harvested—$374/m^3, compared with Quebec at $260/m^3, New Brunswick at $156/m^3, British Columbia at $133/m^3, and Nova Scotia at 127/m^3 ($2007).[45] The national average was $205/m^3. In 1998, Nova Scotia's rate of value-added production was 34% that of Ontario, 49% that of Quebec, and 81% that of New Brunswick.

In 2004, the most recent year for which comparable data were available,[46] the highest rate of value-added product per cubic metre of wood harvested was in Manitoba ($425/m^3), followed by Ontario ($367/m^3), Quebec ($241/m^3), and New Brunswick ($176/m^3). The lowest rate was found in Prince Edward Island ($54/m^3). Nova Scotia ranked second lowest among the provinces ($107/m^3) and well below the Canadian average ($183/m^3), with a rate of value-added production that was 25% that of Manitoba, 29% that of Ontario, 44% that of Quebec, and 61% that of New Brunswick (Table 13-4 below).

Table 13-4. Value added per cubic metre of wood harvested ($2004), by province, 1998 and 2004

	VALUE ADDED (PER M^3 OF WOOD HARVESTED) 1998	VALUE ADDED (PER M^3 OF WOOD HARVESTED) 2004
CAN	$205	$183
NL	$50	$121
PE	$39	$54
NS	$127	$107
NB*	$156	$176
QC	$260	$241
ON	$374	$367
MB	$123	$425
SK	$79	$142
AB*	$113	$137
BC	$133	$117

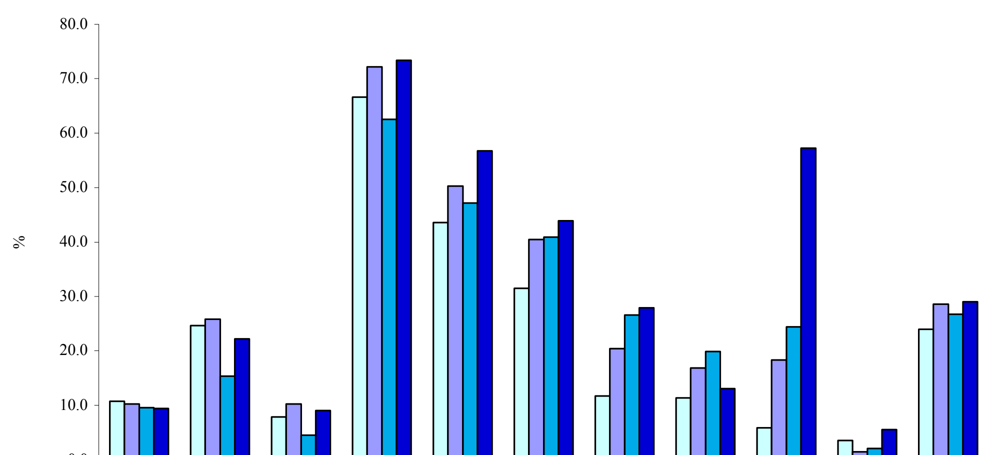
Sources: Value added for logging industry from 1990–2002 from Statistics Canada, CANSIM Table 301-0004 (Annual Survey of Forestry); Value added for logging industry from 2003-2005 from Statistics Canada, CANSIM Table 301-0007 (Annual Survey of Manufactures and Logging); Value added for paper, wood products, and wood furniture from 1990-2002 from Statistics Canada, CANSIM Table 301-0003 (Annual Survey of Manufactures); Value added for paper, wood products, and wood furniture from 2003-2005 from Statistics Canada, CANSIM Table 301-0006 (Annual Survey of Manufactures and Logging); Total Roundwood Harvested values from the National Forestry Database Program's Compendium of Canadian Forestry Statistics 2005, Table 5.1.

Notes:

- * For comparability reasons, value-added data for New Brunswick and Alberta are for 1997.
- Value-added figures for each province come from logging, paper and allied products, wood product manufacturing, and wood furniture and related products. The latter sector includes value-added products made from wood, including wood kitchen cabinet and countertop manufacturing, other wood household furniture, and wood office furniture. The rate of value added by province was calculated by dividing the total value added for each of these four sectors by the total volume of roundwood harvested in that province in the years under consideration.
- The most recent data available are for year 2005. However, due to the following reasons, 2004 data are reported here: 1) Total Roundwood Harvested data for New Brunswick and Manitoba are incomplete for the year 2005; and 2) in 2005, the value-added data for a number of forestry sectors were suppressed to protect confidentiality. Therefore, pan-Canadian comparisons were not possible using 2005 data.
- In 1998, the value added from paper and allied products is not included in the Newfoundland, Manitoba, or Saskatchewan totals for that year because the data were suppressed by Statistics Canada to protect confidentiality. For the same reason, data for value added in the paper and allied products and the wood furniture sectors are not included in the totals for Prince Edward Island in 1998. In 2004, data for wood furniture and related products were suppressed for British Columbia.
- In 2004, the Annual Survey of Manufactures and Logging replaced the Annual Survey of Forestry and the Annual Survey of Manufactures. While the survey still covers the same target industries, there are a few conceptual and methodological changes. There are some changes to the definition of financial variables in the new survey. However, these were only found to affect the comparison of the costs of energy and water utilities and the costs of materials and supplies. Prior to 2004, businesses with revenues below $30,000 per year were excluded from the survey. In the new survey, values are published for businesses above certain revenue thresholds that vary by province, industry, and year.
- Conversion to 2004 constant dollars was made using the Bank of Canada's Inflation Calculator, January 18, 2008. Numbers have been rounded.

As Table 13-4 above indicates, value added per cubic metre of wood harvested in Manitoba increased from $123 in 1998 to $425 in 2004. While more investigation is required to ascertain why some provinces seem to be doing better than others with regard to this indicator, there is some evidence to suggest that the Manitoba government's explicit commitment to promoting value-added business operations has helped make Manitoba a leader in Canada in this field.[47] In March 2002, Manitoba Conservation published a five-year *Report on the Status of Forestry* that referenced the government's policy to actively promote value-added processing in the province.[48] In the last several years, in fulfillment of that objective, programs have been implemented in Manitoba to link urban buyers with a chain of loggers, kiln operators, and furniture and cabinet makers. In 2007, nearly three-quarters of all the wood exports from Manitoba were characterized as "value-added." In the same year, 57% of Ontario's wood shipments, 44% of Quebec's, and 13% of Nova Scotia's were value-added. The Canadian average was 29% (see Figure 13-11 below).[49]

Figure 13-11. Value added as a percent of total wood exports, by province, 1998–2007



	BC	Alta	Sask	Man	Ont	Que	NB	NS	PEI	NL	Canada
1998	10.7	24.6	7.8	66.6	43.6	31.5	11.7	11.3	5.8	3.5	24.0
2001	10.2	25.8	10.2	72.2	50.3	40.5	20.4	16.8	18.3	1.4	28.6
2004	9.5	15.3	4.5	62.5	47.2	40.9	26.6	19.9	24.4	2.0	26.7
2007	9.4	22.2	9.0	73.4	56.8	43.9	27.9	13.0	57.2	5.5	29.0

Source: Data provided to GPI Atlantic by Dan Schrier, Manager, Trade and Business Statistics, B.C. Stats, Ministry of Labour and Citizens' Services, Government of British Columbia. Original data are from Statistics Canada.

Note: Value-added exports are defined by B.C. Stats as a product made from lumber such as mouldings, siding, engineered wood, and completed articles primarily of wood. Engineered wood products include glued laminated timber and laminated veneer lumber. Articles made from wood include doors, windows, prefabricated houses, and furniture. Excluded from the definition are shakes and shingles, and panel products such as plywood, oriented strand board, and medium density fibreboard.[50]

According to Candace Christiano, co-owner of a value-added wood products business in Cape Breton, there are still many obstacles facing value-added industries in Nova Scotia. They include:

- Continued lack of interest in value-added potential and current uses by NSDNR and Nova Scotia Economic Development
- Lack of policy relating to resource allotments for value-added end uses or end users
- Global market pressure to reduce prices[51]

In 2001, GPI Atlantic reported that two key factors contribute to the fact that Nova Scotia has a poorly developed value-added forest sector. In 2007, the situation had not changed.

1) The wood market continues to be dominated by three transnational companies from the pulp and paper industry: US-based Bowater, Inc., in Liverpool; US-based Neenah Paper, Inc., in Abercrombie (formerly Kimberly–Clark); and US-based NewPage in Port Hawkesbury (formerly Swedish Stora Enso).[52] These three companies hold Crown leases or agreements on the majority of Crown lands in the province and rely heavily on private landowners for the majority of their wood supply. According to one analyst: "Given the lack of alternatives and local high unemployment [. . .] the large, mostly foreign, pulp and paper mills are political capital instrumental in the electoral process and survival of the provincial governments."[53]
2) The highly degraded condition of most of the region's forests further diminishes the opportunities for improving the quality of forest stands, thus producing higher value forest products.

A 2003 study, prepared for the Nova Scotia Community College and funded by Enterprise Cape Breton Corporation (ECBC) and Atlantic Canada Opportunities Agency (ACOA), about the value-added wood products industry in Nova Scotia, and citing the 2001 *GPI Forest Accounts*, had the aim to "develop a comprehensive plan that will promote its sustainable growth and viability as a vital contributor to the provincial economy."[54] The report cited a number of "threats" to the viability of the Nova Scotia Secondary Wood Products Industry (NSSWPI), including:

- *Provincial focus on primary manufacturing*: "The growth of the NSSWPI has been hindered by the past policies of the province with regard to the use of Crown Land and this policy now threatens any significant growth in the sector. It has been pointed out in earlier studies that the NSSWPI generates higher revenues and provides more jobs per unit of wood fibre than the primary sector but this has failed to drive any change in initiatives to promote higher value-added conversion of wood resources."
- *Inadequate education and training in the field*: Opportunities for training and technical assistance in the province are currently lacking. Despite the fact that the Atlantic region has more postsecondary institutions per capita than anywhere else in Canada, there is inadequate education in the field of manufacturing or industrial engineering. "Left as is, this issue will be the greatest threat to a viable exporting NSSWPI that can contribute to increased employment and GDP in the province."
- *Limited natural resources*: "We believe the forests have reached their limit in sustainable

harvest levels for both softwoods and hardwoods. Our conclusion is based on lengthy discussions with the Natural Resources department of Nova Scotia and other stakeholders in the primary and secondary sectors of the industry and a review of available data."[55]

Some of the report's key recommendations are combined and summarized below. For more detail, please refer to the original report.[56]

- Create organizational and educational infrastructure for a NSSWPI by creating a NSSWPI Strategy Implementation Commission, which would be responsible for the overall implementation of the recommendations.
- Create a new Advanced Woodworking Technology Centre at the Nova Scotia Community College, and form a Nova Scotia chapter of the Wood Products Group. These structural initiatives could draw people into the value-added sector through career recruitment and retention initiatives.
- Develop a value-added forest resource strategy. In other words, "more roundwood *currently being harvested* needs to make its way into the supply chain of the value-added wood products industry in NS. Currently, very little is finding its way [there . . . .] Instead, much of the hardwood and softwood roundwood is leaving the province to be processed elsewhere or is being converted into very low value-added products [. . . . H]igher-grade hardwood material is being exported to veneer mills in the US and elsewhere."
- Develop a Technical Assistance Program for existing companies and new start-ups.
- Promote the development of higher tier secondary wood products such as furniture or veneer.
- Develop a Nova Scotia Forest Certification Plan: "Two of the most important markets to Nova Scotia—Europe and the United States—will both continue to move toward value-added wood products from 'certified forests.'"[57]

Since 2003, some of these recommendations have been implemented and some have not. Thus, there has not been much progress on the first two recommendations above—creating a NSSWPI Strategy Implementation Commission and a New Advanced Woodworking Technology Centre. The Marconi Campus of the NSCC, where the current Wood Products Manufacturing Technology Program is found, has benefited from some new equipment, but the training and career recruitment vision laid out in the 2003 report has not been even remotely realized. While more forest land is being certified by the Forest Stewardship Council (FSC) in Nova Scotia, a forest certification plan in the value-added sector does not yet exist in the province.

On the positive side, a Nova Scotia Secondary Wood Products Association (NSSWPA) has been formed since 2003 and is designed to do what the Wood Products Group (WPG) does in New Brunswick. Thus, the NSSWPA's mandate includes the promotion of the value-added sector in Nova Scotia, and the Association currently runs a web site and has published some brochures dedicated to this objective.

However, the NSSWPA is not a chapter of the Atlantic-wide WPG, as recommended in the 2003 NSCC study. The WPG's mandate is "to represent, promote, and advance the interests of specialty and value-added wood-products companies in Atlantic Canada,"[58] and could, thus, provide a suitable framework and supporting structure for the new NSSWPA. One limiting factor is that the NSSWPA is currently run by volunteers and, therefore, requires an infusion of multi-year core funding in order to function as the marketing and policy research body that is envisioned.

Substantial progress has been made in developing a Technical Assistance Program, with the NSSWPA forging links with the Nova Scotia Community College (Marconi Campus), Wood Products Quality Council, and Forintek, a division of FPInnovations, a not-for-profit research organization involved in the wood products sector.

On balance, and despite progress on some of the 2003 recommendations described above, Nova Scotia still lags behind other provinces in terms of developing an integrated and dedicated value-added forest resource strategy. Currently, no formal policy with regard to the value-added sector exists in this province.[59]

13.7. Jobs per unit of biomass: how much wood fibre do we need to employ one person?

Data sources: 1981–1996 harvest volume data are from the NSDNR, 1997, Toward Sustainable Forestry: A Position Paper; 1999–2006 data are from NSDNR Registry of Buyers Annual Reports; Provincial employment data 1990–2006: original data from Statistics Canada, Labour Force Survey, provided to GPI Atlantic by Patrick Brannon, Research Analyst, Atlantic Provinces Economic Council, October 16, 2007; Employment data for Windhorse Farm provided by Jim Drescher; Employment data for Finewood Flooring and Lumber Limited provided by Candace Christiano.

Result: Jobs per unit of biomass in the forest industry in Nova Scotia have not increased since 2001.

From a GPI perspective, the mark of sustainability is the capacity to live off the interest generated by natural capital—in this case the province's forests—while retaining and protecting the value of the capital stocks for future generations. Therefore, given the need to restore the health of Nova Scotia's degraded forests, to reduce over-harvesting and clearcutting, and to integrate social, economic, and environmental objectives in use of the province's forest resource, a key indicator of genuine progress in the GPI is to increase employment per unit of biomass harvested. Unfortunately, and despite the evidence and recommendations presented the *GPI Forest Accounts*, data indicate that there has been no improvement in this area in the last six years and that the opposite may, in fact, be happening.

In Nova Scotia, over the past 45 years, there have been a number of trends that have resulted in unsustainable harvesting of the province's forests. These include:

- An increase in mechanization and automation in both harvesting and processing
- Investment in modern, state-of-the-art sawmill technology
- A decline in high-value sawlog species
- Globalized market and trading patterns

All of these together have led not only to the virtual liquidation of the province's remaining natural and old-growth forests as noted earlier, but also to a decrease in employment when measured in terms of jobs per unit of biomass harvested.

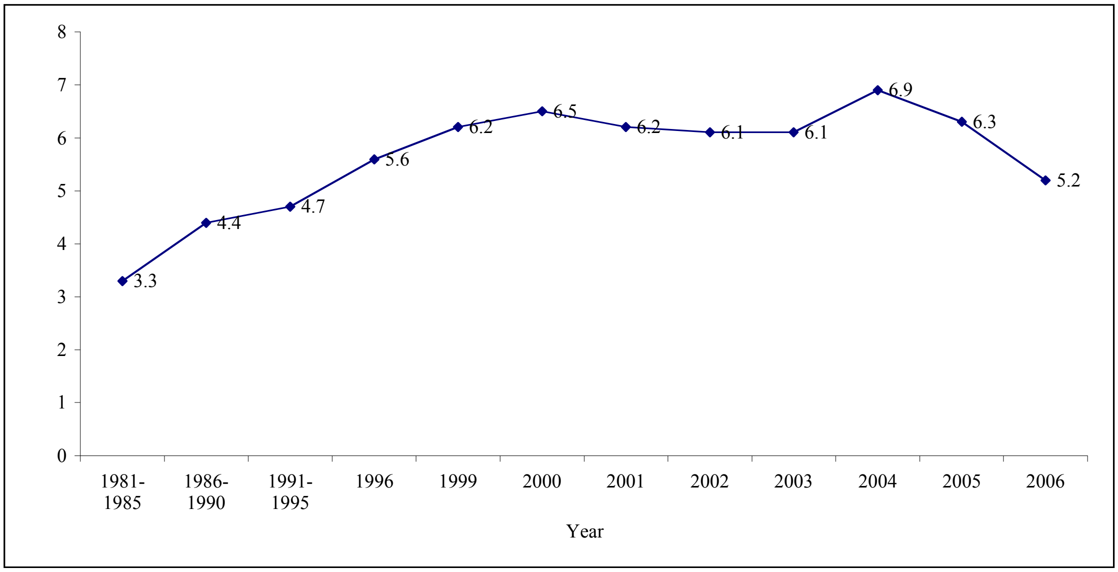
As Figure 13-12 below illustrates, over a 25-year period, the annual harvest volume of hardwood and softwood species from both public and private land has increased by nearly 60%—from an average of 3.3 million cubic metres annually in the early 1980s to 5.2 million cubic metres in 2006. Wood harvest volume peaked in 2004 at nearly 7 million cubic metres of wood—more than double the levels of the early 1980s. According to NSDNR's Registry of Buyers, the "ten month shut down at Nova Scotia's largest pulp mill, Stora Enso, precipitated a significant decrease in the amount of pulpwood harvested in 2006." In that year, 5.2 million cubic metres of wood was cut—down 17.5% from the 6.3 million cubic metres cut the year before.[60]

In 1997, as noted earlier, NSDNR published a report called *Toward Sustainable Forestry*, which at the time raised alarm bells regarding the increase in harvest volumes, particularly on private lands, where silviculture activities were declining. The report noted that "softwood harvests have exceeded the sustainable supply level" on private lands, and stated that "it seems reasonable to conclude that overharvesting is a potentially serious problem demanding immediate attention."

It is unclear whether this situation has improved in the intervening period, especially since harvest volumes continued to climb following publication of that report. Indeed—with the exception of the anomalous 2006 results attributable to the shutdown of the Stora Enso plant—harvest volumes have remained consistently higher than they were prior to that report's publication.

The 1997 NSDNR report also recommended that a Registry of Buyers report be published annually, providing data on the amount of wood being taken out of Nova Scotia's forests. This has occurred, and these annual reports have been used by GPI Atlantic both in 2001 and here to determine annual harvest volumes. However, in addition, NSDNR stated in its 1997 report that it would "regularly" publish and distribute a "state of the forest" report. Such reports would indeed be helpful in assessing whether the current levels of harvest coupled with silvicultural practices are, in fact, sustainable. To our knowledge, however, these reports have never been published.

Figure 13-12. Actual annual harvest volumes on crown and private land (cubic metres), Nova Scotia, 1981–2006



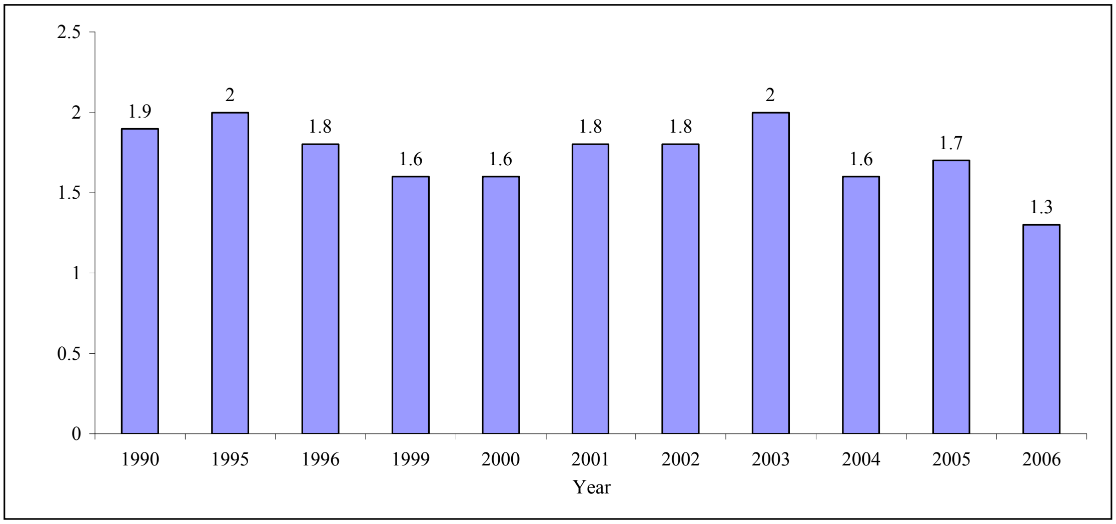
Sources: 1981-1996 data are from the NSDNR, 1997, Toward Sustainable Forestry: A Position Paper. 1999-2006 data are from NSDNR Registry of Buyers Annual Reports. The Registry of Buyers was established in 1998.

When it comes to employment in the forest industry, the question that is typically asked is: "How many people does your company employ?" Instead, from a sustainable forestry perspective, the question should be: "How much wood fibre do you need to employ one person?" In the 2001 *Nova Scotia GPI Forest Accounts*, GPI Atlantic found that companies that employed a combination of selection harvesting with value-added wood production had the highest jobs per unit of biomass ratio. By contrast, companies that relied on clearcutting and pulp and paper manufacturing produced far fewer jobs per unit of biomass harvested.

Figure 13-13 below illustrates that, since this indicator was last reported on in the 2001 GPI forest accounts, results have not improved. Though no clear trend is discernible, jobs per unit of biomass in the forest industry apparently decreased between 2001 and 2006—from 1.8 to 1.3 jobs per 1,000 cubic metres of wood harvested, peaking in 2003 at 2 per 1,000 cubic metres.

However, the apparently anomalous 2006 results are likely related to the Stora Enso Port Hawkesbury mill shutdown. According to Statistics Canada's Labour Force Survey, total direct employment in the forest industry in 2006 was 6,900. This figure includes primary, wood, and pulp and paper jobs.[61] Without the 2006 results, Figure 13-13 shows no clear trend, though it is also apparent that there has been no overall increase in jobs per unit of biomass harvested in the period under consideration.

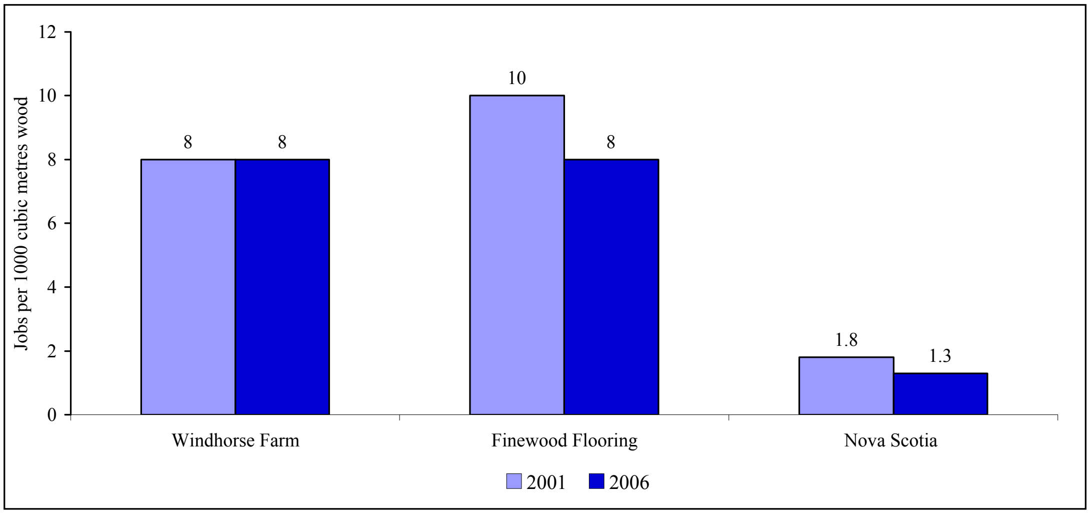
Figure 13-13. Number of full-time jobs per 1,000 cubic metres of wood harvested, Nova Scotia, 1990–2006



Source: Harvest volume data from NSDNR, 1997, Toward Sustainable Forestry: A Position Paper and NSDNR Registry of Buyers Annual Reports. Employment data from Statistics Canada's Labour Force Survey for 1990 to 2006 were provided to GPI Atlantic by Patrick Brannon, Research Analyst, Atlantic Provinces Economic Council, October 16, 2007.

In 2001, GPI Atlantic reported on six case studies, which all demonstrated and confirmed that getting the most value from every piece of wood cut can reduce harvest levels while increasing employment. Two of the case studies explored in 2001 were Windhorse Farm, a sustainably logged forest near New Germany where selection harvest methods and uneven-aged forest management have historically been used, and Finewood Flooring and Lumber Ltd., a value-added wood products business on Cape Breton Island. In 2001, Windhorse Farm directly employed eight people full-time for every 1,000 cubic metres of wood harvested, and Finewood Flooring directly employed ten per 1,000 cubic metres. In 2006, Windhorse Farm still employed eight per 1,000 cubic metres, and in 2007, Finewood Flooring employed eight per 1,000 cubic metres—down from 2001, due to more efficient processing of the products, according to the company owner.[62] These direct employment figures remain well above the 1.3 jobs per 1,000 cubic metres created by the Nova Scotia forestry industry in 2006 (see Figure 13-14 below).

Figure 13-14. Estimates of full-time jobs per 1,000 cubic metres of wood harvested, Nova Scotia, 2001 and 2006



Sources: NSDNR Registry of Buyers; Statistics Canada's Labour Force Survey (employment data provided by Patrick Brannon, Research Analyst, Atlantic Provinces Economic Council, October 16, 2007); Drescher, 2007; Christiano, 2007.

Note: Figures for Finewood Flooring are for 2007.

13.8. Recommendations

The GPI analysis demonstrates clearly that—according to a wide range of criteria and indicators of forest health—Nova Scotia's forests have been severely degraded over time, and their capacity to perform a wide range of forest functions has been seriously compromised. These functions include protection of soils, watersheds, biodiversity, habitat for species, aesthetic quality and recreational opportunities, climate regulation and sequestration of carbon from the atmosphere, and provision of the high quality, wide diameter, clear timber that characterizes older forests.

To begin to restore and protect the value of Nova Scotia's forest wealth so that it can once again provide a full range of forest functions and services, GPI Atlantic recommends:

- Creating greater incentives (tax and silvicultural) to woodlot owners for investment in forest restoration and uneven-aged management, including selection harvesting and restoration forestry methods, in order to restore the natural age distribution and species diversity of the province's forests, and to provide more sustainable jobs.
- Sharply reducing the rate of unsustainable clearcutting methods and the volume of wood harvested annually.

- Developing a value-added forest strategy in Nova Scotia with a shift from volume-based to value-added forest products, in order to produce high-value wood products, and thus to increase the number of jobs per unit of wood harvested.
- Immediately protecting all remaining old-growth forest, and older forests that have the greatest potential to return to their old-growth state over time.
- Monitoring the full range of forest values and services, and the full cost and benefits of associated harvest methods, to be counted and tracked in annual forest accounts and in ongoing forest management planning.
- Creating an adequate network of representative protected areas in Nova Scotia.
- The Nova Scotia Department of Natural Resources undertaking the task of calculating provincial age class distributions using Permanent Sample Plot (PSP) data in five-year periods from 1965-1970 to 2003-2008, when the 2008 field season is completed, and providing this information to the public. (The historical PSP data have never been made public.)
- Certifiying all Crown land in the province allocated for harvest by the Forest Stewardship Council (FSC).

Given the high rate of private ownership of forest land in Nova Scotia (69%), government policy will have to focus as much on incentives encouraging good stewardship as on policy and regulation. Incentives should include encouraging the development of small-scale wood product industries and local Nova Scotian manufacturing and value-added enterprises. This can create a win-win situation with less wood needed to provide more jobs, and with more public and private revenues remaining in local communities within the province. Thus, forest policy and practice would benefit forest-dependent communities, providing long-term sustainable employment and contributing to their overall wellbeing.

While results have been presented here in the form of six separate indicators, the evidence—and the GPI as a whole—clearly indicates the social, economic, and environmental aspects of forest health and their interrelated nature. Thus, restoring the health of Nova Scotia's severely degraded forests, including their capacity to perform a wide range of vital functions that are now seriously compromised, requires the restoration of their age diversity. That, in turn, requires a sharp expansion of protected areas and a change in forest harvest practices and policies. A shift from clearcutting to selection harvest methods, and from over-reliance on pulp and paper production to greater value-added production, can increase jobs and value per unit of biomass harvested, and will reduce current rates of over-harvesting and improve the viability and resilience of the forestry industry for the long term.

Note to Reader: Please see Section 23.1 for additional references.

14. Fisheries and Marine Resources

For the original GPI Atlantic report on fisheries, please see the following:

The Nova Scotia GPI Fisheries and Marine Environment Accounts (2002)
http://gpiatlantic.org/pdf/fisheries/fisheries.pdf

Headline Indicators

1. Fish in the sea: measuring the quantity and value of fish stocks
2. Fish size: a measure of health and quality of individual fish
3. Mean trophic level of harvested species
4. Number of marine species at risk
5. Shellfish closures: a measure of marine environmental quality
6. Employment: a measure of socioeconomic wellbeing of fishers and fishing communities
7. Fishery GDP: a conventional economic measure
8. Age structure of fishers: a measure of fishery community resilience
9. Institutional expenditures: resources to effectively manage fisheries and the marine environment

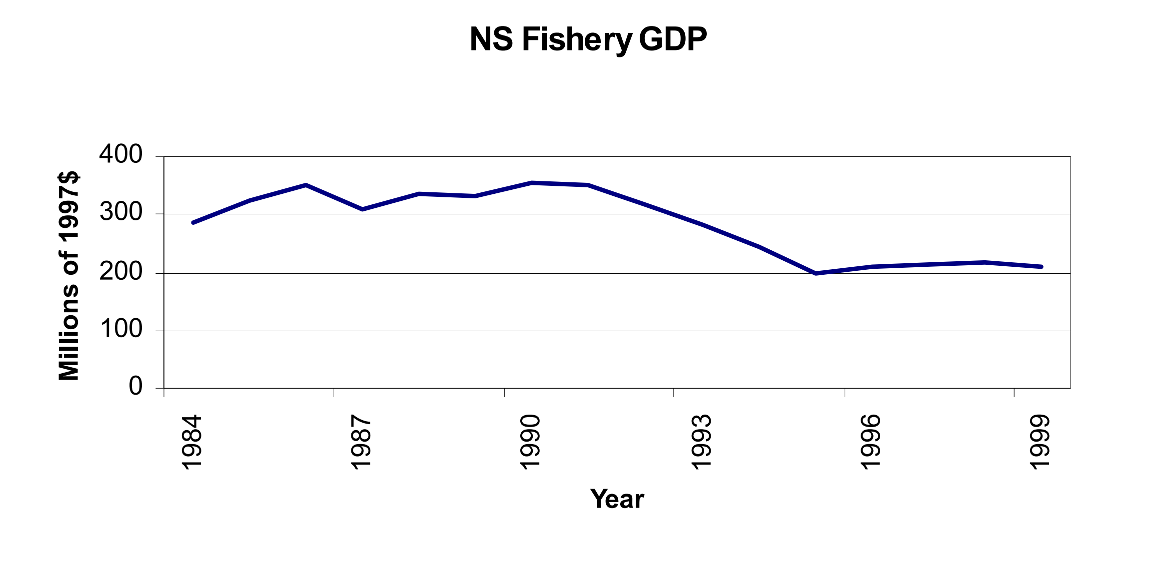
Note to Reader: Please see Section 23.2 for additional references.

14.1. Introduction: why we need new indicators for fisheries and the marine environment

In the late 1980s, Nova Scotia's fishery for cod and other groundfish seemed to be booming. The media reported steady catches, high exports, and strong contributions of the fishery to the province's GDP—the conventional measuring stick of the economy. Figure 14-1 shows that, between 1984 and 1991, the fishery GDP appeared strong and relatively stable, at values between $285 and $356 million (in 1997 dollars).[1]

However, unbeknown to anyone, fish stocks were dropping, and by 1992-1993, many fisheries were collapsing, and the fabric of coastal communities began to unravel. The fishery GDP, which had stayed at high levels right up to the time of the collapse, dropped to around $200 million by 1995 (in 1997 dollars). Our conventional economic measuring sticks, notably the fishery GDP, but also other measures such as catches and exports, did not warn of the impending disaster. These measures counted only what we took out of the sea but gave no value to what we left behind. While catches were kept high, the decline of the groundfish stocks remained hidden from public view as we focused excessively on a narrow set of economic measures that failed to incorporate all that we value in the fishery—notably healthy fish stocks, a healthy ecosystem, strong fishing communities, and a sustainable fishing economy.

Figure 14-1. Fishery GDP ($1997 millions), Nova Scotia, 1984–1999



Source: Nova ScotiaDepartment of Finance (2001).

Note: This graph appears in Charles et al. (2002) and is shown here only to illustrate Nova Scotia's fishery GDP up to the fishery collapse. More recent trends in Nova Scotia's fishery GDP are shown in Figure 14-16 below.

Another example of failing to measure what we value may be found in the marine oil spills that have occurred in the ocean ecosystems of Nova Scotia and beyond. Every such oil spill is good news for the economy (if we use conventional measures), because cleaning up the mess causes money to be spent, producing an overall positive effect on economic indicators such as GDP. Yet, as with the collapse of fish stocks, we know that oil spills really represent a decline in wellbeing and sustainability, not an increase in prosperity as our conventional measures imply.

If healthy fisheries and protection of the marine environment are important to us, we clearly need a set of measures that better reflect the reality of what we value and that assess the wellbeing of the fishery and the marine environment more accurately. Unlike the confusing signals sent by our economic growth statistics, genuine indicators of fisheries and marine environment health would move in a positive direction to reflect positive outcomes, and decline in response to declining fish stocks, oil spills, and other liabilities. Such declining indicators would also send early warning signals to policy makers that could trigger timely remedial action, thus potentially avoiding disasters like the collapse of the groundfish stocks.

Such genuine indicators of fishery and marine environmental health would enable us to track over time the state of Nova Scotia's fish stocks, the fishery's contribution to our economy, the quality of the marine environment, the wellbeing of the communities that depend on the ocean for their livelihood, and the effectiveness of the institutions that govern fishing activities and ocean use. In other words, an appropriate set of indicators will allow us to assess more comprehensively the entire fishery and marine "system" (Garcia and Charles 2008).

Developing such a comprehensive, accurate and meaningful overall assessment of the state of the fishery and the marine environment is a crucial challenge for society. This is particularly so for a region like Atlantic Canada, given the area's historical dependence on the ocean, and given the region's recent hard experience. Perhaps more directly than in other parts of the country, Atlantic Canada has learned the hard way—through the 40,000 jobs that were lost when the groundfish stocks collapsed in 1992—that the conventional "jobs versus environment" debate is a myth, and that when our natural resource health declines, we lose jobs. We urgently need measures that properly account for the value of our natural, human, and social capital (and that monitor their depreciation), just as we presently account for produced capital.

The *Nova Scotia GPI Fisheries and Marine Environment Accounts* have been developed as a response to this challenge. The GPI accounts and their corresponding indicators can and should be monitored and applied on a regular basis to evaluate the wellbeing and sustainability of fisheries and the marine environment. Indeed, each indicator in the accounts is selected to measure one of the fundamental components of wellbeing and sustainability that must all be simultaneously achieved in a process of sustainable development (Charles 2001). Together, the indicators cover crucial aspects of the marine system, including ecosystem health, socioeconomic progress, the wellbeing of coastal communities, and the institutional integrity of fishery and ocean management. Together, the indicators demonstrate clearly that these environmental, economic, social, and institutional dimensions of sustainability and wellbeing are inextricably linked.

This chapter, therefore, presents a set of key indicators that highlight crucial aspects of the GPI fisheries and marine environment accounts, and that include ecological, socioeconomic, community, and institutional indicators. The majority of the indicators presented here appeared in the original *GPI Fisheries and Marine Environment Accounts* report (2002) but have been updated to illustrate recent trends. This report also includes newly developed indicators designed to measure additional aspects of fisheries and the marine environment.

Although the indicators in this report represent the most salient and current set of measures developed to date, it should be noted that a full and more comprehensive suite of indicators is actually required to measure all of the multiple dimensions that contribute to sustainable use of marine resources, healthy ecosystems, and resilient coastal communities. A range of additional indicators in the *GPI Fisheries and Marine Environment Accounts* can be found in the original report.[2]

14.2. Fish in the sea: measuring the quantity and value of fish stocks

Data sources: DFO. 2008a. Canada Provincial Quantities, Commercial Landings, Seafisheries. DFO Statistical Services, Department of Fisheries and Oceans; DFO. 2008b. Canada Provincial Values, Commercial Landings, Seafisheries. DFO Statistical Services, Department of Fisheries and Oceans; Fanning, L.P., Mohn, R.K., and W.J. MacEachern. 2003. *Assessment of 4VsW cod to 2002.* Canadian Science Advisory Secretariat Research Document 2003/027. Table 13; Mohn, R., Lambert, T.C., Wilson, S., and G.A.P. Black. 1998. *Assessment of Status of 4Vn Cod (May–Oct.): 1997*. Canadian Stock Assessment Secretariat Research Document 98/09. Table 7; Mohn, R.K., and J.E. Simon. 2002. *Biological information relevant to the management of 4TVW haddock.* Canadian Science Advisory Secretariat Research Document 2002/102. Table 5; Stone, H., Perley, P., and D. Clark. 2006. *2006 Assessment of Pollock in 4VWX and 5Zc.* Canadian Science Advisory Secretariat Research Document 2006/088. Table 15.

Result: Using groundfish in the Eastern Scotian Shelf region as an indicator, fish abundance has decreased substantially since the 1980s. The cod biomass shows no sign of recovery, while the haddock and pollock stocks show limited recovery. The value of the groundfish stocks in the Eastern Scotian Shelf region has decreased since the late 1980s, signifying a depreciation of natural capital. Despite modest increases in the value of the haddock and pollock stocks, the value of all groundfish stocks in the region remains low compared to the historically high levels of the mid- to late 1980s.

Lobster landings have increased nearly five-fold since the 1970s. This leads to a perception that lobster stocks are healthy, but increased levels of fishing effort on lobster may have contributed considerably to the increased catches since 2001.

The benefits of fisheries have traditionally been accounted for using measures of catches, landed value, and exports. Yet, we have seen in Nova Scotia that a high landed value can be accompanied by, and indeed can be an indicator of, declining fish stocks. Monetary indicators can appear positive even while the harvests are not sustainable. Positive signals based only on fishery *output* can give a highly misleading sense of security and optimism if they are misused as indicators of progress and sustainability. Therefore, to fully account for the benefits of a given harvest, these measures must be accompanied by a measure of the change to the fish stocks *remaining in the ocean* after the fishery has taken place. Here, we examine these changes from both biological and "ecological economics" perspectives. The former is addressed through biomass trends in commercial fish stocks, while the latter is examined by translating biomass into monetary values, for comparison with traditional economic measures.

This approach and understanding reflects the concept of *natural capital*—the natural assets that include not only the fish in the sea, but also the quality of the water, the ocean bottom habitat, and other elements of the marine environment. Some of the benefits that natural capital provides, such as the fish available for harvesting, are obvious, while other benefits, such as the habitat provided for non-target species, may not be directly apparent to humans. Given the interdependence of all components of the marine ecosystem, however, it is prudent to recognize the indirect benefits as well. All of these marine assets clearly have significant and real value—they keep the fishery functioning, among other roles, and it is important to monitor how they change over time if we are to assess accurately the actual economic health of the fishing industry.

By valuing both the quantity and quality of a natural resource stock, the GPI accounts can provide a more accurate and comprehensive measure of fishery strength and health than a current income accounting system that mistakenly counts the depletion of the resource as economic gain. The GPI natural capital accounts in effect introduce a balance sheet of resource health into the accounting system, in a manner analogous to that used by all businesses to assess depreciation in capital value and to signal the need for re-investment.

Although, for this analysis, natural capital has been expressed in monetary terms, it must be acknowledged that there is no general agreement on how to measure these assets accurately. Indeed, some natural assets are truly "invaluable" and irreplaceable, thus, not conducive to quantitative valuation.[3] Nevertheless, the policy arena is so dominated by budgetary considerations that valuation—particularly in monetary terms—is an important strategic tool to ensure that attention is paid to the sustainability of our natural wealth as economic policies are being shaped, and in particular, to ensure that changes in natural capital are not ignored, as has happened in the past.

The task of assessing the value of natural capital within specific fish stocks is difficult because there is no universally accepted methodology for quantifying the value of fish stocks in the ocean. In particular, while determining the total value of natural assets in the sea should take into account how an adult fish living today will (through reproduction) contribute to fish stocks in the future, measuring this future contribution is difficult due to uncertainties about the dynamics of reproduction. For this reason, a major simplification is made here: we measure the monetary value of natural capital in a given year simply as a product of the estimated fish biomass and the price of fish (in constant dollars).

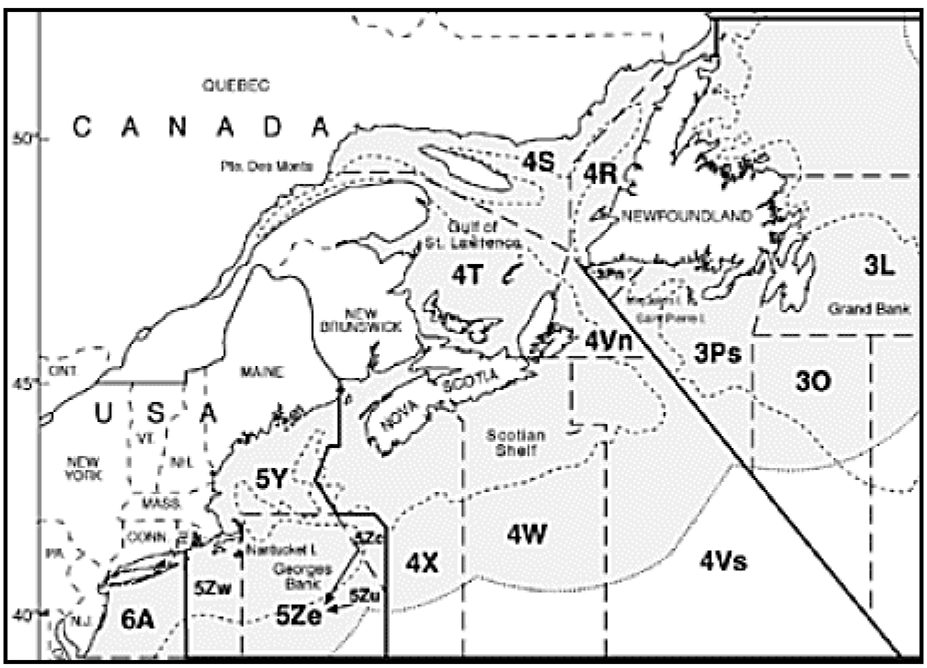
Thus, the proxy for natural capital used here is the current market value of fish in the sea—the total revenue that could theoretically be obtained if every fish were caught and sold that year. On the one hand, this over-estimates the market value of those fish to society, since the *costs* of catching the fish are not deducted. On the other hand, as noted above, this method of calculation also tends to seriously under-estimate natural capital in that it does not account for a fish stock's contribution to ecosystem services, or its ability to reproduce and thus produce an ongoing flow of benefits over time beyond its own immediate value.

If market prices do not change, and if fish biomass is maintained from one year to the next, a similar level of natural capital (as measured here) can be expected each year. On the other hand, natural capital will decline if either the price or the biomass decreases. In general, therefore, natural capital will vary over time in response to both variations in biomass and fish price, each of which is influenced by many factors. For example, biomass is affected by physical and chemical factors in the marine environment, by natural predation, and by fishery harvesting. Market value can be influenced by factors such as the condition and size of the fish, local and export market demands, and scarcity.

Here, we examine the stocks of two groups of commercially valuable species that inhabit the waters around Nova Scotia. The first group consists of bottom-dwelling (benthic) fish known as "groundfish"—specifically cod, haddock, and pollock. The second species examined is lobster, a highly valuable benthic shellfish.

Before the value of the fish remaining in the ocean can be measured, we first must know their abundance. Research vessels trawl Nova Scotia's waters every year to estimate abundances of commercially important fish species. Estimates are made according to distinct population groups called fish stocks. The federal Department of Fisheries and Oceans (DFO) annually publishes biomass estimates for many marine species in the waters surrounding Nova Scotia. Fish stocks in Nova Scotia are defined using the fishing zones designated by the Northwest Atlantic Fisheries Organization (NAFO) (Figure 14-2 below).

Figure 14-2. Partial map of Atlantic Canada, focused on Nova Scotia, showing fishing zones based on Northwest Atlantic Fisheries Organization (NAFO) statistical areas



Note: Throughout this report, indicators refer to the fishing zones shown on this map. For example, the notation 4VsW refers to fishing zones 4Vs and 4W on this map.

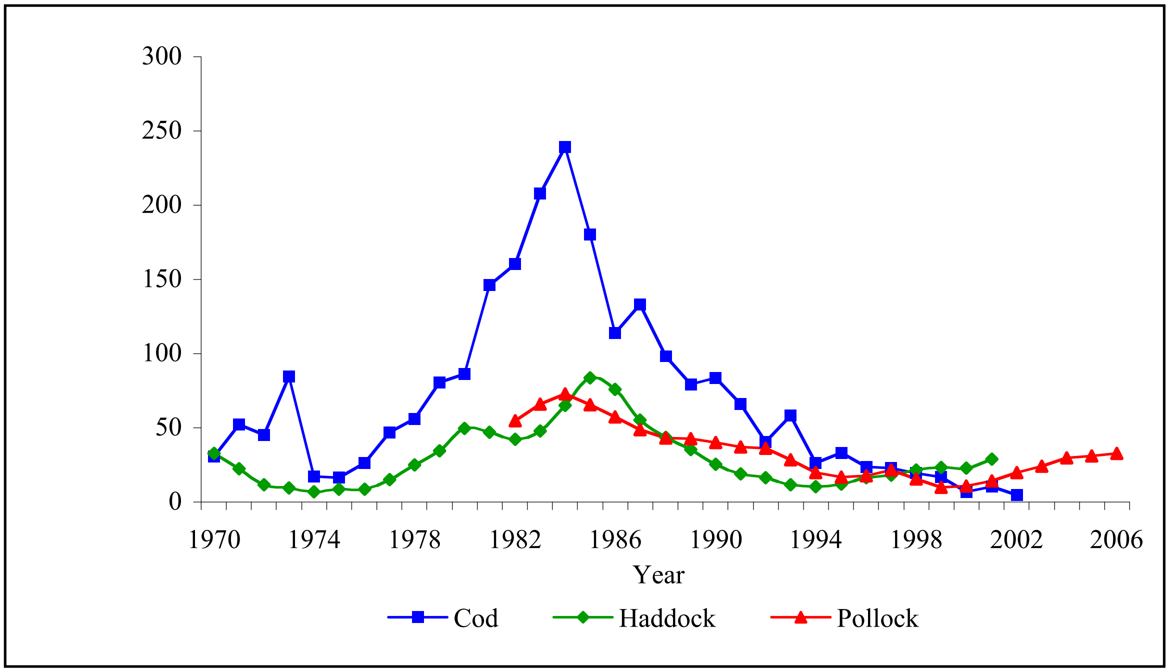
It must be noted that, while the accuracy of biomass estimates has presumably improved over time, reflecting advances in the study of marine ecology, in technological tools, and in sampling and estimation techniques, there remain many sources of uncertainty in the biomass estimates.[4] These arise due both to technical problems in the estimation process, and to variability in the biomass levels themselves, which, in turn, are affected by environmental factors such as food availability, water temperature, and the integrity of the bottom habitat used for spawning; by toxicological impacts on eggs, developing embryos, and juveniles; and by predation pressure, including impacts of fishing by humans.

14.2.1. Groundfish

Figure 14-3 illustrates the declines in biomass (age 3+) for the selected groundfish species—cod, haddock and pollock—in the Eastern Scotian Shelf region since the mid-1980s. This region was chosen as a good example to illustrate groundfish biomass trends, but it must be noted that such trends vary across Atlantic Canada.

For groundfish on the Eastern Scotian Shelf, it is notable that the early 1970s was a time of very low stocks, reflecting the overfishing that took place prior to the 200-mile limit coming into effect with the Law of the Sea Convention. With what was thought to be better control over the fishery, combined with a lucky increase in recruitment of fish to the population, the biomass of the cod stock recovered rapidly into the mid-1980s. But all was not well with the cod stock, and the most recent collapse began in 1985, continuing into the 21st century. So far, the cod stock shows no signs of recovery.[5]

Figure 14-3. Biomass (age 3+) of cod, haddock, and pollock (000s of metric tonnes), Eastern Scotian Shelf, 1970–2006



Data table for Figure 14-3

Year	4VW Cod	4TVW Haddock	4VWX5Zc Pollock (Western)	Year	4VW Cod	4TVW Haddock	4VWX5Zc Pollock (Western)
1970	30.390	32.663	n/a	1989	79.235	35.315	42.674
1971	52.075	22.441	n/a	1990	83.553	25.318	40.229
1972	45.206	11.538	n/a	1991	66.120	19.066	37.157
1973	84.362	9.388	n/a	1992	40.594	16.552	36.307
1974	17.275	7.045	n/a	1993	58.200	11.785	28.618
1975	16.415	8.440	n/a	1994	26.085	10.190	19.813
1976	26.499	8.601	n/a	1995	33.199	12.098	16.887
1977	47.048	15.022	n/a	1996	23.842	16.333	17.730
1978	56.149	25.207	n/a	1997	22.666	17.997	21.533
1979	80.751	34.494	n/a	1998	19.219	21.389	15.337
1980	86.318	49.553	n/a	1999	16.622	23.270	9.750
1981	146.029	46.904	n/a	2000	6.702	22.782	10.930
1982	160.423	42.293	54.759	2001	10.222	28.919	14.022
1983	207.704	47.687	66.103	2002	4.722	n/a	19.744
1984	239.111	65.228	72.634	2003	n/a	n/a	24.307
1985	180.143	83.536	65.693	2004	n/a	n/a	29.719
1986	113.776	75.727	57.463	2005	n/a	n/a	31.041
1987	133.257	55.101	48.555	2006	n/a	n/a	32.828
1988	98.445	43.551	42.894				

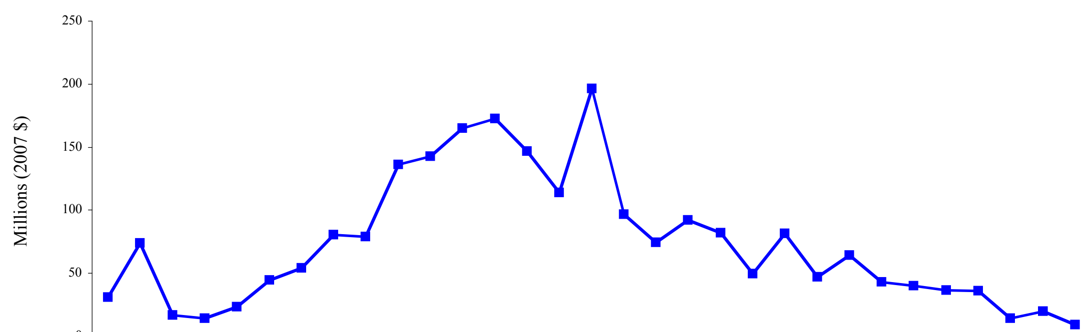
Sources: Fanning et al. (2003); Mohn et al. (1998); Mohn and Simon (2002); Stone et al. (2006)

Note: This includes NAFO statistical areas 4V and 4W. However, data for the Cape Breton portion of this stock (4Vn) are included for years 1981-1997 only.

The corresponding monetary value of natural capital embodied in the Eastern Scotian Shelf cod stock is estimated in Figure 14-4 below by multiplying (in each year) these biomass estimates by the price of cod (adjusted for inflation). The latter remained essentially constant through the 1970s until around 1985, rose to a peak in 1987, then dropped temporarily before resuming a steady increase to reach its highest recorded level in 1999. Cod prices in the late 1990s were more than twice as high as those in the early 1980s, and have remained at these high levels (around $2,000 per metric tonne) throughout the last decade (see appendix in Section 14-12 below).

The value of natural capital for cod in the Eastern Scotian Shelf region off Nova Scotia (Figure 14-4 below) increased through the 1980s to a peak of $200 million ($2007)[6] in 1987, but then exhibited a steady decline in value from 1987 to 2002, as the collapse of the cod stock led to historically low levels of natural capital in 2002 (the most recent year in our data). By 2002, virtually the entire $200 million value that had been present in the Eastern Scotian Shelf cod stock had been wiped out—what was left amounted to only an estimated $9 million in 2002. Perhaps the most dramatic aspect of this trend is that the decline in natural capital in cod, to the lowest on record, occurred *despite* a considerable price increase.

Figure 14-4. Value of cod stocks ($2007 millions), Eastern Scotian Shelf, 1972–2002



	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Series1	31.0	73.6	16.9	14.0	23.2	44.5	54.1	80.5	79.0	136.4	142.6	165.0	172.7	146.8	113.6	196.6	96.7	74.4	91.9	82.0	49.8	81.6	47.0	64.1	42.9	40.2	36.6	36.0	14.0	19.5	9.1

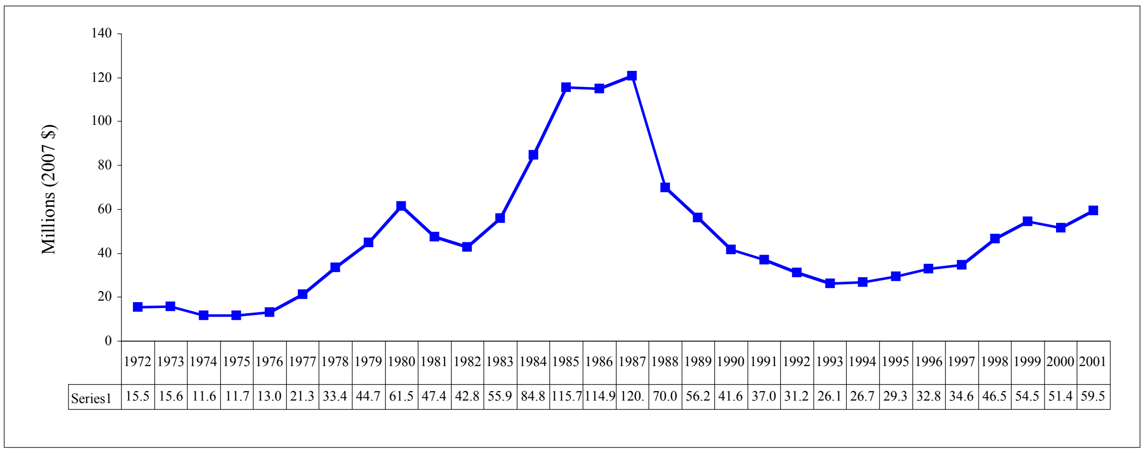
Sources: DFO (2008a); DFO (2008b); Fanning et al. (2003); Mohn et al. (1998).

For haddock, the biomass generally followed a similar path to that of cod—with a decline in the early 1970s, a recovery to a peak in 1985, and another decline to low levels by the mid-1990s (see above for an explanation of this). Thereafter, the haddock stock has followed a different path from that of cod, with a slight increase into the early 2000s (Figure 14-3 above), up to the end of our available data series.

Over the period during which the biomass of haddock decreased, prices increased fairly steadily from a low point in 1982 to considerably higher levels in the mid-1990s (see appendix in Section 14-12). Since 1999, haddock prices have decreased steadily to the lowest levels (in 2004/2005) in two decades.

The haddock stock of the Eastern Scotian Shelf appreciated sharply in value from the late 1970s to an estimated value of $120 million in 1987. As haddock biomass dropped after 1985, steadily increasing haddock prices partially and temporarily compensated for this, keeping the natural capital measure high. However, the value of haddock natural capital fell dramatically in the late 1980s and early 1990s, losing 78% of its value by 1994, before beginning a slow recovery in the mid- to late 1990s. Despite continuing price increases for haddock between 1989 and 1999, however, the value of this natural capital did not recover to the high levels of the mid-1980s, and in 2001 (the most recently available data), it remained at half the level (about $60 million) of the 1987 peak year (Figure 14-5 below).

Figure 14-5. Value of haddock stocks ($2007 millions), Eastern Scotian Shelf, 1972–2001



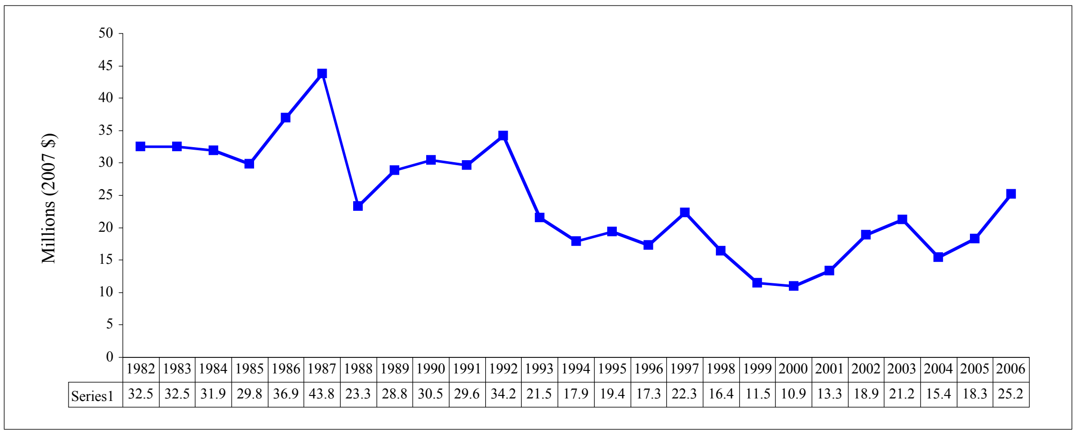
	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Series1	15.5	15.6	11.6	11.7	13.0	21.3	33.4	44.7	61.5	47.4	42.8	55.9	84.8	115.7	114.9	120.	70.0	56.2	41.6	37.0	31.2	26.1	26.7	29.3	32.8	34.6	46.5	54.5	51.4	59.5

Sources: DFO (2008a); DFO (2008b); Mohn and Simon (2002).

Turning to pollock, the biomass of the Eastern Scotian Shelf stock, like those of cod and haddock (see above), was heavily depleted prior to the mid-1970s and the 200-mile limit coming into place. From then through the mid-1980s, there was an increasing biomass, followed by a long and fairly steady decline until 1999, after which the stock experienced a modest increase (Figure 14-3 above). As the biomass of pollock decreased between the mid-1980s and 1999, the price steadily increased (see appendix in Section 14-12), peaking in 1999 just as the biomass reached its lowest recorded level. The price of pollock then dropped sharply between 1999 and 2004 (by more than half, or over $600 per metric tonne), coinciding with some recovery in the fish stock. Since 2004, the price of pollock has increased to about $800 per metric tonne, or about two-thirds the peak 1999 value.

Figure 14-6 shows the estimated natural capital value of the Eastern Scotian Shelf pollock stock—which again is the product of both biomass and price levels. Overall, there is a remarkable long-term depreciation in the value of the pollock stock between 1987 and 2000—coinciding with the declining stock biomass, though with increasing prices over the same period helping to counter and ameliorate the effects of decreasing stock biomass on the stock's overall value. The increased stock biomass since 2000, in tandem with the increased price of pollock since 2004, has resulted in recent increases in the value of this stock. Thus, the stock value plummeted from an estimated peak value of $44 million in 1987 to a 2000 low point of $11 million, before partially recovering to $25 million in 2006—reflecting a loss of $19 million in value compared to the 1987 peak.

Figure 14-6. Value of pollock stocks ($2007 millions), Eastern Scotian Shelf, 1982–2006



Sources: DFO (2008a); DFO (2008b); Stone et al. (2006).

While many groundfish stocks around Nova Scotia have declined since the mid-1980s, many other species, especially shellfish, have not. Shrimp, for example, appear to have increased in biomass since 1995.[7] As well, if the steady increase in lobster landings is any indication, as seen in Figure 14-7 below, lobster biomass from Nova Scotia appears to have increased remarkably since 1980, with 2006 landings four to five times the levels of the 1970s. However, this apparent conclusion is subject to some serious caveats, as indicated below.

14.2.2. Lobster

In contrast to groundfish, for which there are fairly regularly monitored and maintained estimates of stock abundance, regular biomass estimates for lobster have not been available. This means, as well, that time series of natural capital values cannot be found for lobster stocks around Nova Scotia, since these require quantitative biomass estimates.

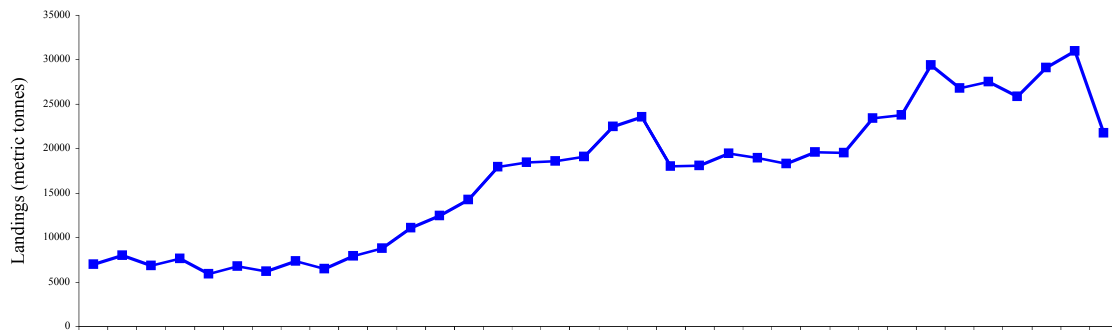
Lobster catch levels are available, but we must recognize that, in many fisheries, the use of catch data as an ecological indicator, or as an indicator of the health of a fish stock, can be dangerous. Catch levels can send highly misleading signals about biomass because many variables other than biomass, including fishing effort and technology, can affect landings. Indeed, there are many examples of fisheries around the world in which high catch levels were mistakenly interpreted as implying strong stocks, when in reality they merely meant that powerful fleets with sophisticated mechanized fishing gear could seek out and catch fish even as stocks declined.

Despite these limitations, lobster fisheries, unlike many others in Canada, are managed by keeping the amount of fishing effort fixed. This implies that catches should—theoretically at least—reflect the abundance of lobster in the sea; in other words, catch levels may provide a rough indicator of lobster biomass. However, there is evidence that over time, even if the number of fishers and lobster traps remains the same, the intensity of fishing and technology can rise, thereby leading to increased landings. Therefore, while the use of catch data in the lobster fishery may better reflect abundance than it would in, say, the groundfish fishery, even here, catch data must be carefully interpreted.

Figure 14-7 below is a time series of lobster landings in Nova Scotia extending back to 1972. Five time periods are apparent from the figure:

- Prior to the 1980s, catch levels in Nova Scotia remained stable at between 6,000 and 8,000 metric tonnes a year. Since there was no apparent change in the effort devoted to lobster fishing during the 1970s, this seems to support an interpretation of stable stocks in a relatively sustainable fishery.
- From the early through mid-1980s, there was a period of rapid increase in catch levels, perhaps due to some combination of higher biomass (due perhaps to environmental conditions or predator–prey changes) and/or increased fishing activity.
- Between the late 1980s and late 1990s, there was little variation in Nova Scotia's lobster landings, which again suggests that lobster stocks were relatively stable (although the total catch landings are aggregated over a number of lobster stocks, thus hiding some variations among them).
- Catch levels increased again beginning in 2001 before reaching a record high of more than 20,000 metric tonnes in 2006 at four to five times the levels of the 1970s. This increase might suggest a high stock biomass. However, the latest stock status reports explicitly note that changes in fishing effort have not been accounted for and could be a possible explanation for the increased catch levels.[8]
- Most recently, in 2007, lobster landings in Nova Scotia suddenly dropped to 70% of the 2006 record level, returning to the lower levels of the 1990s. It is too early to determine the cause of this sharp decrease—in particular, what it says about the sustainability of the high catch levels of the previous few years. The concern, of course, is that lobster stocks could be in potentially serious trouble—possibly for the first time in recorded history.

Figure 14-7. Lobster landings (metric tonnes), Nova Scotia, 1972–2007



	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Series1	6951	7983	6834	7647	5909	6759	6161	7366	6484	7897	8804	11066	12427	14236	17958	18425	18597	19089

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Series1	22467	23569	18034	18041	19420	18952	18261	19593	19527	23389	23736	29406	26820	27506	25857	29127	30952	21767

Source: DFO (2008a).

14.3. Fish size: a measure of health and quality of individual fish

Data sources: Clark, D.S. and P. Perley. 2006. *Assessment of Cod in Division 4X in 2006.* Canadian Science Advisory Secretariat Research Document 2006/087. Table 9; Fanning, L.P., Mohn, R.K., and W.J. MacEachern. 2003. *Assessment of 4VsW cod to 2002.* Canadian Science Advisory Secretariat Research Document 2003/027. Table 5; Gavaris, S., O'Brien, L., Clark, K., and B. Hatt. 2007. *Assessment of Eastern Georges Bank Atlantic Cod for 2007.* Transboundary Resource Assessment Committee Research Document 2007/04. Table 5; Power, M.J., Clark, K.J., Fife, F.J., Knox, D., Melvin, G.D., Stephenson, R.L., and L.M. Annis. 2006. *2006 Evaluation of 4VWX Herring.* Canadian Science Advisory Secretariat Research Document 2006/49. Table 20; Stone, H., Perley, P., and D. Clark. 2006. *2006 Assessment of Pollock in 4VWX and 5Zc.* Canadian Science Advisory Secretariat Research Document 2006/088. Table 8; Swain, D.P., Currie, L.G., Chouinard, G.A., Poirier, G.A., Savoie, L., Hurlbut, T., and D. Daigle. 2007. *Assessment of the southern Gulf of St. Lawrence cod stock, March 2007.* Canadian Science Advisory Secretariat Research Document 2007/033. Table 9.

Result: The size at age of some finfish stocks around Nova Scotia have remained relatively stable over time, while other stocks show either increasing or decreasing trends over the past 10 to 15 years.

While scientists have traditionally focused on the total biomass of fish stocks, it is also important to monitor another fundamental indicator of the health of the stock—the wellbeing of individual fish. Two key measures of this are 1) size at age—the average length or weight of a fish of a given age, and 2) condition factor—which essentially tells us whether the fish are growing well—for example whether they are "skinny" or "plump." Even if the biomass remains at a reasonable level, a declining trend in size at age or in the condition factor may indicate stress on the fish population or genetic changes in the population due to selective harvesting.[9] Such adverse trends, in turn, may warn of potential problems with fishery sustainability.

The health of individual fish may also reflect the overall health of the marine environment, since fish size and condition may be influenced by factors such as pollutants and water temperature.[10] Furthermore, these indicators have economic implications because smaller fish fetch lower prices on the market and can require more fishing effort per tonne of fish. Finally, these indicators also reflect the general GPI accounting principle that natural capital, like produced capital, may depreciate in value due to both quantitative depletion (e.g., fewer fish or trees) and qualitative degradation (the quality of a fish population or a forest). While declining fish stock biomass indicates the former, as seen in the previous section, assessments of fish size and condition point to qualitative factors that also influence natural capital value.

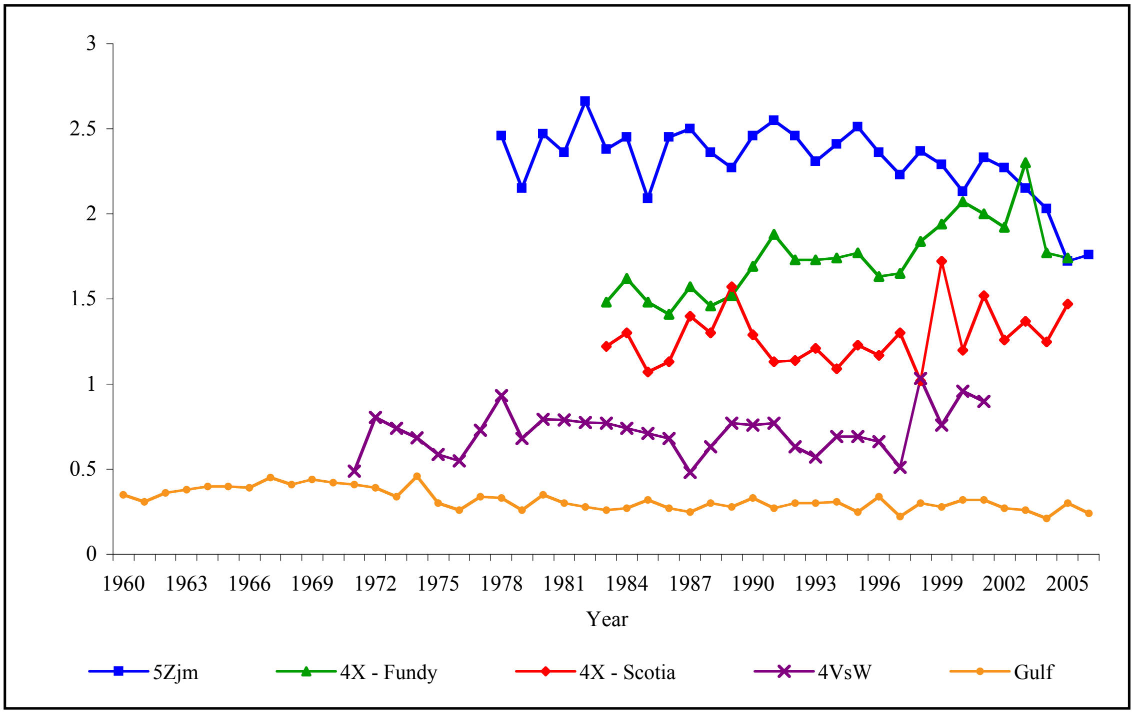
Figure 14-8 below provides time series for the weight of three-year-old cod in various stocks around Nova Scotia. It is clear that geographical location affects the size of a fish at a particular age and for a particular species—in this case cod. Not surprisingly, cod in the warmer southern waters off Nova Scotia (areas 5Z and 4X), including the George's Bank area, are larger at age 3 than cod living in the colder waters on the Eastern Scotian Shelf (4VsW) and in the Gulf of St. Lawrence (off northern Cape Breton and in Nova Scotia's northern waters—area 4TVn). Figure 14-8 also indicates changes over time in average size at age for each of the cod stocks assessed. Fishing zones are as indicated in Figure 14-2 above.

The average size at age of cod stocks in the Gulf of St. Lawrence has decreased slightly since the 1960s, while that of cod in the neighbouring Eastern Scotian Shelf area (4VsW) has fluctuated up and down over time with no clear trend. Overall, size at age in the Eastern Scotian Shelf waters remained relatively stable between the early 1970s and the late 1990s, but between 1998 and 2001, it began to increase rapidly. (Note that recent estimates of the size at age for the 4VsW cod stock may be unreliable because the fishery moratorium implemented in that area in 1993 has made estimation difficult and the type of gear used to catch the cod has also changed.[11])

The average size at age of cod stocks in the eastern portion of Georges Bank has been declining rapidly since 1995 and reached a record low in 2005/2006. Although the reason for the decline is unclear, this size decline is believed to be hampering recovery of this stock.[12] Cod stocks in the nearby Southwest Nova Scotia (4X) area have shown an increase in their average size at age, although in the Bay of Fundy, size at age increased rapidly in the late 1990s and then declined sharply after peaking in 2003.

These changes, and the different trends in the various cod stocks, are not well understood. It is possible that the recent changes in the size at age for these different cod stocks may be an indication of larger changes occurring in marine ecosystems and the marine environment.

Figure 14-8. Size trends across cod populations (kilograms), waters around Nova Scotia, 1960–2006

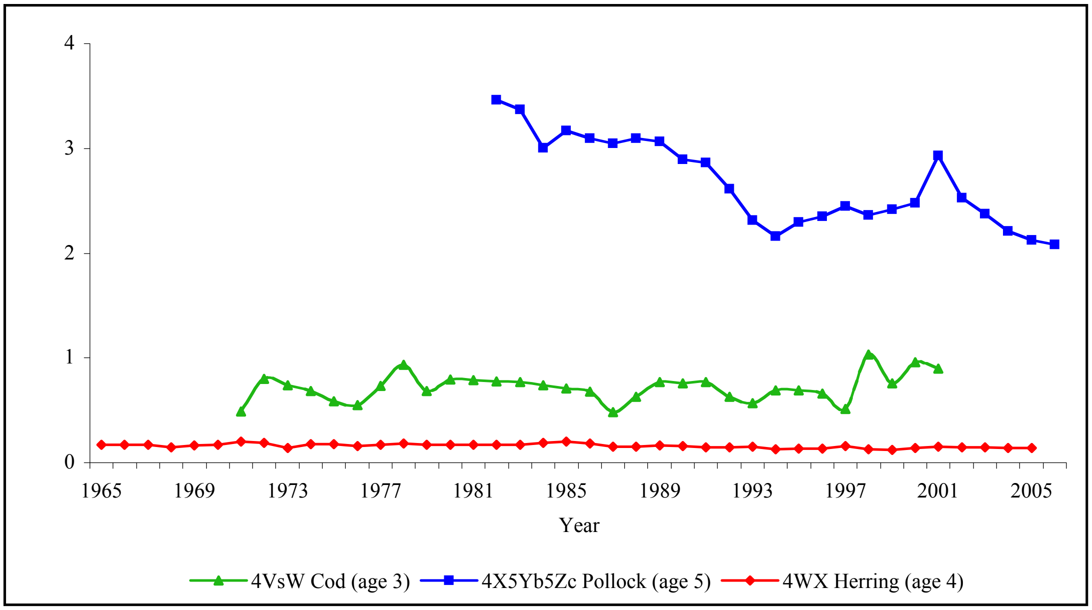


Sources: Clark and Perley (2006); Fanning et al. (2003); Gavaris et al. (2007); Swain et al. (2007).

Note: See appendix in Section 14-12 for the data table.

Figure 14-9 below considers the "size at age" indicator from a different perspective, exploring how size at age trends vary across species. Different species living in a similar region differ both in overall size at age and in trends over time. While there has been no overall trend in size at age for herring or cod since the early 1970s (despite some fluctuations up and down), the average size of pollock decreased considerably between the early 1980s and the mid-2000s—with a weight decline at age 5 of about 40% during this 20-year period. This suggests a significant change, and one that may indicate a potential decline in the value of that stock.

Figure 14-9. Fish size trends for cod, pollock, and herring (kilograms), waters around Nova Scotia, 1965–2006



Data table for Figure 14-9

Year	4VsW Cod (age 3)	4X5Yb5Zc Pollock (age 5)	4WX Herring (age 4)	Year	4VsW Cod (age 3)	4X5Yb5Zc Pollock (age 5)	4WX Herring (age 4)
1965	n/a	n/a	0.172	1986	0.680	3.095	0.182
1966	n/a	n/a	0.172	1987	0.480	3.046	0.153
1967	n/a	n/a	0.172	1988	0.630	3.096	0.154
1968	n/a	n/a	0.148	1989	0.770	3.068	0.162
1969	n/a	n/a	0.162	1990	0.760	2.894	0.161
1970	n/a	n/a	0.169	1991	0.770	2.866	0.147
1971	0.488	n/a	0.199	1992	0.630	2.615	0.148
1972	0.803	n/a	0.192	1993	0.570	2.312	0.153
1973	0.740	n/a	0.143	1994	0.690	2.163	0.131
1974	0.684	n/a	0.175	1995	0.690	2.296	0.136
1975	0.585	n/a	0.179	1996	0.662	2.353	0.137
1976	0.549	n/a	0.159	1997	0.512	2.446	0.161
1977	0.730	n/a	0.174	1998	1.032	2.361	0.131
1978	0.932	n/a	0.181	1999	0.759	2.419	0.120
1979	0.681	n/a	0.172	2000	0.958	2.478	0.138
1980	0.795	n/a	0.172	2001	0.897	2.929	0.150
1981	0.789	n/a	0.172	2002	n/a	2.528	0.148
1982	0.773	3.462	0.172	2003	n/a	2.376	0.149
1983	0.772	3.373	0.172	2004	n/a	2.210	0.139
1984	0.740	3.005	0.191	2005	n/a	2.126	0.141
1985	0.710	3.169	0.204	2006	n/a	2.081	n/a

Sources: Fanning et al. (2003); Power et al. (2006); Stone et al. (2006).

Size and Age at Maturity

An important element in fishery management is to ensure sufficient spawning—production of eggs and resulting juveniles—to produce a healthy stock over time. One aspect of this strategy lies in ensuring that enough fish have an opportunity to spawn before being captured. An approach to analyzing this is to compare the age (or size) at which the fish become sexually mature with the age (or size) at which they become vulnerable to the fishery. If the latter is too low relative to the former, conservation problems could arise. However, not all fish reach maturity at the same age, so measures are used such as "age at 50% maturity"—i.e., the age at which approximately 50% of the fish in the stock reach reproductive maturity. (Similarly, entry into the fishable stock occurs over a range of ages and sizes.)

The age of maturity in a fish population may fluctuate from year to year depending on population size, on competition for food and space both internally and with other species, and on environmental conditions such as water temperature.[1] Indeed, age at maturity can be a useful indicator of population stress. Furthermore, analysis of the age at maturity provides an indicator of the biomass of fish that will reproduce in a given year (the spawning stock biomass), which can help managers predict roughly the number of fish that will enter the fishable stock in subsequent years (the recruitment). This can aid in fishery planning. While this information would be useful in a variety of ways, it requires extensive monitoring and is not available for all species.[2] Further elaboration of indicators in this area will be important for future development of the GPI fisheries and marine environment accounts.

[1] Trippel, E.A. 1995. *Age at maturity as a stress indicator in fisheries*. Bioscience 45(11): 759–771.
[2] Trippel, E.A., M.J. Morgan, A. Fréchet, C. Rollet, A. Sinclair, C. Annand, D. Beanlands, and L. Brown. 1997. *Changes in age and length at sexual maturity of Northwest Atlantic Cod, Haddock and Pollock Stocks, 1972–1995*. Can. J. Fish. Aquat. Sci. Tech. Rep.

14.4. Mean trophic level of harvested species: are we fishing down marine food webs?

Data sources: DFO. 2008a. Canada Provincial Quantities, Commercial Landings, Seafisheries. DFO Statistical Services, Department of Fisheries and Oceans; DFO. 2008b. Canada Provincial Values, Commercial Landings, Seafisheries. DFO Statistical Services, Department of Fisheries and Oceans; Froese, R. and D. Pauly. Editors. 2008. FishBase. World Wide Web electronic publication. (www.fishbase.org) September 19, 2008; Pauly, D. and V. Christensen. 1997. Trophic levels of fishes. Box 16, p. 127 In R. Froese and D. Pauly (eds) FishBase 97: concepts, design and data sources. ICLARM, Manila; Pauly, D., Palomares, M.L., Froese, R., Sa-a, P., Vakily, M., Preikshot, D. and S. Wallace. 2001. Fishing down Canadian aquatic food webs. *Can. J. Fish. Aquat. Sci.* 58: 51-62. Table 1.

Result: There has been a steady decline in the mean trophic level of the species landed in Nova Scotia's fisheries since the mid-1980s. Species at the top of the marine food web have been depleted, and lower trophic level species are now the primary target and source of revenue in Nova Scotia's fisheries.

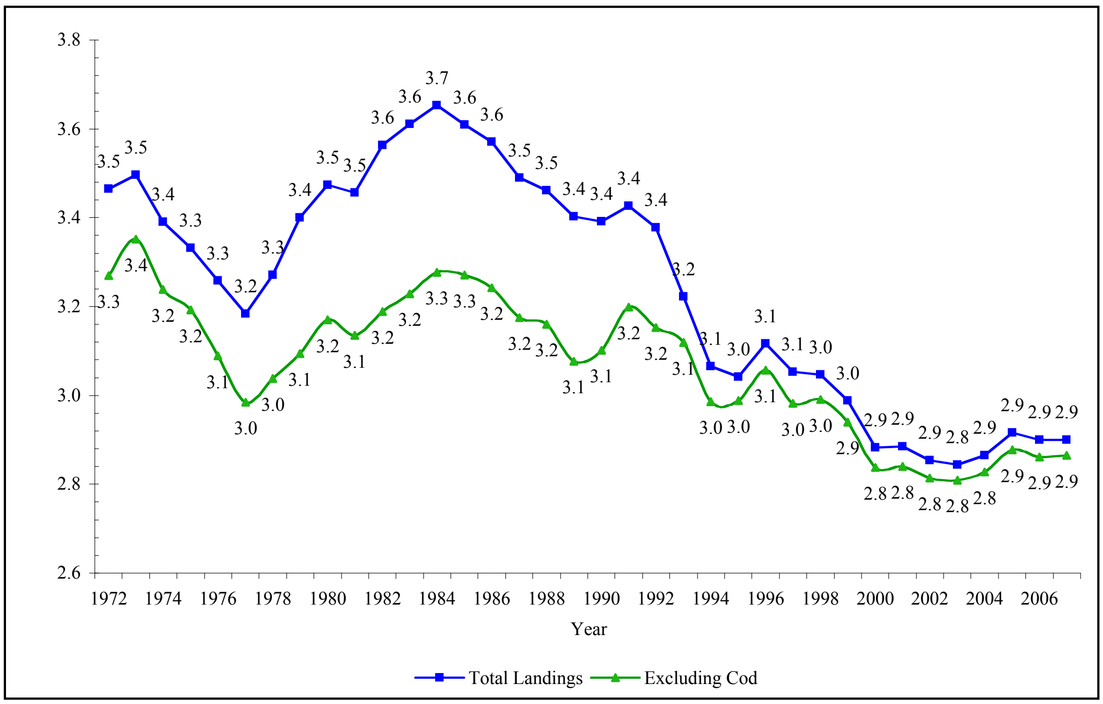
Conventional fisheries management has focused on maximizing the catch from single-species fisheries without consideration of the effects of fishing on non-target species and marine ecosystems. There is growing recognition of the need to move away from this single-species focus to consider the cumulative and indirect effects of fishing on marine ecosystems.[13] Fisheries can alter the structure and dynamics of marine food webs by changing the relative abundance of species at different trophic levels. Substantial reductions in the population of a single keystone species (a species whose impact on its community is larger than its biomass would suggest) in a marine food web can result in trophic cascades that disrupt predator-prey interactions among species at various trophic levels.[14]

Pauly et al. (2001) point out that, in fisheries where both large and small species are targeted, the large, long-lived species will decline more rapidly than the smaller, shorter lived species because of fundamental differences in their life history strategies. Therefore, over time, species at the bottom of the food web will comprise an increasingly larger portion of the total catch in a given fishery as stocks of species at the top of the food web become depleted. This phenomenon has been called "fishing down marine food webs."[15]

A number of studies have demonstrated this phenomenon by calculating the mean trophic level (TL) of all species landed in a particular region's fisheries over time.[16] Figure 14-10 below shows the mean TL of harvested species, weighted by their respective landings, in Nova Scotia fisheries over the period 1972 to 2007. Following Pauly et al. (2001), the mean TL is shown first for all landed species, and then for the same set of species but excluding cod.

Figure 14-10 shows an initial decline in the mean trophic level of Nova Scotia fisheries followed by a period of increasing mean TL beginning in the late 1970s, which can be traced to growth of the fisheries for groundfish in the waters around Nova Scotia. After peaking in 1984, the mean TL then began a period of steady decline, despite the fact that landings of cod and other groundfish remained high throughout the 1980s. The initial cause of the decline in mean TL after 1984 was not due to decreased landings in the groundfish fishery but rather to increased landings of lobster (a lower TL species). The rapid decline in the mean TL in the early 1990s, however, clearly marks the collapse of the groundfish fishery in Atlantic Canada and the shift toward targeting species at lower trophic levels, mainly lobster and other shellfish. Lobster landings continued to increase through the mid-1990s, causing the mean TL to decrease even further. Since 2000, the mean TL has remained relatively stable at historic lows.

Figure 14-10. Mean trophic level (weighted by landed weight) in Nova Scotia Fisheries, 1972–2007

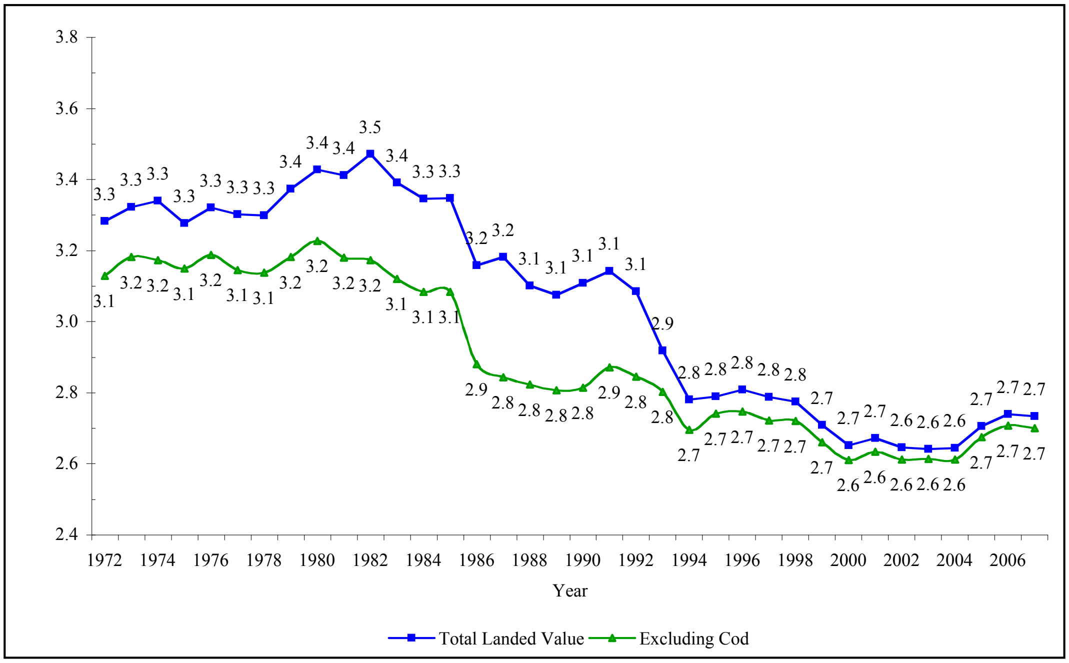


Sources: DFO (2008a); Froese and Pauly (2008); Pauly and Christensen (1997); Pauly et al. (2001).

Figure 14-11 below provides a different way of looking at the trophic level of catches in Nova Scotia fisheries, this time weighted by landed value. This indicator can be interpreted as telling us which fish species (in terms of trophic levels in the ecosystem) are contributing most to Nova Scotia's fishing economy at any point in time.

Since, in a Nova Scotia context, commercial marine species at the bottom of the food web, such as lobster and other shellfish, are typically worth more per unit weight than species at higher trophic levels, we see that the mean trophic level in Figure 14-11 is less than that in Figure 14-10 above. However, trends in the indicators, from the early 1980s to the present, are the same in both graphs, and Figure 14-11 below highlights the fact that Nova Scotia's fishery economy has become increasingly dependent on species toward the bottom of the food web.

Figure 14-11. Mean trophic level (weighted by landed value) in Nova Scotia Fisheries, 1972–2007



Sources: DFO (2008b); Froese and Pauly (2008); Pauly and Christensen (1997); Pauly et al. (2001).

This clear reality that Nova Scotia's fisheries have been increasingly fishing down the marine food web is particularly disturbing for two reasons. First, it is an indication of the extent to which fisheries have altered the marine ecosystems around Nova Scotia and depleted populations of important predators at the top of the food chain (notably, the cod stocks). Such populations may have been reduced to the point at which they are no longer able to perform their traditional ecosystem functions.

Second, the increased reliance on species at the bottom of the food web has made Nova Scotia's fisheries less resilient from both a biological and socio-economic perspective. A healthy, more biologically diverse marine ecosystem is more likely to recover from shocks or perturbations than a severely degraded and less diverse one.[17] This is a key consideration given the potential impacts of climate change on marine ecosystems.

Furthermore, if the lobster fishery were to collapse or become less profitable, there are few remaining options within the fishery. Following the collapse of the cod stocks, some fishers were able to adapt to the crisis by entering the growing lobster fishery, but now, with Nova Scotia fisheries already dependent on species at the bottom of the marine food web, there is less room to manoeuvre. It will not be possible to continue to fish down the marine food web indefinitely, so a collapse in the lobster fishery has the potential to cause even greater socio-economic devastation than the collapse of the cod.

14.5. Marine species at risk

Data sources: Campana, S., Joyce, W. and L. Marks. 2003. *Status of the Porbeagle Shark (Lamna nasus) in the Northwest Atlantic in the Context of Species at Risk.* Canadian Science Advisory Secretariat Research Document 2003/007. Table 1; COSEWIC. 2005. *Canadian Species at Risk*. Committee on the Status of Endangered Wildlife in Canada; DFO. 2008c. Aquatic Species at Risk, Maritimes. (http://www.dfo-mpo.gc.ca/species-especes/home_e.asp) September 24, 2008; Kraus, S.D., P.K. Hamilton, R.D. Kenney, A. Knowlton, and C.K. Slay. 2000. Status and trends in reproduction of the North Atlantic right whale. *J. Cetacean Res. Manage*; Kraus, S.D., Brown, M.W.,Caswell, H., Clark, C.W., Fujiwara, M., Hamilton, P.K., Kenney, R.D., Knowlton, A.R., Landry, S., Mayo, C.A., McLellan, W.A., Moore, M.J., Nowacek, D.P., Pabst, D.A., Read, A.J. and R.M. Rolland. 2005. North Atlantic Right Whales in Crisis. *Science* 309: 561-562.

Result: The two species groups examined here—marine mammals, and sharks and rays—have experienced substantial population declines in Atlantic Canada. While the mortality rate and birth rate of the North Atlantic right whale population have both increased since the previous *GPI Fisheries and Marine Environment Accounts* report (2002), the increased birth rate is insufficient to counter the rate of population decline, and the population is now in even greater jeopardy.

Fishing and other human activities in the marine environment have seriously impacted the populations of some marine species, including both target species in the fishery and other, non-target species. Although fisheries agencies have long monitored the status of populations of commercially harvested species, little effort was directed at determining the status of non-target marine species. In 1977, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created to assess the status of wildlife species in Canada.[18] Since its creation, COSEWIC has assessed the population status of a number of marine species in Atlantic Canada. Table 14-1 below lists all marine species that have been designated by COSEWIC as species at risk in Atlantic Canada.

Table 14-1. Marine species at risk, waters around Nova Scotia

VULNERABLE / SPECIAL CONCERN	THREATENED	ENDANGERED	EXTIRPATED	EXTINCT
• Atlantic cod • American eel • Atlantic wolffish • blue shark • fin whale • harbour porpoise • roughhead grenadier • Sowerby's beaked whale • winter skate (Georges Bank—Western Scotian Shelf—Bay of Fundy)	• cusk • Northern wolffish • shortfin mako shark • spotted wolffish • striped bass (Southern Gulf—Bay of Fundy) • winter skate (Eastern Scotian Shelf)	• Atlantic salmon • blue whale • leatherback sea turtle • North Atlantic right wWhale • Northern bottlenose whale • porbeagle shark • white shark • winter skate (Southern Gulf)	• Atlantic walrus • grey whale	• eelgrass limpet • sea mink

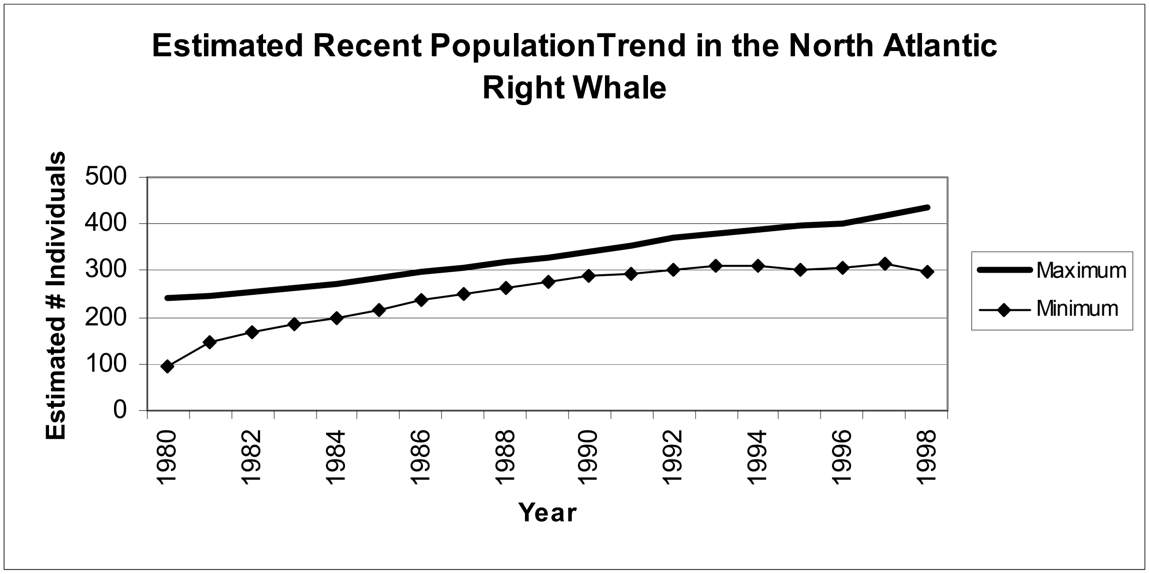
Sources: COSEWIC (2005); DFO (2008c).

Non-target species of critical importance in Nova Scotian waters include various species of marine mammals. As of 2008, a total of six different species of marine mammals have been designated by COSEWIC as being at risk (Table 14-1 above). Perhaps none is more closely monitored at present than the endangered North Atlantic right whale, thereby providing substantial time series data for trend analysis that can serve as a useful indicator of success in marine conservation efforts. The North Atlantic right whale is among the most depleted species of whales worldwide.

Population trends of North Atlantic right whales are not universally agreed upon, particularly when one looks far back in time. Only very rough estimates are available for the level of the population in pre-exploitation times; Reeves et al. (1992) have estimated this level at somewhat over 1,000 right whales, but place many caveats on this estimate. They also estimate that the population may have fallen to less than 100 by the time the right whale became protected in 1935.[19]

Brown et al. (1994) have determined that the right whale population did not increase significantly from that low level during the initial 50 years of protection. This estimate is reinforced by the analysis of Kraus et al. (2000), indicating that the population was around 100 in 1980 before rising to just under 300 in 1998 (Figure 14-12 below). In summary, then, despite the uncertainties involved, there is general agreement that, while the North Atlantic right whale population size is now above what it was at its lowest, it still remains far below levels present prior to exploitation.

Figure 14-12. Estimated population trend in the North Atlantic right whale, 1980–1998



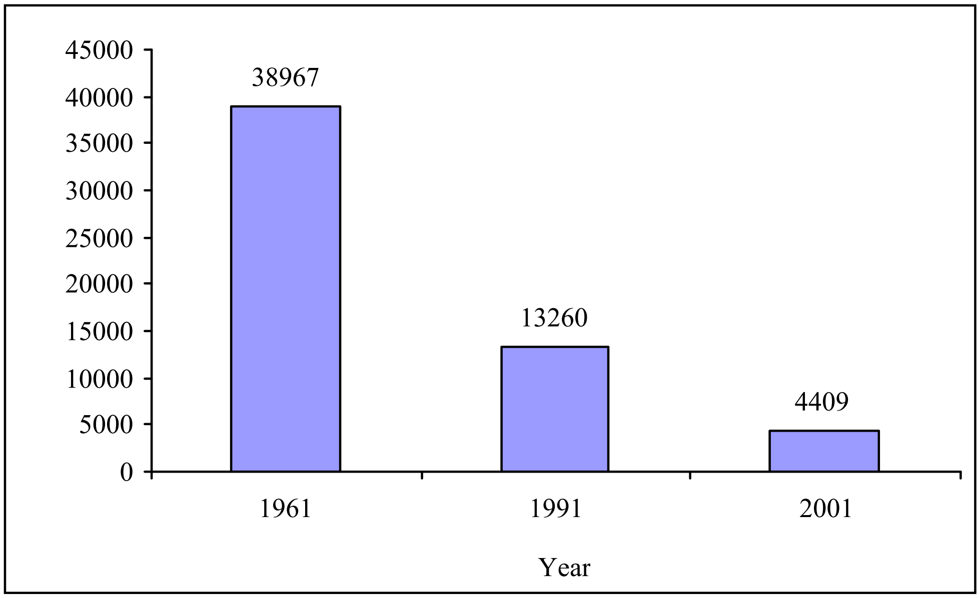
Source: Kraus et al. (2000).

Since the last *GPI Fisheries and Marine Environment Accounts* report in 2002,[20] Kraus et al. (2005) have reported two major changes in the right whale population trend. First, there has been a significant increase in the mortality of the population. In 2004 and 2005, over a period of just 16 months, there were eight reported deaths, including six adult females and a young calf. These deaths represent a large reduction in the reproductive potential of the right whale population. Kraus et al. (2005) estimated that this increase in mortality would reduce population growth by between 3.5% and 12%.

Second, there has been an increase in the population's birth rate. Between 2001 and 2005, the number of calves born each year was higher than the average of 12 per year prior to 2000. A total of 31, 21, 19, 16, and 28 calves, respectively, were born in each of the years between 2001 and 2005. According to Kraus et al. (2005), while this increased birth rate translates to an increased population growth rate, it is not sufficient to counter the estimated 2% annual decline of the population.

Sharks and rays are a second group of species well represented in Table 14-1 above, with five of these species having been designated as "at risk." One of these, the porbeagle shark, spends the majority of its time in Atlantic Canadian waters.[21] After two periods of heavy exploitation in the 1960s and 1990s, the estimated biomass of porbeagle declined by 89% between 1961 and 2001 (Figure 14-13 below).[22] Baum et al. (2003; 2005) have shown a large, rapid decline in many other coastal and oceanic shark populations in the northwest Atlantic since the late 1980s, many of which have not been assessed by COSEWIC.

Figure 14-13. Estimated total biomass of porbeagle shark in the Northwest Atlantic, 1961, 1991, and 2001



Source: Campana et al. (2003).

It should be noted that only a small portion of all marine species have been assessed in terms of their stock levels. As more marine species are assessed, it is likely that more will be designated as being at risk, simply because we are learning about the state of more marine species, some of which are discovered to be in poor condition. Thus, if we use the number of designated species at risk as an indicator to track over time, it will be important to differentiate between an increase in the indicator that reflects a deterioration in the condition of certain species and of the marine environment versus an increase that simply reflects a better understanding of the condition of more marine species. One way to make this differentiation is to monitor changes in the status of already-assessed species as well as numbers of at risk species. In this case, the combination of an increasing number of at risk species *and* a downward trend in an established set of species, would point to worsening conditions.

14.6. Shellfish closures: a measure of marine environmental quality

Data sources: Wilson, S. 2000. *The GPI Water Quality Accounts,* **GPI***Atlantic*, Halifax, section 7.1, pages 101-103. Data on shellfish closures provided by Environment Canada. 1999. Environmental Protection Branch, *Shellfish Monitoring Program*, Environment Canada Atlantic Region Office, Amar Menon; Environment Canada. 2004. *Canadian Shellfish Sanitation Program (CSSP).* (http://www.atl.ec.gc.ca/epb/sfish/cssp.html). Accessed October 3, 2008.

Result: The number of shellfish closures in Nova Scotia has increased steadily since 1940, and has more than doubled since 1985.

Filter feeding organisms like oysters, mussels, and soft shell clams live within provincial estuaries and mud flats. If the surrounding waters are bacterially contaminated, the shellfish tissue itself becomes contaminated. Consumption of shellfish from contaminated areas can cause serious illness, generating public health issues. Thus, contaminated coastal areas are closed to shellfish harvesting.

While contamination can occur from natural causes, land-based agricultural or municipal run-off often causes the closures by adding excess nutrients to the water. With these additional nutrients, algae thrive, causing algal blooms. Algal blooms may also be induced when marine contaminants toxic to algal grazers (such as zooplankton) enter the water and reduce the amount of algae that is grazed. Additionally, some algae produce toxins as a natural defence against grazing predators; when the algae increases, they, in turn, can further reduce the population of grazers, thereby creating more opportunity for the algae to thrive. Algal blooms can have a variety of impacts. For example, they can lead to die-off of eel grass beds, which are valuable fish habitat.

Closures due to toxins and bacterial contamination are good indicators of marine environmental quality, and often further point to the extent of land-based contamination. Closures also directly affect the health of the shellfishery sector. The loss of market, recreational opportunities, and subsistence harvests creates serious negative impacts and costs to coastal communities, and local economies, while the closures may also signal environmental problems in the marine ecosystem as a whole.

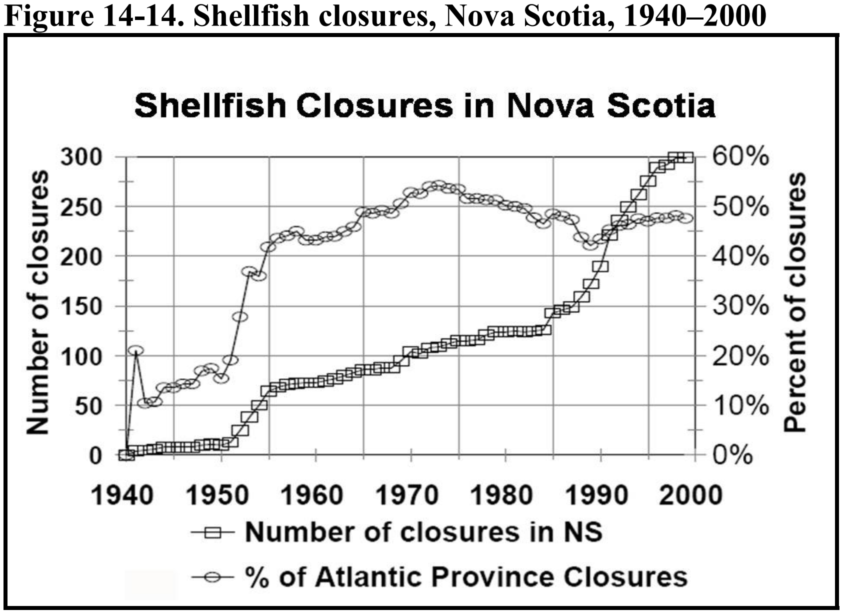
Figure 14-14 below shows the number of shellfish closures in Nova Scotia for each year between 1940 and 2000. The number of closures remained stable until around 1950, at which point closures began to increase steadily. Since 1985, there has been a rapid increase in the number of provincial shellfish closures, with the number of closures more than doubling between 1985 and 2000, to around 300. Indeed, additional data from Environment Canada (2004)—not shown in

Figure 14-14—indicates that this increasing trend in shellfish closures has continued over the period 2001 to 2004.

While the results for this indicator are negative from a marine environmental health perspective, care is needed in interpreting the results. The increases over time are certainly due in large part to deterioration of marine environmental quality, but this increase could also reflect higher health standards and an expansion or increased efficiency of monitoring programs, so that there will be some contaminated sites detected in recent years that had previously been overlooked.

Figure 14-14 below also shows the number of closures in Nova Scotia as a percentage of all closures in Atlantic Canada. This indicates that the province has the largest number of closures in the region, at about 50% of all closures, and that this proportion has remained fairly steady since around 1960. It is possible that different levels of monitoring in Nova Scotia compared to other provinces in Atlantic Canada, rather than a different quality of the marine environment, could lead to Nova Scotia's relatively high proportion of shellfish closures. Thus, the other provinces might possibly have more contaminated sites, but fewer closures, if they also have inadequate monitoring programs. However, since shellfish monitoring is conducted by federal agencies—Environment Canada and Department of Fisheries and Oceans (DFO)—operating at a regional rather than provincial level, there are unlikely to be significant differences in the monitoring programs among the provinces in the region.

Figure 14-14. Shellfish closures, Nova Scotia, 1940–2000



Sources: *Figure*: Adapted from Wilson (2000); *Data*: Environment Canada (1999, 2004).

14.7. Employment: a measure of socioeconomic wellbeing of fishers and fishing communities

Data source: Statistics Canada. 2008. Labour *force survey estimates (LFS), by North American Industry Classification System (NAICS), sex and age group, annual (persons x 1,000)*. Avalable from http://cansim2.statcan.ca/. Accessed September 24, 2008.

Result: The number of fishers employed in Nova Scotia decreased greatly from the highs experienced in the late 1980s and early 1990s to much lower levels later in the 1990s following the collapse of the groundfish fishery. After 2001, the number of fishers rose somewhat, then fell again, and certainly has not returned to the high, likely unsustainable, pre-collapse levels.

Fishery employment is valuable in helping to facilitate economic and social development, and in enhancing social stability and socio-economic wellbeing among fishers and in coastal fishing communities.[23] This is particularly so in those rural fishing communities where fishing is the primary source of livelihood, and where there are limited alternative employment opportunities outside the fishery. In such cases, the viability of these coastal communities may hinge on employment in the fishery. If employment levels fall below a critical threshold, the wellbeing and sustainability of the community may be threatened.[24]

At the same time, employment has its limits in any fishery, corresponding to productive limits of the fish stocks and the need for economic viability among fishers. Therefore, we can envision the idea of "sustainable employment" in a fishery, a level that can be maintained indefinitely over time. Such a goal would imply that management approaches be used to provide employment in the fishery to the extent possible, compatible with sustainable catch levels from the fish stocks.[25] As a fishery policy goal, this fits within the broader aim of "sustainable prosperity" within Nova Scotia government policy. It means avoiding policies that seek to maximize employment, but also avoiding those policies that reduce employment unnecessarily.

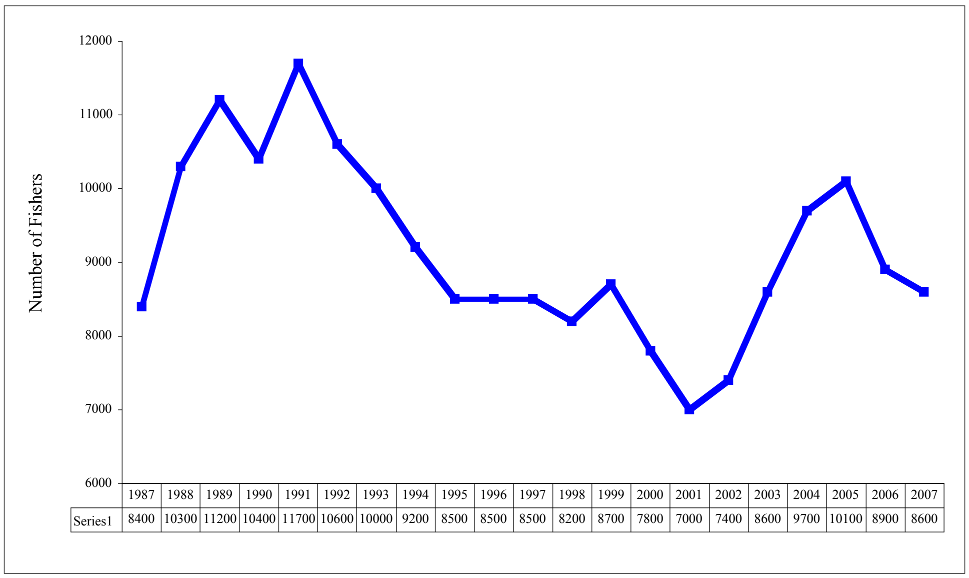
A desirable indicator for this would be to measure how close society comes to achieving this balancing goal. However, the research has not been carried out to properly measure such an indicator. Instead, in this chapter we simply report fishery employment levels, recognizing the need for careful interpretation of this measure.

The number of fishers employed in Nova Scotia fisheries is shown in Figure 14-15 below. Fishery employment increased rapidly through the late 1980s, as fishers sought to enter the booming groundfish fishery, and Canadian fisheries policy viewed employment in the commercial fishery as a key goal.[26] Prior to the collapse of the groundfish fishery in the early 1990s, fishery employment represented approximately 6% of Nova Scotia's total employment.[27]

In 1991, just prior to the collapse of the groundfish fishery, employment in Nova Scotia fisheries peaked.

As catches fell dramatically with the collapse of the groundfish fishery in the early 1990s, so did employment. Between the mid- to late 1990s, the number of fishers remained relatively stable, at levels about 28% lower than the 1991 peak, but then decreased further between 1999 and 2001 to a level about 40% below the 1991 peak. From 2001 to 2005, the number of fishers in Nova Scotia increased—possibly in response to the expansion of the shellfish industry and the increase in lobster landings indicated above—to the highest levels in over a decade (reaching about 86% of the 1991 peak in 2005). However, fishery employment has again decreased in recent years.

Figure 14-15. Employment trend in Nova Scotia fisheries, 1987–2007



Source: Statistics Canada (2008).

Overall, Figure 14-15 above indicates a long-term decline in fishery employment over a 20-year period, despite significant fluctuations in employment over time, as fishers enter or exit the fishery (in response to such factors as the emergence of new fisheries, changes in fish stock abundance, or trends in the value of the Canadian dollar). This decline certainly has negative implications, especially in those communities where few alternative sources of employment are available.

Two key reasons for the decline would seem to be 1) the unsustainable pre-collapse employment levels, and 2) governmental actions (e.g., failing to enforce federal owner-operator rules) that have led to unnecessarily great losses in employment. In other words, we cannot expect employment to be maintained at pre-collapse levels, but sustainable levels might be higher than at present with supportive government policy and action. A focus on "sustainable employment" would shift fishery policy to encourage employment "per fish caught." This might involve supporting more sustainable and labour-intensive fishing methods and community-based management approaches. As noted above, the development of an indicator to monitor "sustainable employment" would be a useful priority for the future.

14.8. Fishery GDP: a conventional economic measure

Data sources: Nova Scotia Department of Finance. 2008. Nova Scotia Statistical Review. Economics and Statistics Division. Available from http://www.gov.ns.ca/finance/statistics/agency/publications/publications.asp?id=Pub21. Accessed October 12, 2008.

Result: As noted in Section 14.1, Nova Scotia's fishery GDP was steady at high levels for several years up to the time of the groundfish collapse. Between 1992 and 1995, that fishery GDP decreased by almost half. After 1995, the fishery GDP increased again and by 2006 it had grown to nearly 80% of the 1992 level.

Official and media reports on the state of Nova Scotia's fishery traditionally focus on the quantity of fish caught, the total fishery revenue, the level of fish exports—and fishery's contribution to the GDP, the conventional measuring stick of economic progress and prosperity.

Here we include this conventional indicator—even though GDP values are highly incomplete—in order to contrast results with those emerging from a GPI analysis. In particular, the GDP omits the value of many vital non-market services that Nova Scotia's marine environment provides, even though the economic health of the fisheries sector depends on these non-market services. Specifically, aspects of ecosystem health remain invisible in the GDP statistics and conventional accounting mechanisms. For example, the essential value of nutrient cycling is not captured in the GDP, despite being essential for fish growth. Similarly, habitat structure and quality are crucial to the value of Nova Scotia's fisheries, but cannot be discerned in GDP-based measures.

In particular, because the GDP only measures what we extract from the oceans and send to market, it does not account for what we leave in the sea—either the quantity and health of our fish stocks or the quality of our marine environment. Unlike the biomass, age, trophic level, environmental quality, and other GPI indicators presented above, the GDP is, therefore, incapable of sending policy makers early warning signs that could trigger timely remedial action and that might effectively avert the kinds of collapse such as the groundfish fishery in 1992, which could have been curtailed if adequate conservation measures had be put in place in time.

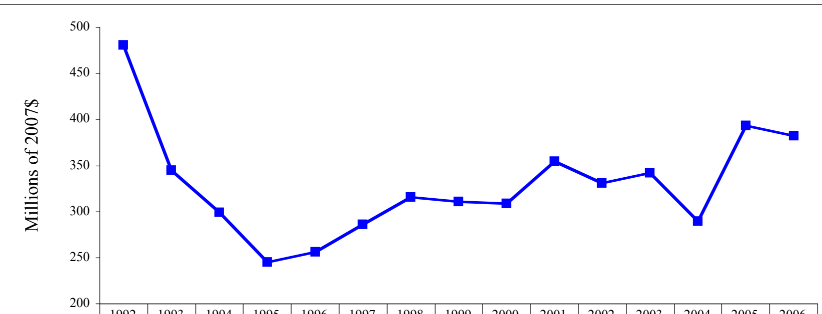
As noted in Section 14.1 above, Nova Scotia's fishery GDP was strong and stable in the years just prior to the groundfish collapse, suggesting a healthy economic sector. While we were catching, selling, and exporting large volumes of fish—and thus stimulating fishery GDP growth—we were simultaneously depleting the natural capital on which the fishery sector depended.

This resource depreciation—not captured in the conventional economic accounts—is analogous to what happens if the capital stock of a business (factories, equipment, etc.) is depleted or wears out over time and is not replaced. In contrast to a piece of machinery, however, fish stocks can potentially be self-sustaining and can naturally appreciate (grow) in economic value over time when harvested sustainably. If fish stocks are subjected to over-exploitation or other pressures, however, they will lose economic value. In sum, the problem with reliance on GDP-based measures of progress is not only that they *omit* key ingredients required for a healthy fishery, but also that they perversely count the depletion of natural wealth as economic gain.

Therefore, the fishery GDP is presented here, not because it is a recommended GPI indicator, but rather to demonstrate the contrast between this measure and the more nuanced assessments of fishery and marine environment health presented above.

As indicated in Figure 14-16 below, Nova Scotia's fishery GDP dropped following the collapse of the groundfish fishery, from $481 million in 1992 to $245 million in 1995 (in 2007 dollars), just over half the 1992 value. Nova Scotia's fishery GDP has resumed its upward trend since that time, largely in response to substantial growth in the shellfish sector (i.e., actually benefiting from the "fishing down the food chain" effect described in the trophic level indicator in Section 14.4 above). Thus, the province's fishery GDP increased from $245 million in 1995 to $382 million, in 2006 (in 2007 dollars), representing an increase of 56% in that time period, up to almost 80% of its 1992 level. Again, it should be noted that these GDP figures are affected by the overall landings in the fishery, the species mix in that catch, and the prices involved.

Figure 14-16. Fishery GDP ($2007), Nova Scotia, 1992–2006



	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Series1	480.7	344.9	299.0	244.8	255.9	285.8	315.4	310.7	308.8	354.5	330.8	342.0	289.6	393.4	382.0

Source: Nova Scotia Department of Finance (2008).

Notes: In Figure 14-16, all monetary amounts are in $2007, while Figure 14-1 above uses $1997 as the constant dollar year. Figure 14-16 shows an increase in fishery GDP between 1995 and 1998, while Figure 14-1 shows a relatively stable trend over the same time period. Although the exact reason for this discrepancy is not clear, it is common for the Nova Scotia Department of Finance to revise earlier data sets in later years based upon updated information. Since Figure 14-16 uses the most recent annual estimates over the time period, its depiction of the trend between 1995 and 1998 should be more accurate than Figure 14-1.

14.9. Age structure of fishers: a measure of fishery and community resilience

Data sources: Statistics Canada, Census. 1931. *Labour Force Survey for Canada, Provinces and Territories*. 1931 Census. Statistics Canada; Statistics Canada, Census. 1941. *Labour Force Survey for Canada, Provinces and Territories*. 1941 Census. Statistics Canada; Statistics Canada, Census. 1951. *Labour Force Survey for Canada, Provinces and Territories*. 1981 Census. Statistics Canada; Statistics Canada, Census. 1961. *Labour Force Survey for Canada, Provinces and Territories*. 1961 Census. Statistics Canada; Statistics Canada, Census. 1971. Labour Force 15 years and over by Detailed Industry, Age and Sex, for Canada, Provinces and Territories. 1971 Census. Statistics Canada. 94-747:13-25; Statistics Canada, Census. 1981. Labour Force 15 years and over by Detailed Industry and Sex, Showing (a) Age Groups and (b)Class of Worker for Canada, Provinces and Territories. 1981 Census. Statistics Canada. 92-921: 3-21; Statistics Canada, Census. 1991. *Labour Force 15 years and over by Detailed Industry and Sex, Showing (a) Age Groups and (b) Class of Worker for Canada, Provinces and Territories*. 1991 Census. Statistics Canada. 93-113: 1-37; Statistics Canada, Census. 2001. *Industry - North American Industry Classification System, Age Groups and Sex for the Labour Force 15 Years and Over of Canada, Provinces, Territories, Census Metropolitan Areas and Census Agglomerations*. 2001 Census. Available from http://www.statcan.ca/menu-en.htm. Accessed October 1, 2008; Statistics Canada, Census. 2006. *Industry - North American Industry Classification System, Age Groups and Sex for the Labour Force 15 Years and Over of Canada, Provinces, Territories, Census Metropolitan Areas and Census Agglomerations*. 2006 Census. Available from http://www.statcan.ca/menu-en.htm. Accessed October 1, 2008.

Result: The proportion of older fishers has increased since 1931, while the proportion of younger fishers has decreased. The proportion of middle-aged fishers has remained relatively stable.

The "age structure" of a fish population tells us how many fish there are of each age in the population. It is well accepted in ecological science that age structure can be an important factor in the health and resilience of fish stocks, as it is in forests and in wildlife populations.[28] In most cases, a healthy fish stock (again like a healthy forest) will ideally have a broad age spectrum that includes all age groups with a relatively even distribution among them, including an abundance of both young fish and old fish.

Resilience in human communities in general—and in coastal fishing communities in particular—might be considered similarly. Thus, an age structure that covers all age groups among fishers is desirable both from a human perspective (for example, to ensure a range of social interactions within the fishery and continuity within fishing communities) and from a management perspective (for example, to ensure effective transfer of skills and knowledge and to avoid abrupt increases or decreases in harvesting capacity over time). Of course, as with fish populations, this is not to suggest that all ages must always be equally represented at all times.

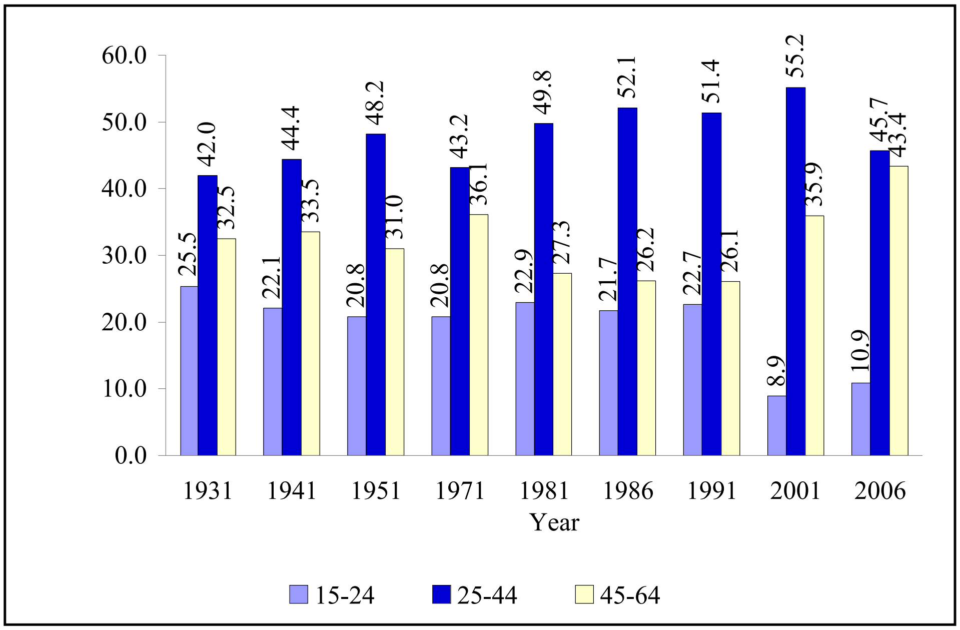
Figure 14-17 below shows that, in Nova Scotia, the proportion of middle-aged fishers (25-44 years) has remained relatively stable over the past 75 years at around 45% of all fishers, although the proportion rose to higher levels in the 1980s and 1990s—peaking at 55% in 2001—before dropping back to 46% in 2006.

The larger changes have been at either end of the age spectrum. The proportion of young fishers (15-24 years), fairly stable for more than half a century—at 20-25% of all fishers from 1931 to 1991—has dropped by more than half since the groundfish collapse and today constitutes only about 10% of all fishers. By contrast, the proportion of older fishers (45-64 years) has risen dramatically since the groundfish stock collapse—from 26% in 1986 and 1991 to 43% of all fishers today. Thus, the overall age distribution among fishers in Nova Scotia has shifted markedly in the last 15 years to a considerably higher overall average age of fishers.

This recent and very dramatic change in age distribution in the fishing community has negative implications for the resilience both of the fishery and of coastal communities, both of which face an aging fishing population with fewer young recruits. This result also sends a message concerning problems with Nova Scotian fish stocks and with the federal government's fisheries policies. First, this indicator—showing an aging fishing population—indirectly reinforces the results of indicators presented earlier in this report pointing to diminishing fish in the sea. We can expect that, when fish are abundant, there will be more interest among young people in entering the fishery and more opportunities to do so. Conversely, when such opportunities are limited, the existing employment base will likely age over time, as the data here demonstrate.

Second, this indicator suggests that federal fishery policy is not presently ensuring a strong age structure of fishers in Nova Scotia, or encouraging young fishers to enter the fishery, but rather may be leading in the opposite direction. This suggests an urgent need to shift policy directions to diversify the fishery age structure, thereby boosting the resilience of the fishery while supporting coastal communities. For example, rather than allowing large fishing companies to gain control over fishing licenses, as at present, a more effective policy might enforce existing owner-operator rules so that young crew members have a better chance of taking over from retiring fishers.

Figure 14-17. Age distribution of fishers (%), Nova Scotia, 1931–2006



Source: Statistics Canada, census (multiple years).

Note: For 1991, 2001, and 2006 data, the upper age group represents ages 45+.

Resilience and Diversity Indicators

Resilience reflects the ability of a fishery or a marine ecosystem to bounce back from shocks and to maintain its integrity. It is, thus, a highly desirable attribute. Resilience is an attribute both of ecological systems (in which genuine progress is assessed by the capacity of the ecosystem to maintain its "health" over time) and of human systems (in which resilient socioeconomic structures and communities are able to bounce back from dramatic changes in the natural resource base, the economy, and social conditions).

Multiple attributes are required to make a fishery resilient. A diverse age structure among fishers (Section 14.9 above) is just one factor. Indeed, *diversity* in the larger sense has been identified by observers as key to resilience in human communities, just as biodiversity is a key indicator of ecosystem resilience. Additional diversity indicators that may contribute to socioeconomic and community resilience include: diversification of total fishery landings across multiple species; access of individual fishers to multiple fisheries, rather than specialization in just one fishery; and economic (livelihood) diversification among fishers—all of which can be considered positive indicators from a resilience perspective.

Each of these additional diversity and resilience indicators is referenced very briefly here in order to encourage further developmental work in these areas with a view to expanding and deepening these GPI fisheries and marine environment accounts.

Diversified landings

From the human perspective in the fishery, reduced reliance on single fisheries and single fish stocks means not only a more diverse set of fisher livelihood options, thus greater resilience within fisher communities, but also potential insurance against a downturn in fish landings of a particular species. As noted from the evidence presented so far, such a downturn can occur either when fish stock abundance or health are compromised, as in the recent 30% drop in lobster landings seen in Figure 14-7 above or the 40% decline in pollock size shown in Figure14-9 above, or as a result of particular commodity price changes. For example, a diversified fishery can clearly respond more flexibly to the kinds of price fluctuations illustrated in Appendix Figures 14-1 through 14-3, and can embrace a conservation requirement in a particular species without compromising the fishery or fishing income as a whole.

This capability to respond more effectively to both ecological and economic signals implies that a diversity of landings in a fishery system would be highly beneficial in terms of socioeconomic and community resilience, and also as a mechanism to reduce fishing pressure on declining fish stocks. Such diversification must, nevertheless, be handled with care, given the complex interactions between species in an ecosystem. In particular, diversifying by developing new fisheries (notably, on previously unexploited species) can potentially have negative ecological repercussions, perhaps on species traditionally targeted in fisheries (see Section 14.4 above).

Resilience and Diversity Indicators (continued)

Multi-fishery access

Diversification of landings applies not only to the fishery overall, but to individuals as well. For the reasons outlined above, individual fishers have greater flexibility and resilience if they hold licenses to fish more than one species because this enables them to switch between fisheries in response to changing abundances, ecological signals, and profitability. In particular, if the abundance of one fish species declines (or even collapses as with cod), fishers can shift to other fisheries, thereby maintaining their livelihood from fishing. From both an individual fisher and a community perspective, therefore, such multi-fishery access enhances the resilience of the overall fishery situation.

Multi-fishery access can also be positive for biological sustainability, since fishers can move to other fisheries in response to early signals of stock declines, rather than maintaining excessive effort in fishing the declining stock (but with care required to ensure that large-scale redirection of fishing is not such as to deplete a whole series of fish stocks). Thus, the extent to which fishers hold multiple licenses to harvest a range of species can also be seen as an indicator of socioeconomic and community resilience.

Diversified employment

A resilient fishing community is one that can continue to function and to guarantee its members a reasonable level of livelihood security, even during difficult times, and to bounce back from the inevitable disruptions that occur in any economy. Among the many components of a community that contribute to its resilience, including the economic and age structure aspects discussed above, a crucial one is the degree of diversification of the local economy as a whole.

Thus, abundant evidence indicates that communities with diversified economies and diverse employment opportunities are less vulnerable to variability and market fluctuations within a single industry (such as the fishery) because other industries within the community contribute to overall economic stability. Conversely, communities reliant primarily on a single industry have been much more economically vulnerable and will more likely be affected by the variable success and difficulties within that industry.[1] This has been the unfortunate experience of some Nova Scotian communities, such as those in Cape Breton that were over-reliant on fishing, coal, or steel, and which suffered major economic setbacks and severe hardship as each of those industries collapsed. In short, employment diversity can also be a useful indicator of socioeconomic and community resilience among coastal fishing communities.

[1] Lamson, C. 1986. *Planning for resilient coastal communities: lessons from ecological systems theory*. Coastal Zone Management Journal 13: 265-280.

14.10. Institutional expenditures: resources to effectively manage fisheries and the marine environment

Data sources: DFO. 2008a. Canada Provincial Quantities, Commercial Landings, Seafisheries. DFO Statistical Services, Department of Fisheries and Oceans; Gardner Pinfold. 2005. *Economic Value of the Nova Scotia Ocean Sector*. Tables 21, 24, and 26; Treasury Board of Canada. 2008. Departmental Performance Reports. Available from http://www.tbs-sct.gc.ca/rma/dpr/dpr-rmr_e.asp. Accessed September 24, 2008.

Result: Expenditures by the federal Department of Fisheries and Oceans in Nova Scotia declined in the second half of the 1990s, jumped substantially in 2000, and then decreased steadily in the subsequent years covered in this analysis (2000–2003). Provincial Department of Fisheries and Aquaculture expenditures show an overall increasing trend since 1996. However, both federal and provincial government expenditures as a proportion of the landed value of Nova Scotia fisheries have decreased over time.

Institutional sustainability is an essential but often overlooked ingredient of sustainable development. In fisheries, measures to ensure sustainability are unlikely to succeed unless sufficient attention is paid to maintaining or building long-term financial, administrative, and organizational capabilities—the essence of institutional sustainability.

To assess this, we need indicators to assess the effectiveness of the management rules by which the fishery is governed, as well as the organizations that implement those rules in managing the fishery, whether formally (e.g., the legal system or governmental agencies) or informally (e.g., fisher associations or nongovernmental organizations). In general, institutional indicators need to examine 1) the manageability and enforceability of regulations, and 2) whether there is a match between i) the level of resources that society wishes to allocate to management, ii) what is needed to accomplish that management effectively, and iii) the actual level of resources available for management. Together, these considerations relate to the effectiveness of the institutions and regulations that manage and govern the fisheries, and to the inherent sustainability of those institutions.

Considerations of effectiveness and adequacy of institutional resources should include a wide range of ecological, social, economic, and cultural factors, including the ability to finance management needs, to conserve species, to foster equity, and to balance and manage the sometimes competing demands of different fisher groups. As past experience in Atlantic Canada has vividly demonstrated, these ecological, social, economic, and cultural factors in fisheries management and governance are intimately linked. Clearly, no assessment of sustainability in the fisheries is complete without careful consideration of this vital institutional dimension and without some attempt to measure management and institutional success.

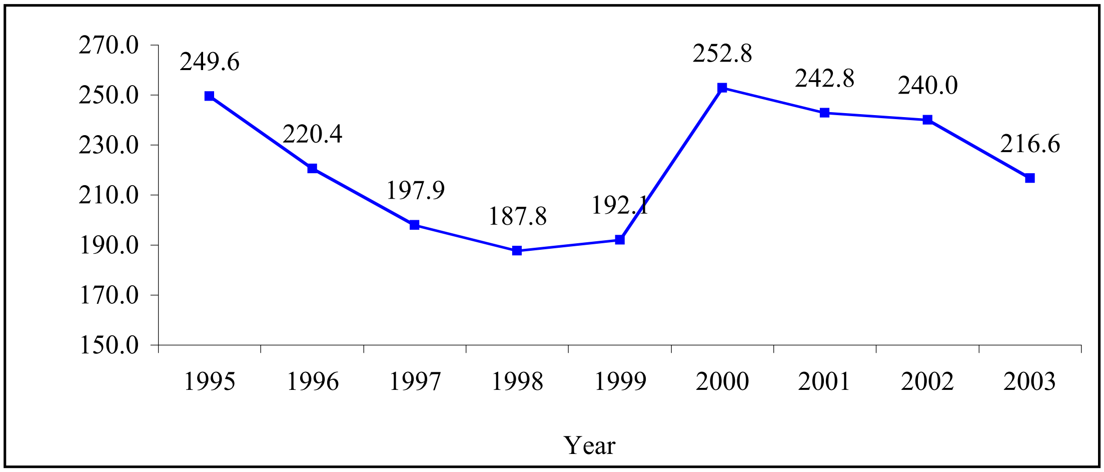
Unfortunately, it is very difficult to compile indicators that cover these various themes and dimensions, and indeed, institutional sustainability is too rarely monitored altogether as a measure of genuine progress. The discussion in this section is accordingly very preliminary in nature, reflecting the fact that new research and data collection are needed to fully develop indicators along the desired lines. Indeed, collection and analysis of quantitative data to operationalize such indicators in this field is highly recommended for future work.

In the meantime, the very limited availability of data on institutional matters means that this analysis deals with trends in only one (albeit fundamental) aspect of institutional sustainability—available levels of financial resources for the various aspects of fisheries management. Ideally, the available financial resources would be compared with those actually required to accomplish the designated and desired goals of fisheries management, but it remains unclear how levels of funding required for successful and sustainable fishery management can be determined and assessed accurately.

In short, it must be acknowledged that this indicator is still at a primitive level of development, but it is included here to highlight the importance of considering the institutional dimension of sustainability and in the hope that its inclusion here will lead to further conceptual, developmental data collection and analytical work in this area. With those caveats, we turn to a simple measure of institutional resources for which some data are available—annual expenditures by government departments. (Even here, however, considerable further analysis is required to assess the portion of these expenditures directly devoted to management of the fisheries in Nova Scotia waters.)

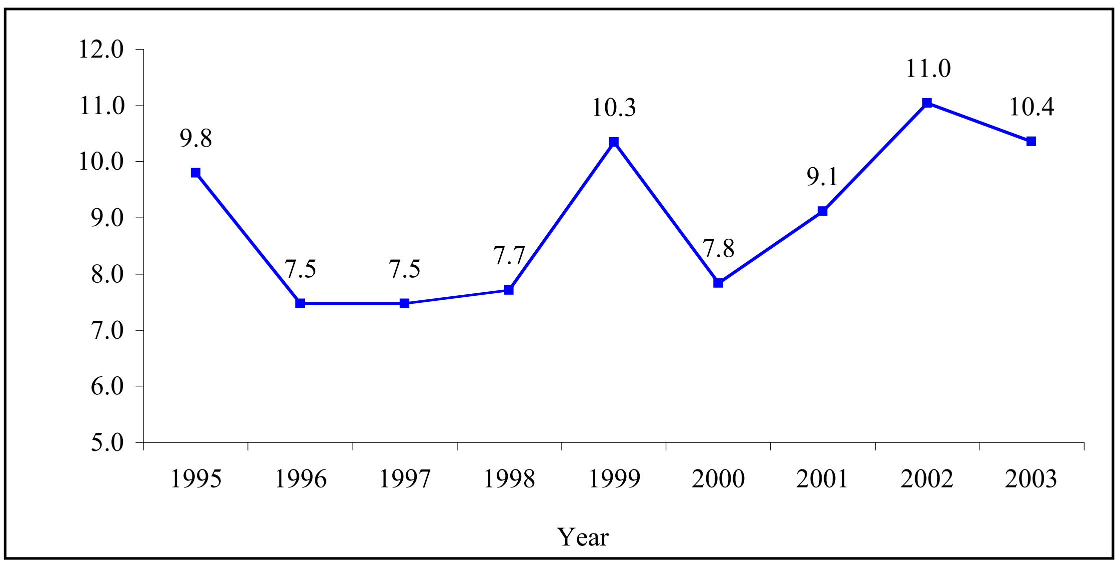
Figures 14-18 and 14-19 below depict the total expenditures of two key governmental management institutions relevant to fisheries in Nova Scotia—the federal Department of Fisheries and Oceans (DFO) and the provincial Department of Fisheries and Aquaculture (NSDFA). Figure 14-18, based on a 2005 study by Gardner Pinfold on the *Economic Value of the Nova Scotia Ocean Sector*, shows that DFO expenditures in Nova Scotia decreased steadily through the mid- to late 1990s before jumping sharply in 2000 by $60 million, and then decreasing from 2000 to 2003. Based on the same study, Figure 14-19 indicates that NSDFA expenditures have fluctuated up and down, but showed an overall increasing trend between 1996 and 2003.

Figure 14-18. DFO total expenditures ($2003 millions), Nova Scotia, 1995–2003



Source: Gardner Pinfold (2005).

Figure 14-19. NSDFA total expenditures ($2003 millions), Nova Scotia, 1995–2003



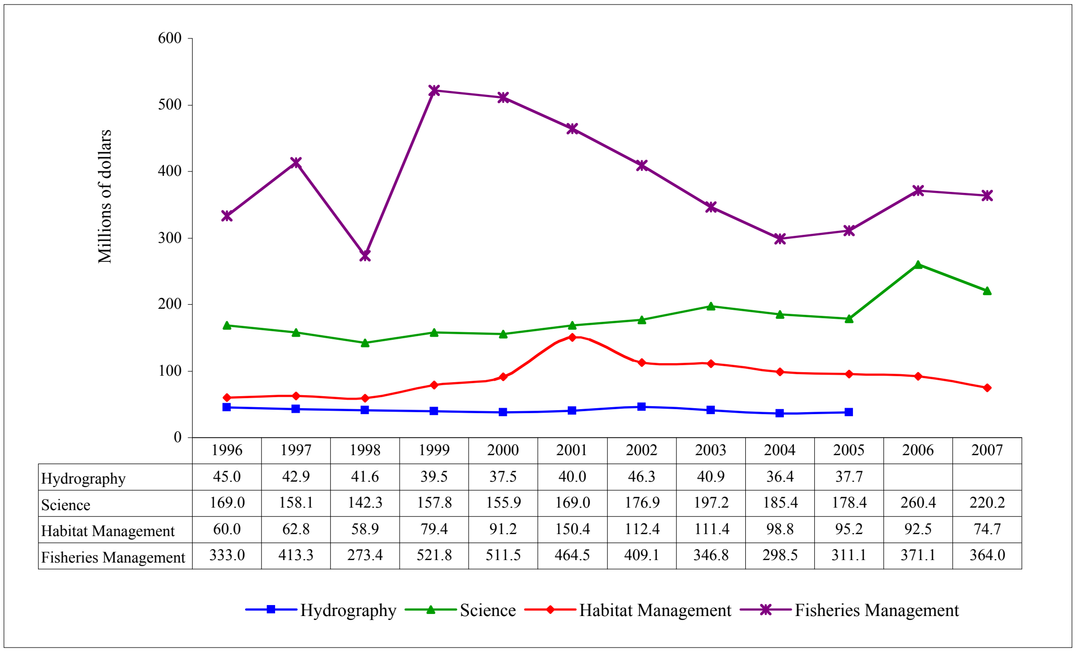
Source: Gardner Pinfold (2005).

Figure 14-20 below depicts DFO's national expenditures (in constant dollars) for specific scientific and management activities, in order to provide an indication of DFO's spending priorities. (A similar breakdown of DFO's expenditures specifically for the waters off Nova Scotia would be desirable for the purposes of this provincial-level GPI, but such a provincial breakdown was not available to the authors.)

Most notably, expenditures on fisheries management rose in the second half of the 1990s—to more than half a billion dollars nationwide ($2007)—and then declined steadily and considerably (by more than 40%) from 1999 to 2004. Between 2004 and 2007, DFO fisheries management expenditures rose somewhat but have remained well below levels of earlier in the decade.

Expenditures on science show a generally increasing trend over the period since the late 1990s, rising from $142 million in 1998 to more than $200 million in 2007, while spending on habitat management and hydrology remained relatively stable between 1996 and 2007 (Figure 14-20).

Figure 14-20. DFO expenditures by category ($2007 millions), Canada, 1996–2007



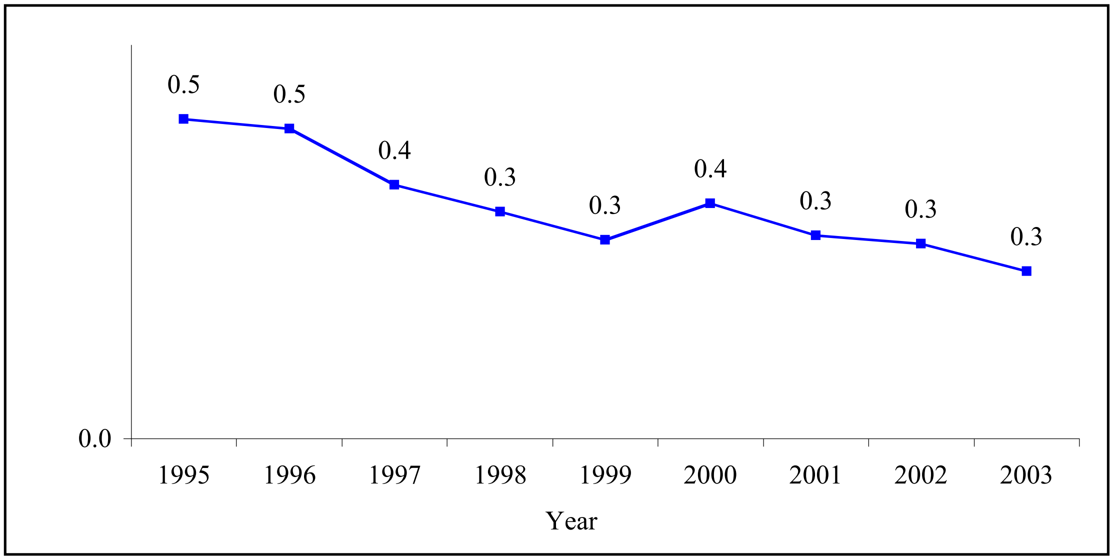
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Hydrography	45.0	42.9	41.6	39.5	37.5	40.0	46.3	40.9	36.4	37.7		
Science	169.0	158.1	142.3	157.8	155.9	169.0	176.9	197.2	185.4	178.4	260.4	220.2
Habitat Management	60.0	62.8	58.9	79.4	91.2	150.4	112.4	111.4	98.8	95.2	92.5	74.7
Fisheries Management	333.0	413.3	273.4	521.8	511.5	464.5	409.1	346.8	298.5	311.1	371.1	364.0

Source: Treasury Board of Canada Secretariat (2008).

While the above indicators show overall dollar expenditures by the federal and provincial departments responsible for fisheries management, it is also helpful to relate that spending to concrete fishery and environmental benefits. Thus, Figures 14-21 and 14-22 below compare governmental spending on fisheries and oceans with the total landed value of fish in Nova Scotia, showing the ratio of the two measures.

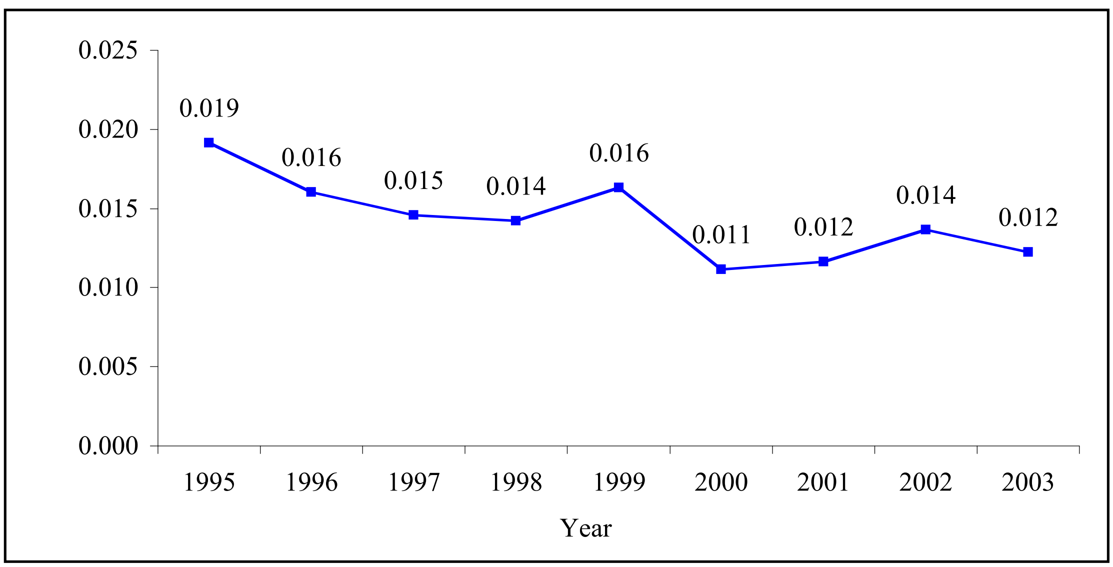
Figure 14-21 illustrates, for example, that total DFO expenditures in Nova Scotia amounted to about 50% of the total landed value of the province's fishery in 1995 before declining steadily to 25% in 2003. Figure 14-22 shows that the ratio of NSDFA expenditures to the province's total fishery landed value also declined between 1995 and 2003—from 2% to about 1.25%.

Figure 14-21. DFO expenditures as a proportion of the province's fishery landed value, Nova Scotia, 1995–2003



Sources: DFO (2008a); Gardner Pinfold (2005).

Figure 14-22. NSDFA expenditures as a proportion of the province's fishery landed value, Nova Scotia, 1995–2003



Sources: DFO (2008a); Gardner Pinfold (2005).

While these ratio indicators provide a preliminary sense of the more complete indicators that might eventually be developed for monitoring institutional sustainability, it must be highlighted that there are a number of difficulties with these measures. First, from a technical point of view,

1) available expenditure data do not fully match spending on management and scientific activities, 2) the landed value measure does not fully reflect the wide range of benefits obtained from the fishery or the marine environment, and 3) changes in the ratios have at least as much to do with changing fish prices as with changes in the operation of fishery management. For these reasons, considerable caution must be exercised in any effort to use either the expenditure data or the ratios as potential proxies for institutional management capacity.

Second, an even more fundamental problem in interpreting these indicators is that it is not clear whether a downward or an upward direction in the indicators is more desirable. On the one hand, the lower the indicator value (for both actual expenditures and as a proportion of fishery landed value), the more "efficient" each dollar spent by government might be considered to be in producing economic benefits to the fishery. If economic benefits can be produced with minimal government spending, this might be taken as meaning that the indicator trends of recent years are desirable.

On the other hand, a higher indicator value, particularly for total government expenditures on fisheries and oceans, might imply the assignment of higher priority to good management and monitoring. From that perspective—and relative to the economics of a single sector (the fishery)—higher governmental expenditures might provide better opportunities to improve our understanding of the ocean environment and to improve ocean management.

These difficulties in applying expenditure data to assessments of institutional sustainability indicate that monetary measurements alone cannot adequately account for society's intrinsic interest in learning about and protecting the ocean. Nor can they indicate the value of ocean and fisheries management by comparison with the value of governmental management, data collection, and research in other sectors besides the fishery. In other words, there is an opportunity cost to fisheries expenditures, and this cost cannot be properly assessed when fisheries expenditures are examined as a proportion of economic benefits solely within that single sector.

Overall, therefore, a more inclusive measure of institutional capacity and sustainability in the fishery is required. Such a measure might assess management and conservation efforts against the benefits these efforts produce through a comprehensive benefit–cost analysis that incorporates social and environmental benefits and costs.

14.11. Conclusion

Fisheries and marine environments are extraordinarily complex and uncertain. As a result, progress toward achieving their sustainable use requires a multi-dimensional, systematic approach that considers ecological, socio-economic, and institutional perspectives (Charles 2001, 2005). Events such as the collapse of the groundfish fishery in Nova Scotia demonstrate that a reliance on conventional measures (such as the fishery GDP) can send misleading signals to managers and policy makers that cause them to believe that marine resources are being used sustainably, when indeed, there are severe problems that threaten the ecological, social, and economic wellbeing of the fishery, and therefore, of the province itself.

The select key indicators from the *GPI Fisheries and Marine Environment Accounts* included in this chapter measure important aspects of our fisheries and of the marine environment from ecological, socio-economic, and institutional perspectives. While a number of conventional measures are included, the chapter has also considered cutting-edge indicators that examine previously neglected social and ecological aspects of fisheries and the marine environment. The ecological indicators assess the state of both target and non-target marine species, the relationship between fisheries and marine ecosystems and food webs, and the quality of the marine environment as a whole. Socio-economic indicators include conventional measures such as GDP and employment, but also important measures of community resilience such as the age distribution of fishers. Finally, and with major caveats, government departmental expenditures provide a simple, preliminary institutional indicator relating to management of the fisheries and the marine environment. In seeking to keep the number of these key indicators to the essential minimum, it is certainly the case that what is presented here reflects only a sample of possible indicators of health and sustainability for fisheries and the marine environment (additional indicators may be found in the full *GPI Fisheries and Marine Environment Accounts*).

This analysis strives for a rough balance between ecological and social indicators. While there are somewhat more indicators dealing with fish stocks and marine ecosystems, and while ecological sustainability is undoubtedly a critical dimension of sustainable development, at the same time socio-economic and institutional indicators are recognized as essential to a genuinely sustainable fishery. However, there continues to be a challenge in obtaining sufficient socio-economic and institutional data to develop appropriate indicators in these areas. Indeed, the very paucity of available and appropriate data in these fields points to an obvious need for more research in this area (cf. Boyd and Charles 2006). Fulfilling this need should be an important component of future efforts in Nova Scotia and more broadly (including initiatives to advance the *GPI Fisheries and Marine Environment Accounts*).

What, then, is the “bottom line” message about the current state of Nova Scotia’s fisheries and marine environment arising out of the key indicators described in this chapter? Before drawing some conclusions, we note that each indicator tells a story, and there is a need to assess and understand the particular nuances of that story; it makes no sense to merely “sum up” results across all of the indicators. Furthermore, we cannot expect that all the indicators will point in the same direction—for example, what is true of one fish stock does not necessarily hold for all. Some indicators point to low or no levels of sustainability, others illustrate a strong trend in the right direction, and many others show no clear trend over time. Thus, the overall picture is a complex one, and we must be cautious in interpreting the results.

Having said this, there are some crucial features in the results here that raise significant concerns. First, consider the ecological perspective. The fish stock indicators show clear examples of biomass, natural capital, and fish condition being managed unsustainably. Furthermore, 1) ecological resilience is threatened as Nova Scotia “fishes down the food chain” with the catch focusing on decreasing trophic levels, 2) several marine species at risk remain in danger of extirpation or extinction, and 3) deterioration in marine environmental quality is illustrated through increasing shellfish closures. This is not a positive situation in terms of ecological trends.

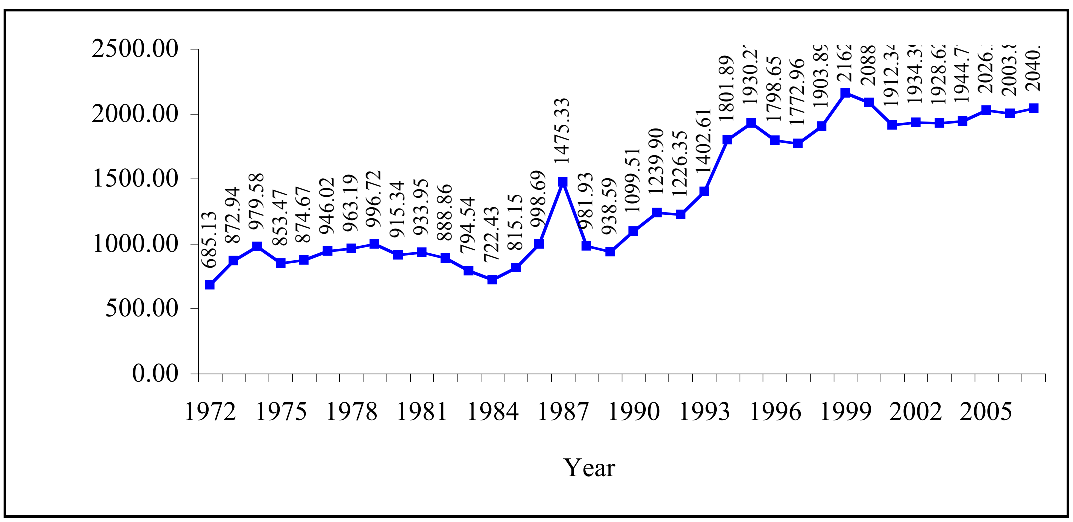
Second, the social perspective shows there are negative signals concerning the resilience of Nova Scotia's fishery, with a major shift in the age structure of the fishing population (less youth, more older fishers). There are also concerns about equity in the fishery, as indicated by a comparison of two indicators: a decrease in employment and a rising fishery GDP. This means fewer Nova Scotians are sharing the growing monetary output from the fishery.

Clearly, these concerns must be addressed by those responsible for fishery management and ocean conservation. Moreover, the very fact that a comprehensive indicator framework such as that presented here can help identify fisheries and marine concerns points to the need to institutionalize such a system and to regularly monitor a wide variety of indicators. This is imperative if we are to move toward genuinely sustainable fisheries and healthy marine environments in Nova Scotia.

Note to Reader: Please see Section 23.2 for additional references.

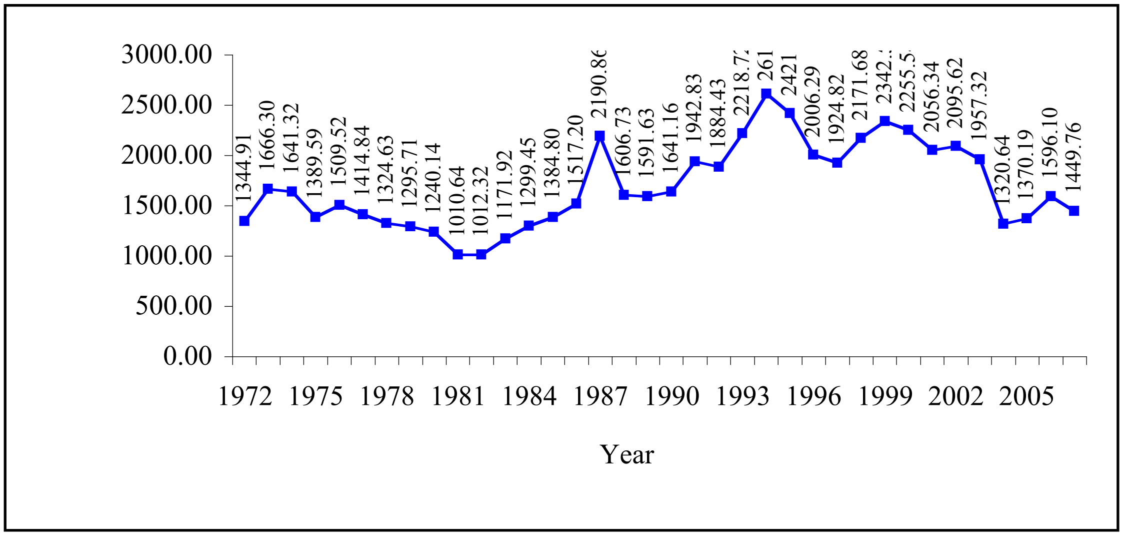
14.12. Appendix figures and tables

Appendix Figure 14-1. Cod prices per metric tonne ($2007), Nova Scotia, 1972–2007



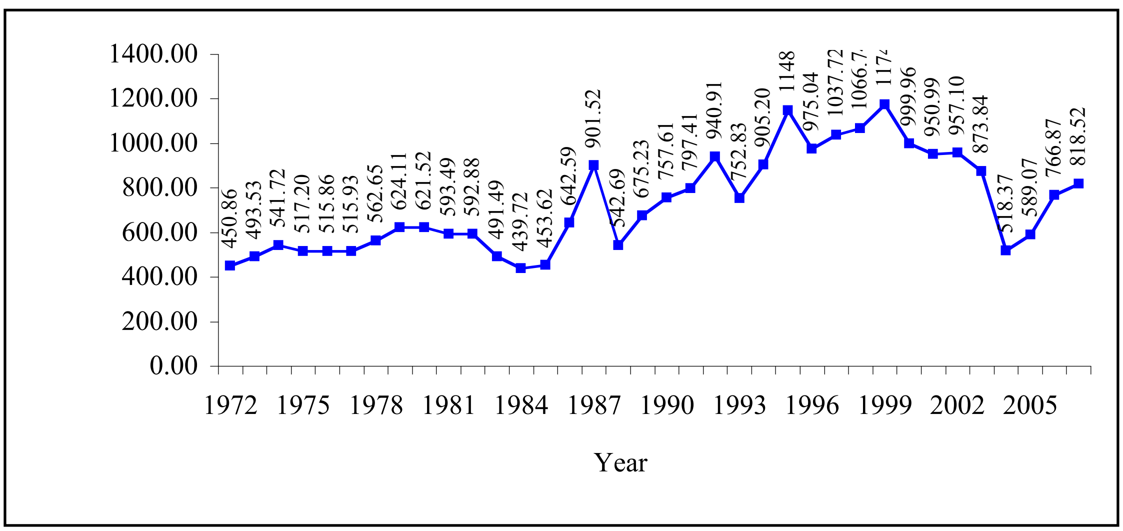
Sources: DFO (2008a); DFO (2008b).

Appendix Figure 14-2. Haddock prices per metric tonne ($2007), Nova Scotia, 1972–2007



Sources: DFO (2008a); DFO (2008b).

Appendix Figure 14-3. Pollock prices per metric tonne ($2007), Nova Scotia, 1972–2007



Sources: DFO (2008a); DFO (2008b).

Appendix Table 14-1. Size trends across cod populations (kilograms), waters around Nova Scotia, 1960–2006

Year	5Zjm	4X - Fundy	4X - Scotia	4VsW	Gulf	Year	5Zjm	4X - Fundy	4X - Scotia	4VsW	Gulf
1960	n/a	n/a	n/a	n/a	0.35	1984	2.45	1.62	1.30	0.740	0.27
1961	n/a	n/a	n/a	n/a	0.31	1985	2.09	1.48	1.07	0.710	0.32
1962	n/a	n/a	n/a	n/a	0.36	1986	2.45	1.41	1.13	0.680	0.27
1963	n/a	n/a	n/a	n/a	0.38	1987	2.50	1.57	1.40	0.480	0.25
1964	n/a	n/a	n/a	n/a	0.40	1988	2.36	1.46	1.30	0.630	0.30
1965	n/a	n/a	n/a	n/a	0.40	1989	2.27	1.52	1.57	0.770	0.28
1966	n/a	n/a	n/a	n/a	0.39	1990	2.46	1.69	1.29	0.760	0.33
1967	n/a	n/a	n/a	n/a	0.45	1991	2.55	1.88	1.13	0.770	0.27
1968	n/a	n/a	n/a	n/a	0.41	1992	2.46	1.73	1.14	0.630	0.30
1969	n/a	n/a	n/a	n/a	0.44	1993	2.31	1.73	1.21	0.570	0.30
1970	n/a	n/a	n/a	n/a	0.42	1994	2.41	1.74	1.09	0.690	0.31
1971	n/a	n/a	n/a	0.488	0.41	1995	2.51	1.77	1.23	0.690	0.25
1972	n/a	n/a	n/a	0.803	0.39	1996	2.36	1.63	1.17	0.662	0.34
1973	n/a	n/a	n/a	0.740	0.34	1997	2.23	1.65	1.30	0.512	0.22
1974	n/a	n/a	n/a	0.684	0.46	1998	2.37	1.84	1.02	1.032	0.30
1975	n/a	n/a	n/a	0.585	0.30	1999	2.29	1.94	1.72	0.759	0.28
1976	n/a	n/a	n/a	0.549	0.26	2000	2.13	2.07	1.20	0.958	0.32
1977	n/a	n/a	n/a	0.730	0.34	2001	2.33	2.00	1.52	0.897	0.32
1978	2.46	n/a	n/a	0.932	0.33	2002	2.27	1.92	1.26	n/a	0.27
1979	2.15	n/a	n/a	0.681	0.26	2003	2.15	2.30	1.37	n/a	0.26
1980	2.47	n/a	n/a	0.795	0.35	2004	2.03	1.77	1.25	n/a	0.21
1981	2.36	n/a	n/a	0.789	0.30	2005	1.72	1.74	1.47	n/a	0.30
1982	2.66	n/a	n/a	0.773	0.28	2006	1.76	n/a	n/a	n/a	0.24
1983	2.38	1.48	1.22	0.772	0.26						

15. Air Emissions, Air Quality, and Impacts

For the original GPI Atlantic report on air quality, please see the following:

The Ambient Air Quality Accounts for the Nova Scotia Genuine Progress Index (2004)
http://gpiatlantic.org/pdf/airquality/airquality.pdf

Headline Indicators

1. Criteria Air Contaminant emissions
2. Ambient air quality
3. Economic costs of air pollution

15.1. Introduction

The atmosphere supports the lives and activities of human beings and of millions of other species of plants and animals. Despite its vastness, even the farthest reaches of the atmosphere, such as the ozone layer in the upper atmosphere, have become contaminated and altered through pollution, partly from natural causes but primarily as a result of the activity of a single species—human beings. The air we breathe is, therefore, never completely unpolluted, and contains elevated levels of dust particles, pollen, fibrous minerals, ash, and gases and compounds such as sulphur oxides, nitrogen oxides, ozone, carbon monoxide, and organic gases and vapours.

Without clean air, we can expect ongoing damage to our ecosystems, our health, and our economy. Air pollutants are known to have substantial impacts on the health of waterways, the productivity of forests, and agricultural crop yields. They also reduce visibility through haze formation that impacts our enjoyment and experience of our environment.

Extensive research in the last two decades has established a strong correlation between air pollution and many health ailments. Statistics show that more people die and are admitted to hospital for heart and lung problems on days with elevated levels of air pollution, and that people do not live as long in cities with high levels of air pollution.[1] If air pollution increases susceptibility to sickness, as the evidence clearly indicates, then it also contributes to the social and monetary cost of caring for those affected, and it correspondingly diminishes individual quality of life.

The Ontario Medical Association (OMA) conservatively estimated that air pollution cost Ontario's health-care system and economy more than $1 billion in 2000, and resulted in approximately 1,900 deaths. As well, 9,800 hospital admissions, 13,000 emergency room visits, and 47 million minor illness days were attributed to anthropogenic (human-induced) air pollutants in 2000. The health damages were estimated to be about $600 million in direct health-care costs and another $560 million in losses to employers and employees. The OMA estimated an additional $5 billion in costs for pain and suffering and $4 billion for loss of life, for a total annual economic loss to Ontario of $10 billion in 2000, rising to a predicted $12 billion by 2015.[2]

Apart from the direct physical damage by air pollution to health, the environment, and materials, the available evidence also points to known, less tangible, pollution-induced economic costs related to lost productivity, diminishing availability of natural resources, and social disruption, which must also be taken into account when assessing the overall effect of air pollution on human society and on the planet.

Given the growing body of publicized evidence on the impacts of air pollution, it is not surprising that air quality is a major concern for Canadians. In a poll conducted by PwC Consulting, approximately "one-third of respondents across Canada said they felt that their health has been affected by the quality of air in the area where they worked or lived."[3] The survey also found that 85% of Canadians believe the government should have stricter regulations regarding air pollution.

One key goal of GPI Atlantic's 2004 *Ambient Air Quality Accounts for Nova Scotia* was to produce a basic ratio between unit changes in ambient air pollution and costs, so that policy makers could, in a simple way, be provided with a snapshot of this full range of environmental human health and economic costs associated with poor air quality. This indicator summary report updates both the key air quality and pollutant emission trends in Nova Scotia and the estimates of air pollution damage costs contained in that first GPI air quality report, and attempts to assess whether or not the province is moving toward sustainability and genuine progress in the area of air quality.

Indicators of Progress

Two key indicators are used to provide an overview of progress on air quality and to highlight the impacts of poor air quality in Nova Scotia:

Indicator 1: Criteria Air Contaminant emissions. The trend in total emissions of Criteria Air Contaminants (CACs) in Nova Scotia is an important indicator because it demonstrates how the province has controlled and managed emissions that are within its control over time. In total, emissions of seven CACs plus mercury are presented here to update the 2004 GPI air quality results using the most recently available data.

Indicator 2: Ambient air quality. Ambient air quality refers to pollutant concentrations to which the general population is exposed. Improvements in ambient air quality can also reduce potential environmental damage resulting from exposure to air pollution (like acid rain damage to lakes and forests, for example).

Ambient air quality within Nova Scotia and the impacts of air pollutants on Nova Scotia's population and environment can be attributed to emission sources both within and outside the province. In other words, Nova Scotians have some ability to affect the quality of their own air by reducing domestic emissions, yet still suffer health and environmental impacts due to pollutant emissions from elsewhere, since air pollutants can be carried thousands of miles by prevailing winds. Nova Scotia is particularly susceptible to such transboundary air pollution from central Canada and the US. This summary updates ambient air quality trends from the 2004 GPI report using the most recently available data.

A third indicator is then provided as a way of expressing the scale of the importance of the previous indicators, and of quantifying pollutant-related impacts and costs:

Indicator 3: Cost of air pollution—economic valuation. This indicator uses a mathematical relationship between air pollutant emissions and ambient air quality and the associated impacts on human health and the environment to develop a partial estimate of the economic costs of air pollution. The estimate is only partial because we do not value all of the environmental damages of air pollution, and consider only the more objective and measurable impacts of particular pollutant emissions—omitting for example, the cost of pain and suffering due to pollution induced health problems, which constituted fully half of the OMA's comprehensive air pollution cost estimate for Ontario. However, the cost estimates do include selected environmental impacts like the acidification of lakes (which is due to sulphuric and nitric acid depositions (H_2SO_4 and HNO_3) forming in the atmosphere when sulphur and nitrogen oxide emissions combine with water in air).

In the damage cost approach, emissions and ambient air quality trigger human health and environmental impacts that are then assigned an economic cost. Here, we use updated emissions data for Nova Scotia as well as a forecast of emissions to 2015 in order to update the economic costs of air pollution in Nova Scotia originally estimated in the 2004 GPI report.

15.2. Criteria Air Contaminant emissions

15.2.1. Introduction

The air we breathe is never completely "pure" or unpolluted. Air contains water vapour; particles of dust, pollen, and ash; and gases and compounds such as sulphur dioxide (SO_2), nitrogen oxides (NO_X), ozone (O_3), and carbon monoxide (CO), all of natural origin. Air pollution occurs when there is a degradation of natural air quality resulting from chemicals or other materials occurring in the air. In polluted air, SO_2, NO_X, O_3, CO, particulate matter (PM), and organic gases and vapours are found at higher than natural levels. These increased concentrations result from anthropogenic or human activities (i.e., the pollutants are released into ambient air from stationary and mobile sources as a result of human activities).

Environment Canada and other government environmental agencies around the world have identified a group of air pollutants called “Criteria Air Contaminants” (CACs) to refer to specific air pollutants for which acceptable levels of exposure can be determined and for which ambient air quality objectives (or standards) have been established. There are seven air pollutants that are considered CACs in Canada.

Table 15-1 below briefly describes and identifies the common anthropogenic sources of these seven air pollutants. These seven CACs plus mercury constitute Indicators *a* through *h* for Criteria Air Contaminant emissions. Please see the appendix in Section 15.5 at the end of this chapter and the original 2004 GPI air quality report for a description of the available evidence on the known health and environmental effects of each of the following pollutants.

Table 15-1. Description of Criteria Air Contaminants (CACs) and mercury, and anthropogenic sources

<table>
<tr><th>CRITERIA AIR CONTAMINANT</th><th>DESCRIPTION</th><th>ANTHROPOGENIC SOURCES[1]</th></tr>
<tr><td>Indicator a.
Carbon Monoxide (CO)</td><td>• Colourless, odourless, and tasteless gas; toxic to humans in sufficient concentrations
• A product of incomplete combustion of fossil fuels (i.e., any combustion process where material is burned without sufficient oxygen)</td><td>• Industrial, including fossil fuel-based electricity generation; residential (e.g., fires, wood or gas stoves, etc.); and waste disposal</td></tr>
<tr><td>Indicator b.
Total Particulate Matter (TPM or PM) or Total Suspended Particulate (TSP)</td><td>• Any aerosol released to the atmosphere in either solid or liquid form which can be inhaled into the respiratory system (e.g., dust, soot, ash, fibre, and pollen)
• Total suspended particulate (TSP) and total particulate matter (TPM) generally used interchangeably</td><td rowspan="3">• Industrial processes, fuel combustion, transportation, and solid wastes</td></tr>
<tr><td>Indicator c.
Particulate Matter ≤10 microns (PM_{10})</td><td>• PM with diameters ≤10µm (PM_{10}) can remain suspended in the air for long periods of time
• Also called “thoracic particles,” since they can be inhaled into the thoracic (tracheobronchial and alveolar) regions of the respiratory system</td></tr>
<tr><td>Indicator d. Particulate Matter ≤2.5 microns ($PM_{2.5}$)</td><td>• PM with diameters ≤2.5µm ($PM_{2.5}$)</td></tr>
</table>

CRITERIA AIR CONTAMINANT	DESCRIPTION	ANTHROPOGENIC SOURCES[1]
Indicator e. Sulphur Dioxide (SO_2)	• Colourless gas with a pungent odour • Combines easily with water vapour in air to form sulphurous acid (H_2SO_3) or with oxygen in air to form corrosive sulphuric acid (H_2SO_4) • Forms a number of oxides but only SO_2 and sulphur trioxide (SO_3) are important as gaseous air pollutants	• Industrial processes and fossil-fuel burning; ore smelting; coal-fired electricity generation; petroleum refining; pulp and paper mills; incineration; and natural gas processing
Indicator f. Nitrogen Oxides (NO_X)	• Generic term for a group of highly reactive gases that contain nitrogen and oxygen in varying amounts • Nitric oxide (NO) and nitrogen dioxide (NO_2) are most important as gaseous air pollutants • NO_2 is a reddish brown gas with a characteristic pungent odour • In sunlight these substances can transform into acidic pollutants, e.g., nitrate (NO_3^-) and nitric acid (HNO_3)	• Combustion of fuels in motor vehicles, residential and commercial furnaces, industrial and electrical-utility boilers and engines, and other equipment • Various industrial processes and solid waste disposal
Indicator g. Volatile Organic Compounds (VOCs)	• A group of photochemically reactive hydrocarbon gases and vapours that tend to evaporate quickly at ordinary temperatures • Contain at least one carbon atom (excluding CO_2 and CO) • Thousands of organic compounds in the troposphere that meet the definition of a VOC • Also called Reactive Organic Gases (ROG) or Non-Methane Volatile Organic Compounds (N-MVOC)	• Incineration, industrial processes (e.g., petroleum refineries, petrochemical plants, plastics manufacturing), and transportation
Indicator h. Mercury (Hg)	• Naturally occurring element that is found in small concentrations in many rocks • Exists in several forms: elemental or metallic mercury, and inorganic or organic compounds	• Combustion of coal (primarily in the power generation sector), waste incineration, base metal smelting, and the chlor-alkali industry

Note: 1) "Anthropogenic" refers to contaminants emitted as a result of human activity.

15.2.2. Indicators

Data sources: Environment Canada. (2006) Emission Inventory Reports 1990-2005 and Baseline Projections for 2010 and 2015; Environment Canada, National Pollutant Release Inventory; OECD 2005 Environmental Data Compendium.

Results:
CO emissions have declined steadily since 1990, and are projected to reach about half of 1990 levels by 2015, but remain higher on a per capita basis in Nova Scotia than in other OECD countries.
TPM emissions declined by 42% from 1990 to 2005, but are projected to increase by about 50% from 2005 levels in the coming decade.
PM_{10} emissions declined by nearly 40% from 1990 to 2005 but are projected to increase by about 30% over the coming decade.
$PM_{2.5}$ emissions declined by one-third from 1990 to 1995, but have seen no further improvement since then and are projected to remain stable at 1995–2005 levels over the coming decade.
Sulphur oxide emissions declined by 22% from 1990 to 2005, and are projected to decrease by another third by 2010. Due, however, to its heavy reliance on coal for electricity generation, per capita SO_X emissions in Nova Scotia are more than double the Canadian average, higher than in all other provinces, and higher than in all of 30 reporting OECD countries—more than three times the level in the United States and more than 20 times that in Germany.
Nitrogen oxide emissions increased by over 20% between 2000 and 2005 to reach their highest level since the 1980s, but are forecast to decline by more than 40% from peak 2005 levels in the coming decade. Per capita NO_X emissions in Nova Scotia were about 10% above the Canadian average and higher than in all but one of 30 reporting OECD countries—65% above US levels and 5.5 times German levels.
Volatile organic compound (VOC) emissions declined by over 40% between 1990 and 2005, and are expected to remain stable at 2005 levels over the coming decade. Per capita VOC emissions in Nova Scotia were about 30% below the Canadian average but still higher than in all 30 OECD countries and more than three times the levels in Germany.
Hg: Coal-fired power generation account for more than 90% of recorded mercury emissions in Nova Scotia. Nova Scotia Power mercury emissions declined sharply between 2000 and 2002, have remained relatively stable since then, and are mandated to decrease by 70% from pre-2001 levels by 2010.

The trends in total emissions of each of the Criteria Air Contaminants (CACs) in Nova Scotia are important indicators as they demonstrate the degree to which the province has successfully controlled and managed emissions that are within its control over time. However, total emissions are not a strong indicator of the actual ambient air quality that leads to environmental and human health impacts. This is because ambient air quality depends on many additional factors, some of which are not within the province’s control, including:

- Cross-boundary air pollution that is emitted in other jurisdictions but impacts Nova Scotia when it is transported by prevailing winds, particularly from central Canada and northeast United States
- Dispersion of pollutants from the source of emissions
- Chemical interactions in the atmosphere

That said, Nova Scotia does have a strong motivation to become a leader in reducing overall air pollutant emissions as this can contribute to improved air quality and set an example to other jurisdictions whose actions, in turn, can help reduce local air pollution problems. Indeed, in pursuit of its stated objective to "achieve international recognition for having one of the cleanest and most sustainable environments in the world by the year 2020," Nova Scotia's April 2007 Environmental Goals and Sustainable Prosperity Act includes the following specific pollutant emission reduction targets:

- Emissions of nitrogen oxides will be reduced by 20% by the year 2009 relative to emissions in the year 2000
- Sulphur dioxide emissions will be reduced by 50% by the year 2010 from sources existing in 2001
- Mercury emissions will be reduced by 70% by the year 2010 relative to 2001 levels
- The province will meet the Canada-wide Standards (CWSs) established by the Canadian Council of Ministers of the Environment for airborne fine-particulate matter and ground-level ozone by the year 2010[4]

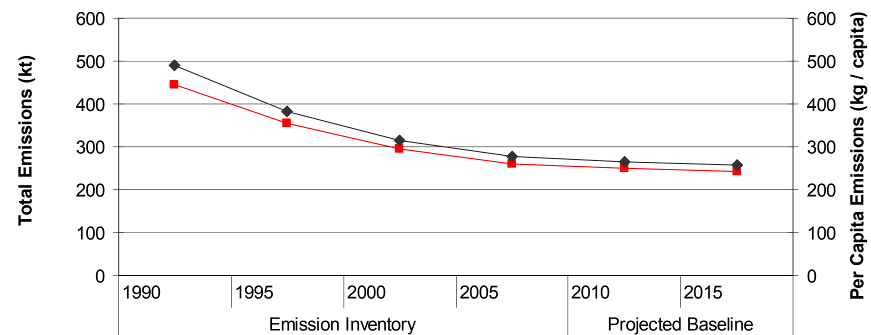
The following eight sections are organized to provide emissions data on each of the seven CACs—namely CO, TPM, PM_{10}, $PM_{2.5}$, SO_X, NO_X, VOCs—plus mercury. Within each section, the first figure presented indicates trends in total and per capita emissions for each pollutant for Nova Scotia for 1990-2005, with projections to 2015. Existing emissions data were collected for the years 1990, 1995, 2000, and 2005, and linearly interpolated to show the historical trend in emissions during this period. Future emission projections are based on emission estimates for the years 2010 and 2015 from Environment Canada's Common Air Contaminants Baseline Forecast.

The estimated emissions are presented both as total emissions in kilotonnes (kt) and as per capita emissions (kilograms/capita). Future population projections are based on Natural Resources Canada's Canadian Energy Outlook, 2006. Figures are also presented in each section to indicate the breakdown of total emissions by sector in Nova Scotia for the year 2005. Comparisons of per capita Nova Scotia emissions with those in Canada, as well as selected provinces and OECD countries, are provided for some indicators.

Carbon Monoxide (CO)

Trends in the estimated CO emissions for Nova Scotia between 1990 and 2005, projected forwards to 2015 using Environment Canada forecasts, are presented in Figure 15-1 below. The overall trend over the 25-year period (1990–2015) indicates declining total and per capita emissions. It is projected that, by 2015, total CO emissions will be just over half of what they were in 1990.

Figure 15-1. Total CO emissions (kilotonnes (kt)), Nova Scotia, 1990–2015



	1990	1995	2000	2005	2010	2015
Total Emissions (kt)	445	356	294	259	249	242
Nova Scotia Per Capita Emissions (kg/capita)	489	384	315	277	264	256

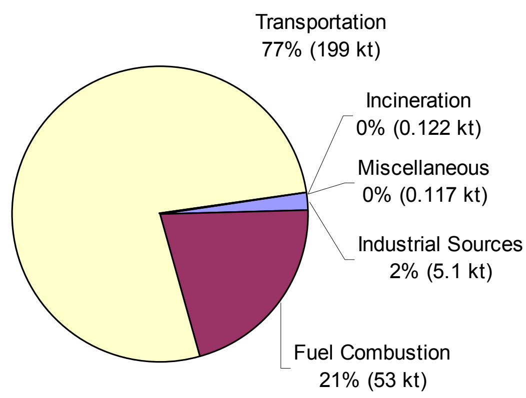
Year

Source: Environment Canada. (2006) Emission Inventory Reports 1990-2005 and Baseline Projections for 2010 and 2015. Available from http://www.ec.gc.ca/pdb/cac/Emissions1990-2015/emissions_e.cfm. Accessed October 2008.

Note: Data exclude emissions associated with open sources such as road dust and natural sources such as biogenics and forest fires.

Figure 15-2 below provides a breakdown of CO emissions released in Nova Scotia in 2005 by major sector. As shown in the figure, transportation sources were by far the largest contributor to CO emissions in Nova Scotia (77% of total emissions). Within this sector, light duty gasoline cars and trucks and the use of gasoline in off-road vehicles were responsible for the overwhelming majority (95%) of transport-related CO emissions. Non-industrial fuel combustion in Nova Scotia was responsible for 21% of total CO emissions in the province, with residential fuel wood combustion contributing the majority of these emissions.

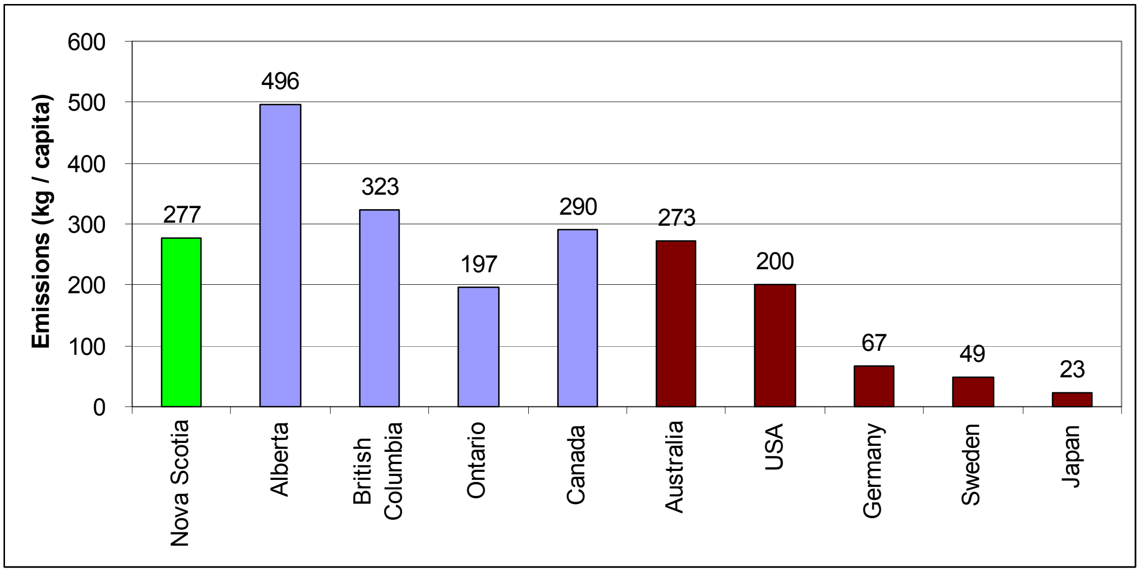
Figure 15-2. CO emissions (kt and %), by major sector, Nova Scotia, 2005



Source: Environment Canada 2005 Air Pollutant Emission Inventory, Version 2, April 8th, 2008

Figure 15-3 below provides a comparison of per capita emissions in Nova Scotia in 2005 to other selected provinces in Canada, the Canadian average, and several OECD countries. Per capita CO emissions in Nova Scotia were close to the Canadian average but higher than the average per capita emissions of other OECD countries. Canada had the highest per capita CO emissions of all 30 OECD countries that reported their CO emissions—45% above US levels, more than four times higher than Germany, and nearly six times more than Sweden.

Figure 15-3. CO emissions per capita (kg), Nova Scotia, Canada, select provinces, and OECD countries, 2005

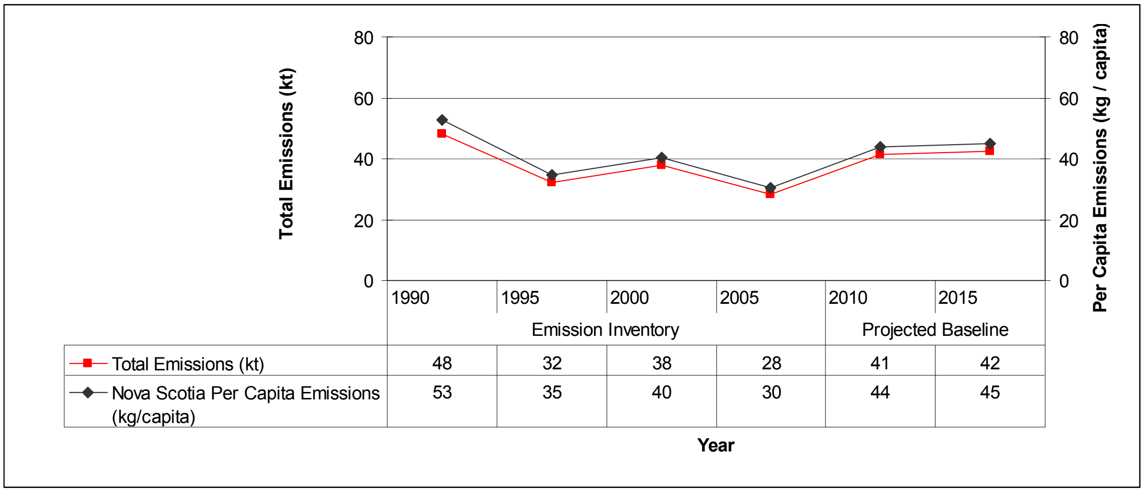


Source: Environment Canada 2005 Air Pollutant Emission Inventory, Version 2, April 8th, 2008 and OECD 2005 Environmental Data Compendium. Available from http://www.oecd.org/document/49/0,3343,en_2649_34283_39011377_1_1_1_1,00.html. Accessed October 2008.

Total Particulate Matter (TPM)

Past and future projected trends in the estimated TPM emissions for Nova Scotia are presented in Figure 15-4 below. The overall trend over the 25-year period (1990-2015) indicates marginally declining per capita emissions as well as total TPM emissions between 1990 and 2005. However, Environment Canada's future baseline projections indicate that Nova Scotia's TPM emissions are likely to increase by about 50% from 2005 levels in the coming decade, returning to approximately the same levels as in 2000.

Figure 15-4. Total particulate matter (TPM) emissions (kt), Nova Scotia, 1990–2015



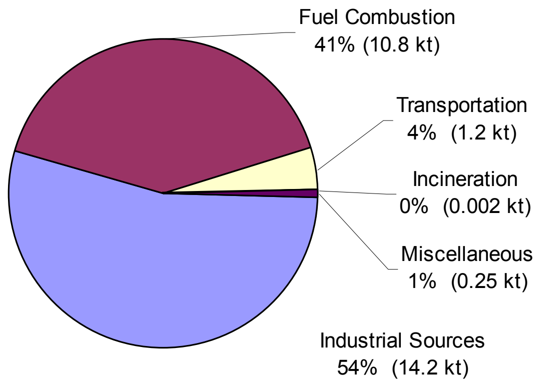
	1990	1995	2000	2005	2010	2015
Total Emissions (kt)	48	32	38	28	41	42
Nova Scotia Per Capita Emissions (kg/capita)	53	35	40	30	44	45

Source: Environment Canada. (2006) Emission Inventory Reports 1990-2005 and Baseline Projections for 2010 and 2015. Available from http://www.ec.gc.ca/pdb/cac/Emissions1990-2015/emissions_e.cfm. Accessed October 2008.

Note: Data exclude emissions associated with open sources such as road dust and natural sources such as biogenics and forest fires.

Figure 15-5 below provides a breakdown of TPM emissions released in Nova Scotia in 2005 by major sector. As shown in the figure, industrial sources were the largest contributor to TPM emissions in Nova Scotia (54% of total emissions) followed by non-industrial fuel combustion (41% of total emissions). The leading industrial sources of TPM emissions were mining and rock quarrying (58% of industrial emissions), as well as the asphalt paving industry, cement and concrete industry, and pulp and paper industry.

Figure 15-5. TPM emissions (kt and %), by major sector, Nova Scotia, 2005

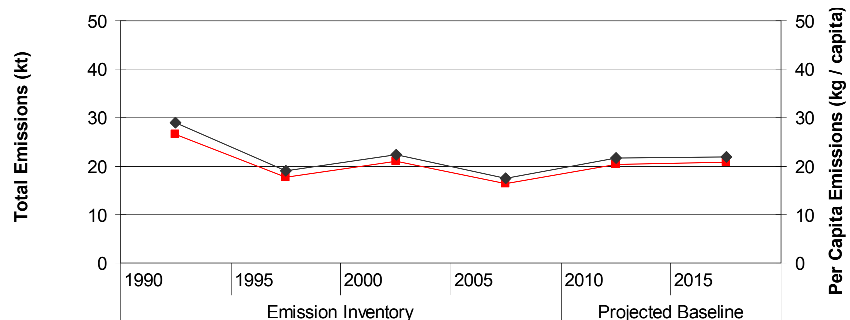


Source: Environment Canada 2005 Air Pollutant Emission Inventory, Version 2, April 8th, 2008

Particulate Matter ≤10 Microns (PM_{10})

Trends in the estimated PM_{10} emissions for Nova Scotia for the years 1990–2015 are presented in Figure 15-6 below. The overall trend over the 25-year period (1990–2015) indicates marginally declining total and per capita PM_{10} emissions between 1990 and 2005. Environment Canada's future baseline projections point to a likely 31% increase in Nova Scotia's PM_{10} emissions from 2005 levels over the coming decade.

Figure 15-6. Total PM_{10} emissions (kt), Nova Scotia, 1990–2015



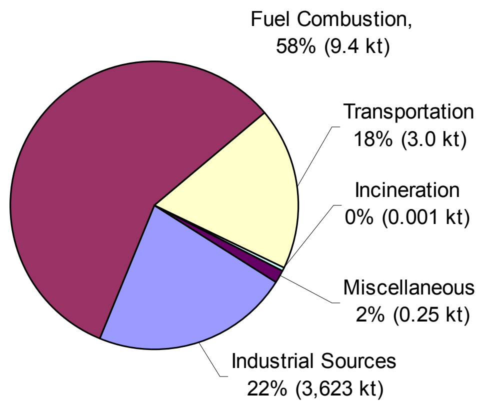
	1990	1995	2000	2005	2010	2015
	Emission Inventory				Projected Baseline	
Total Emissions (kt)	26	18	21	16	20	21
Nova Scotia Per Capita Emissions (kg/capita)	29	19	22	18	22	22

Source: Environment Canada. (2006) Emission Inventory Reports 1990-2005 and Baseline Projections for 2010 and 2015. Available from http://www.ec.gc.ca/pdb/cac/Emissions1990-2015/emissions_e.cfm. Accessed October 2008.

Note: Data exclude emissions associated with open sources such as road dust and natural sources such as biogenics and forest fires.

Figure 15-7 below provides a breakdown of PM_{10} emissions released in Nova Scotia in 2005 by major sector. While the breakdown is somewhat similar to that for TPM shown in Figure 15-5 above, the importance of non-industrial fuel combustion was considerably greater for PM_{10} (58% of total PM_{10} emissions compared to 41% of TPM emissions) and the contribution of industrial sources was considerably smaller (22% of PM_{10} emissions versus 54% of TPM emissions). The leading non-industrial source of PM_{10} emissions was residential fuel wood combustion (86% of non-industrial fuel combustion emissions). While transportation accounted for only 4% of TPM emissions, it accounted for 18% of PM_{10} emissions.

Figure 15-7. TPM emissions (kt and %), by major sector, Nova Scotia, 2005

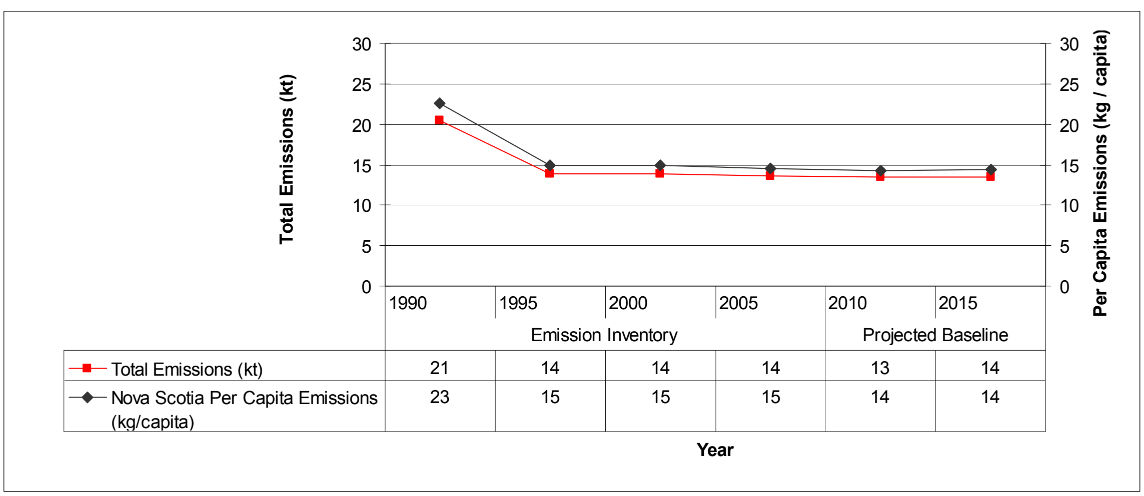


Source: Environment Canada 2005 Air Pollutant Emission Inventory, Version 2, April 8th, 2008

Particulate Matter ≤2.5 Microns ($PM_{2.5}$)

Trends in the estimated $PM_{2.5}$ emissions for Nova Scotia are presented in Figure 15-8 below. The overall trend over the 25-year period (1990-2015) indicates a sharp one-third decline in total and per capita $PM_{2.5}$ emissions between 1990 and 1995 and no further improvement since then. Environment Canada's future baseline projections also indicate that emissions are unlikely to decline further over the coming decade from the stable 1995-2005 levels.

Figure 15-8. Total $PM_{2.5}$ emissions (kt), Nova Scotia, 1990–2015



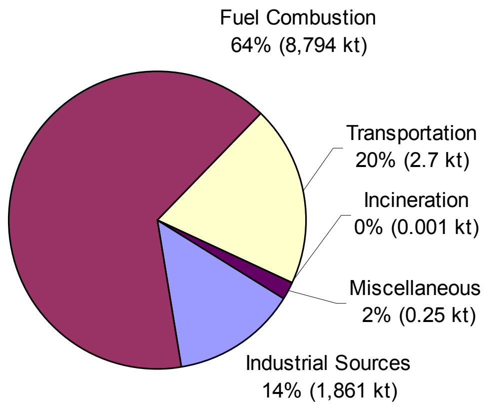
	1990	1995	2000	2005	2010	2015
Total Emissions (kt)	21	14	14	14	13	14
Nova Scotia Per Capita Emissions (kg/capita)	23	15	15	15	14	14

Source: Environment Canada. (2006) Emission Inventory Reports 1990-2005 and Baseline Projections for 2010 and 2015. Available from http://www.ec.gc.ca/pdb/cac/Emissions1990-2015/emissions_e.cfm. Accessed October 2008.

Note: Data exclude emissions associated with open sources such as road dust and natural sources such as biogenics and forest fires.

Figure 15-9 below provides a breakdown of $PM_{2.5}$ emissions released in Nova Scotia in 2005 by major sector. While the breakdown is somewhat similar to that for PM_{10}, the importance of non-industrial fuel combustion was considerably larger (64% of total $PM_{2.5}$ emissions versus 58% of PM_{10} emissions) and the contribution of industrial sources was considerably smaller (14% versus 22% of total emissions). The leading non-industrial source of $PM_{2.5}$ emissions was residential fuel wood combustion (93% of non-industrial fuel combustion emissions).

Figure 15-9. $PM_{2.5}$ emissions (kt and %), by major sector, Nova Scotia, 2005



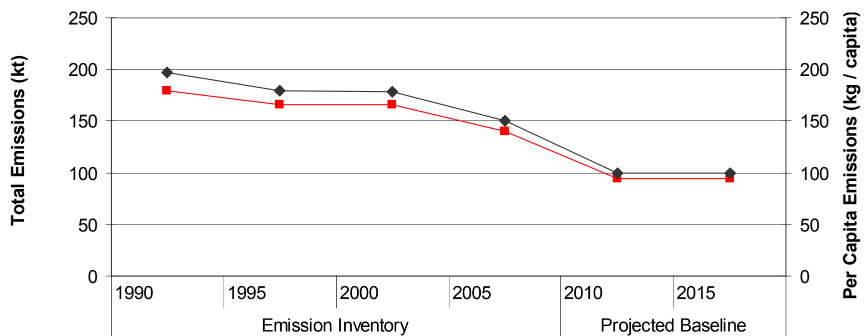
Source: Environment Canada 2005 Air Pollutant Emission Inventory, Version 2, April 8th, 2008

PM_{10} and $PM_{2.5}$ are of particular concern because they are "respirable" or "inhalable" particles and are classified as "toxic" under the 1999 Canadian Environmental Protection Act (CEPA).[5] PM_{10} exposure has been associated with excess mortality from cardiovascular and respiratory diseases, and long-term $PM_{2.5}$ exposure has been significantly associated with cardiopulmonary and lung cancer mortality. $PM_{2.5}$ particles, in particular, are deposited in the respiratory bronchioles and alveoli, and can cause a wide range of adverse health effects.[6]

Sulphur Oxides (SO_X)

Trends in the estimated SO_X emissions for Nova Scotia for the period 1990-2015 are presented in Figure 15-10 below. The overall trend over the 25-year period (1990-2015) indicates declining total and per capita SO_X emissions projected to 2010, with a levelling off thereafter. Between 2010 and 2015, Environment Canada projections indicate that Nova Scotia's SO_X emissions will be about half what they were in 1990.

Figure 15-10. Total SO_X emissions (kt), Nova Scotia, 1990–2015



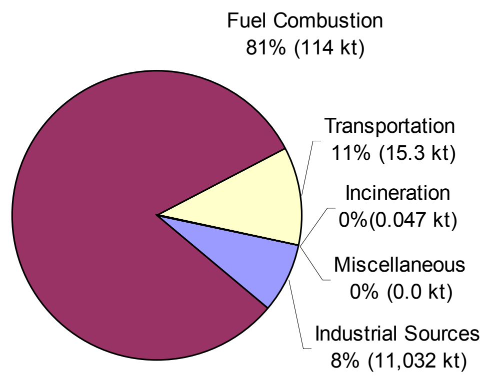
	1990	1995	2000	2005	2010	2015
Total Emissions (kt)	179	166	166	140	94	94
Nova Scotia Per Capita Emissions (kg/capita)	197	179	178	150	100	100

Source: Environment Canada. (2006) Emission Inventory Reports 1990-2005 and Baseline Projections for 2010 and 2015. Available from http://www.ec.gc.ca/pdb/cac/Emissions1990-2015/emissions_e.cfm. Accessed October 2008.

Note: Data exclude emissions associated with open sources such as road dust and natural sources such as biogenics and forest fires.

Figure 15-11 provides a breakdown of SO_X emissions released in Nova Scotia in 2005 by major sector. As shown in the figure, non-industrial fuel combustion sources were by far the largest contributor to SO_X emissions in Nova Scotia (81% of total emissions). Within this sector, electricity generation accounted for the vast majority of SO_X emissions (91% of non-industrial fuel combustion emissions and 74% of total emissions). Approximately 80% of the province's electricity in 2005 and 2006 came from eight coal-fired generating plants—the predominant source of SO_X emissions in Nova Scotia.

Figure 15-11. SO_X emissions (kt and %), by major sector, Nova Scotia, 2005



Source: Environment Canada 2005 Air Pollutant Emission Inventory, Version 2, April 8th, 2008

Given the importance of SO_X to total economic damages attributable to air pollutant emissions in Nova Scotia (accounting for about 40% to 50% of total damages—see Section 15.4 below), we provide more detail here on the drivers of SO_X emissions in Nova Scotia.

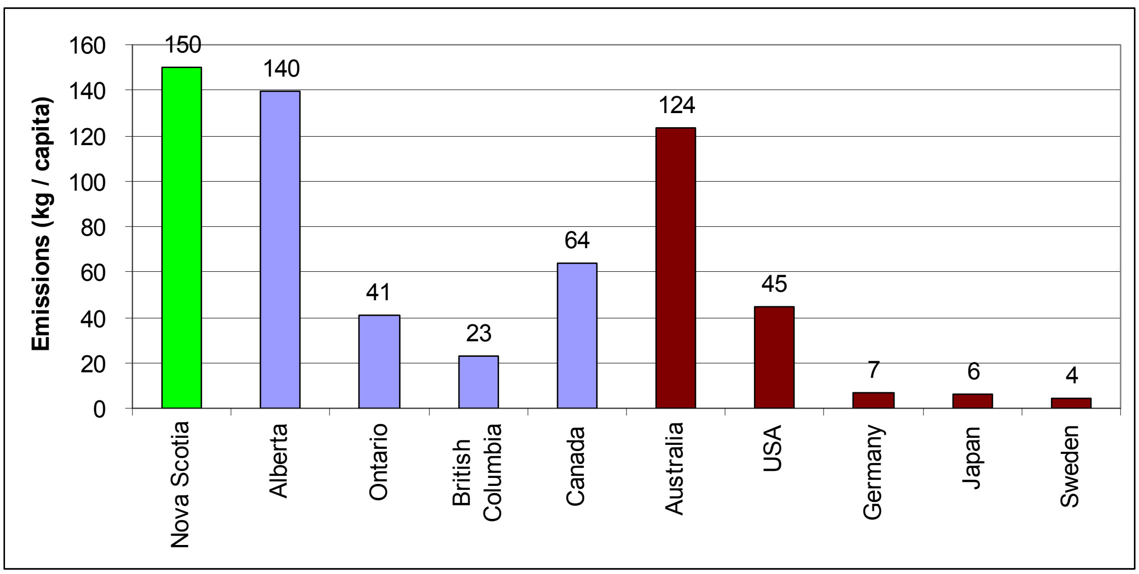
The 1991 Canada–United States Air Quality Agreement[7] contributed substantially to major nationwide reductions of sulphur dioxide (SO_2) emissions from power generation. In the first five years from 1991 to 1996, total Canadian emissions decreased from approximately 3 million tonnes to approximately 2.4 million tonnes. Figure 15-10 above indicates that declines in SO_2 emissions in Nova Scotia from 1990 to 2005 were approximately 39 kt or a 20% emission reduction.

In 2005, new regulations to reduce SO_2 and NO_X emissions were promulgated by Nova Scotia for the electric power sector. Nova Scotia's new Air Quality Regulations require a 25% reduction in the SO_2 emission cap for the province's largest SO_2 emitter (Nova Scotia Power Inc.) beginning in 2005, a further 25% reduction in 2010, and a cap on NO_X emissions by 2009, reducing emissions by 20% from 2000 levels.[8] These regulations are reflected in the projected emission reductions shown in Figure 15-10 above and in Nova Scotia's 2007 Environmental Goals and Sustainable Prosperity Act, which specifies that "sulphur dioxide emissions will be reduced by fifty per cent by the year 2010 from sources existing in 2001."

Achieving these emission reductions will require that some coal-fired power plants be equipped with desulphurization units (SO_2 scrubbers). In 2005, none of Nova Scotia's eight coal fired power plants were equipped with SO_2 scrubbers, which have the potential to reduce SO_2 emissions by as much as 90-95%.[9] Combined with additional emission abatement measures in the electricity generation sector, such as energy conservation, increasing energy efficiency, shifting to renewable energy, and district heating, it is evident that Nova Scotia should be able easily to achieve the mandated emission reductions in the electricity sector, thus substantially reducing overall provincial SO_X emissions.

Figure 15-12 below provides a comparison of per capita SO_X emissions in Nova Scotia in 2005 with other selected provinces in Canada, the Canadian average, and several OECD countries. Due primarily to its heavy reliance on coal for electricity generation, per capita SO_X emissions in Nova Scotia are more than double the Canadian average, higher than in all other provinces, and 6.5 times the level in British Columbia. Per capita SO_X emissions in Nova Scotia are also higher than in all of the 30 OECD countries that reported their emissions—more than three times the level in the United States and more than 20 times that in Germany. Thus, even achieving the SO_X reduction targets specified in Nova Scotia's Air Quality Regulations and Environmental Goals and Sustainable Prosperity Act will still leave the province above per capita Canadian and American levels and still very far in excess of several other provinces and European countries.

Figure 15-12. SO_X emissions per capita (kg), Nova Scotia, Canada, select provinces, and OECD countries, 2005



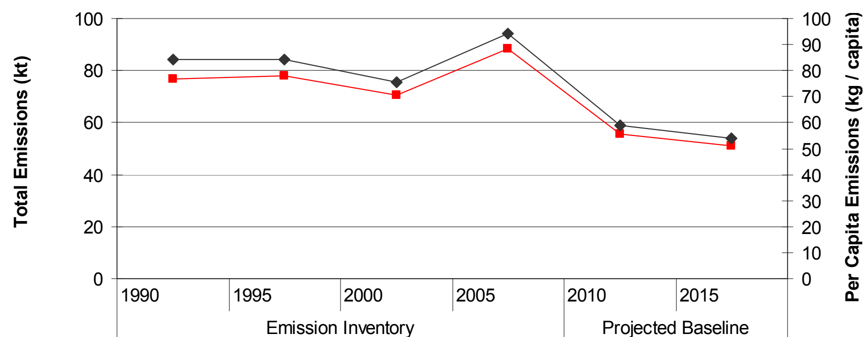
Source: Environment Canada 2005 Air Pollutant Emission Inventory, Version 2, April 8th, 2008 and OECD 2005 Environmental Data Compendium. Available from http://www.oecd.org/document/49/0,3343,en_2649_34283_39011377_1_1_1_1,00.html. Accessed October 2008.

Nitrogen Oxides (NO_X)

Trends in the estimated NO_X emissions for Nova Scotia for the period 1990-2015 are presented in Figure 15-13 below. The overall trend over the 25-year period (1990-2015) indicates that total NO_X emissions and per capita emissions increased by over 20% between 2000 and 2005, where they remained at higher levels than at any time since 1990. However, NO_X emissions are forecast by Environment Canada to decrease significantly in the coming decade as the province's Air

Quality Regulations and 2007 Environmental Goals and Sustinable Prosperity Act—both specifying a 20% reduction in NO_X emissions from 2000 levels by 2009—take effect.

Figure 15-13. Total NO_X emissions (kt), Nova Scotia, 1990–2015



	1990	1995	2000	2005	2010	2015
Total Emissions (kt)	77	78	71	88	55	51
Nova Scotia Per Capita Emissions (kg/capita)	84	84	76	94	59	54

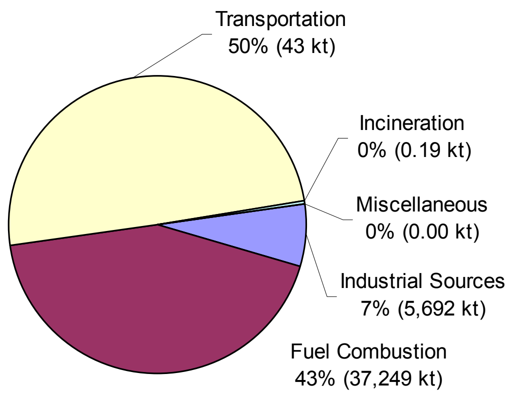
Year

Source: Environment Canada. (2006) Emission Inventory Reports 1990-2005 and Baseline Projections for 2010 and 2015. Available from http://www.ec.gc.ca/pdb/cac/Emissions1990-2015/emissions_e.cfm. Accessed October 2008.

Note: Data exclude emissions associated with open sources such as road dust and natural sources such as biogenics and forest fires.

Figure 15-14 below provides a breakdown of NO_X emissions released in Nova Scotia in 2005 by major sector. As shown in the figure, transportation and non-industrial fuel combustion sources were the largest contributors to NO_X emissions in Nova Scotia (50% and 43% of total emissions, respectively). Marine transportation accounted for 47% of NO_X emissions within the transportation sector. Heavy duty diesel vehicles, and the off-road use of diesel fuel were also significant transportation emission sources. In the non-industrial fuel combustion sector, electric power generation accounted for 88% of the sector emissions.

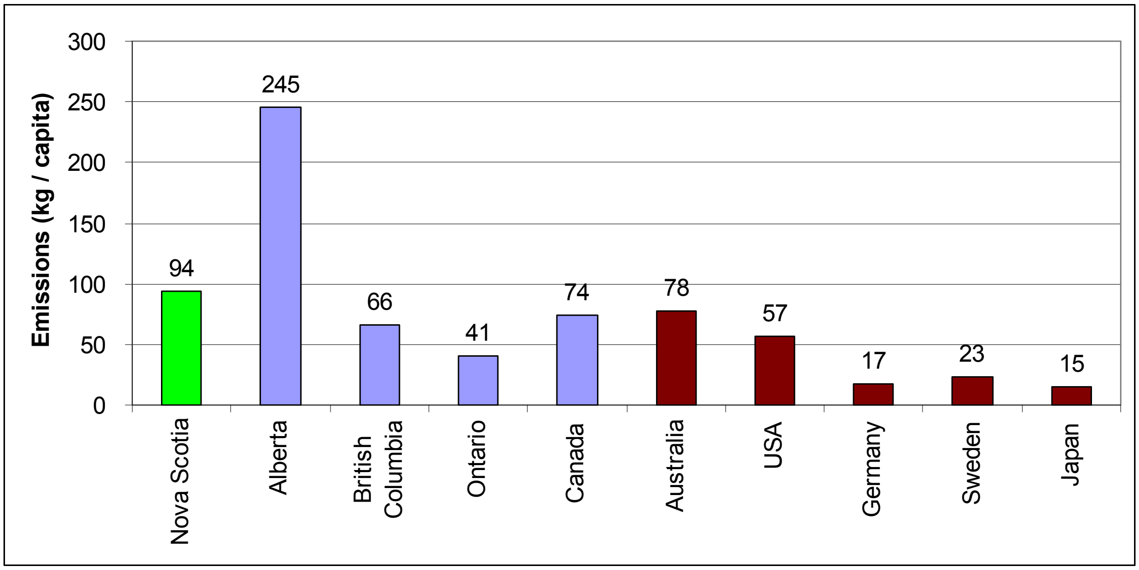
Figure 15-14. NO_X emissions (kt and %), by major sector, Nova Scotia, 2005



Source: Environment Canada 2005 Air Pollutant Emission Inventory, Version 2, April 8th, 2008

Figure 15-15 below provides a comparison of per capita emissions in Nova Scotia in 2005 with other selected provinces in Canada, the Canadian average, and several OECD countries. Per capita NO_X emissions in Nova Scotia were approximately 10% above the Canadian average and were also higher than in all but one of the 30 OECD countries (Iceland) that reported their emissions—65% above US levels and 5.5 times German levels. Per capita NO_X emissions in Alberta were more than three times the Canadian average.

Figure 15-15. NO_X emissions per capita (kg), Nova Scotia, Canada, select provinces, and OECD countries, 2005

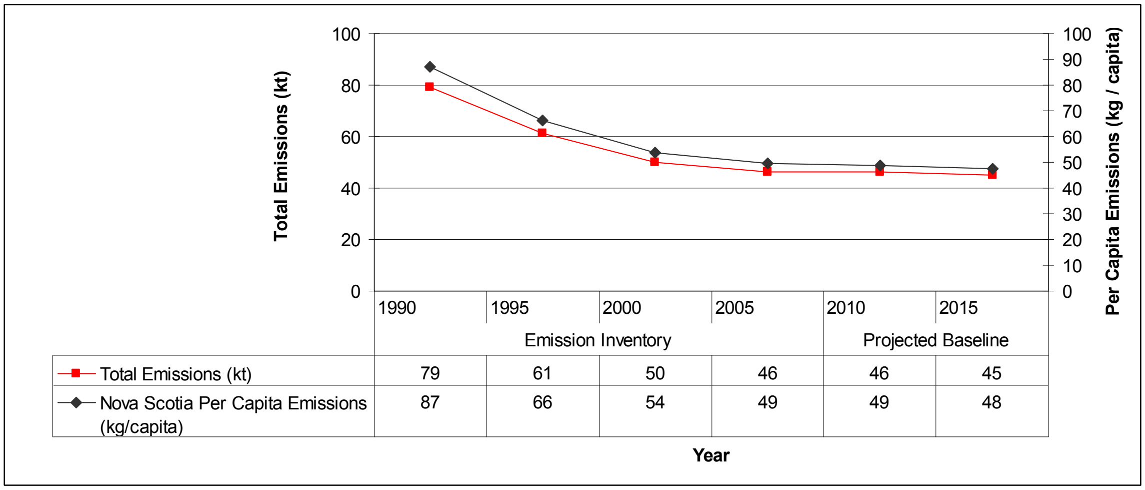


Source: Environment Canada 2005 Air Pollutant Emission Inventory, Version 2, April 8th, 2008 and OECD 2005 Environmental Data Compendium. Available from http://www.oecd.org/document/49/0,3343,en_2649_34283_39011377_1_1_1_1,00.html. Accessed October 2008.

Volatile Organic Compounds (VOCs)

Trends in the estimated emissions of VOCs for Nova Scotia between 1990 and 2015 are presented in Figure 15-16 below. The overall trend over the 25-year period (1990-2015) indicates that total and per capita VOC emissions declined by over 40% between 1990 and 2005. However, Environment Canada's forecasted future VOC emissions are not projected to decline much in the future, and are, in fact, expected to remain relatively stable at 2005 levels over the coming decade.

Figure 15-16. Total VOC emissions (kt), Nova Scotia, 19902015



	1990	1995	2000	2005	2010	2015
Total Emissions (kt)	79	61	50	46	46	45
Nova Scotia Per Capita Emissions (kg/capita)	87	66	54	49	49	48

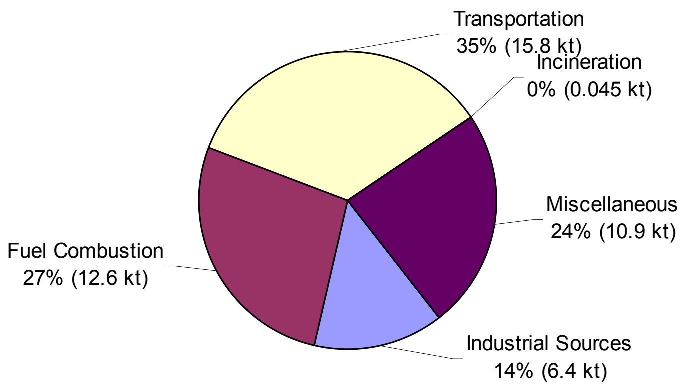
Source: Environment Canada. (2006) Emission Inventory Reports 1990-2005 and Baseline Projections for 2010 and 2015. Available from http://www.ec.gc.ca/pdb/cac/Emissions1990-2015/emissions_e.cfm. Accessed October 2008.

Note: Data excludes emissions associated with open sources such as road dust and natural sources such as biogenics and forest fires.

Figure 15-17 below provides a breakdown of VOC emissions released in Nova Scotia in 2005 by major sector. As shown in the figure, the transportation, non-industrial fuel combustion, and industrial sectors were the largest contributors to VOC emissions in Nova Scotia. The largest individual VOC emission source was from residential fuel-wood combustion (27% of total VOC emissions), comprising almost the entire quantity of emissions from the non-industrial fuel combustion sector.

In the transportation sector, the largest contributing sources of VOC emissions were off-road diesel fuel use and light duty gasoline vehicles. In the industrial sources sector, the downstream petroleum industry was the largest contributing source of VOC emissions (50% of industrial source sector emissions).

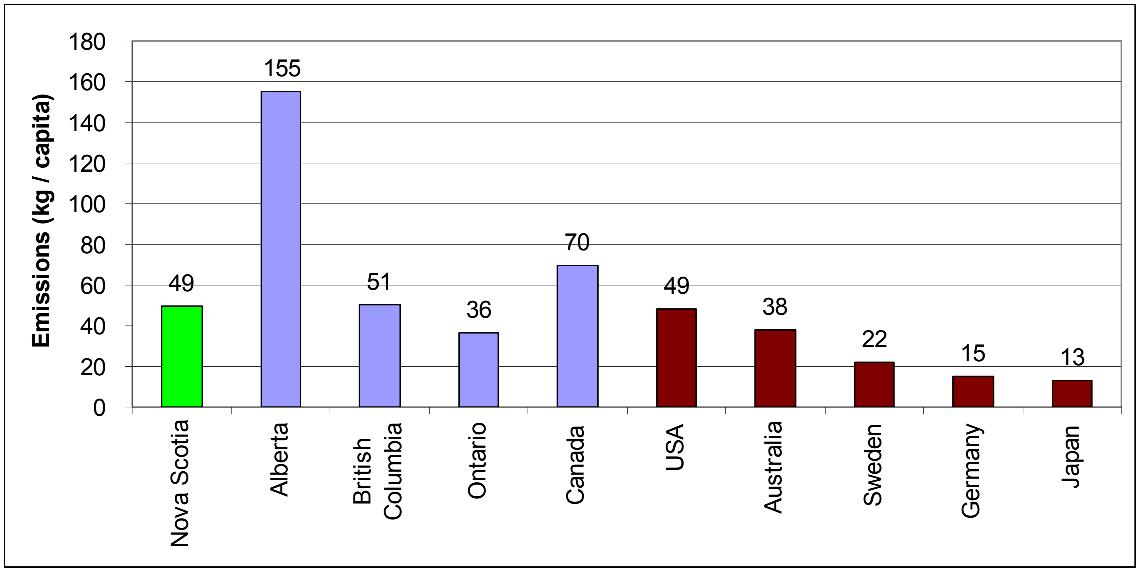
Figure 15-17. VOC emissions (kt and %), by major sector, Nova Scotia, 2005



Source: Environment Canada 2005 Air Pollutant Emission Inventory, Version 2, April 8th, 2008

Figure 15-18 below provides a comparison of per capita VOC emissions in Nova Scotia in 2005 with other selected provinces in Canada, the Canadian average, and several OECD countries. Per capita VOC emissions in Nova Scotia were approximately 30% below the Canadian average. Canada had the highest per capita VOC emissions of all 30 OECD countries that reported their emissions. Nova Scotia also had higher per capita VOC emissions than all 30 OECD countries and more than three times the levels in Germany. Per capita VOC emissions in Alberta were more than twice the Canadian average.

Figure 15-18. VOC emissions per capita (kg), Nova Scotia, Canada, select provinces, and OECD countries, 2005



Source: Environment Canada 2005 Air Pollutant Emission Inventory, Version 2, April 8th, 2008 and OECD 2005 Environmental Data Compendium. Available from http://www.oecd.org/document/49/0,3343,en_2649_34283_39011377_1_1_1_1,00.html. Accessed October 2008.

Mercury (Hg)

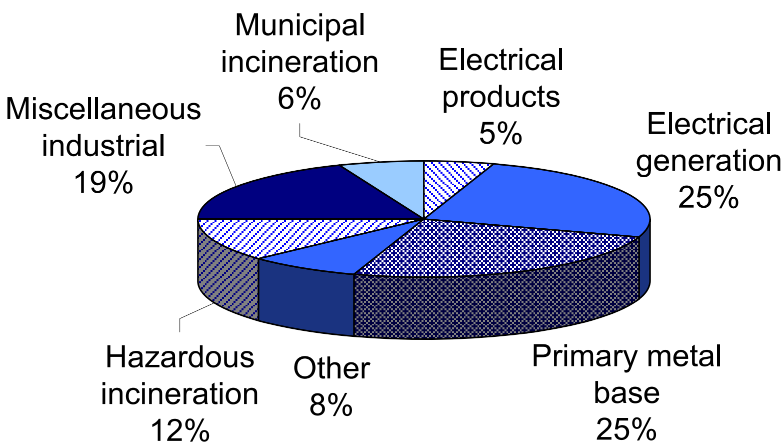
Mercury is considered toxic under the Canadian Environmental Protection Act (CEPA). There is no safe threshold for mercury, as very low concentrations can be toxic to the environment and human health. The toxic effects have the gravest impact on the central nervous system and have been linked to neurological and developmental damage.[10] Acute exposures have been linked to "permanent brain damage, central nervous system disorders, memory loss, heart disease, kidney failure, liver damage, loss of vision, loss of sensation and tremors." Mercury may also be an endocrine disruptor. Exposures that are low-level but chronic can cause neurological, reproductive, behavioural, and learning problems.[11]

The major anthropogenic sources of mercury are coal-fired power plants, metal smelting, incineration, fuel combustion, and intentional use in products such as light bulbs, hospital and dental equipment, and thermostats.

Figure 15-19 below shows the percentage of atmospheric mercury deriving from various anthropogenic sources in Canada.

Nova Scotia Power is the largest emitter of mercury in Nova Scotia. Other provincial sources include the Department of National Defence, Imperial Oil, Lafarge (a concrete producer), and some waste water treatment facilities. Until recently, most products containing mercury were not recovered in Nova Scotia. Now, one company collects a variety of materials containing mercury and sends them out of province for recycling.

Figure 15-19. Sources of atmospheric mercury, Canada, 2000



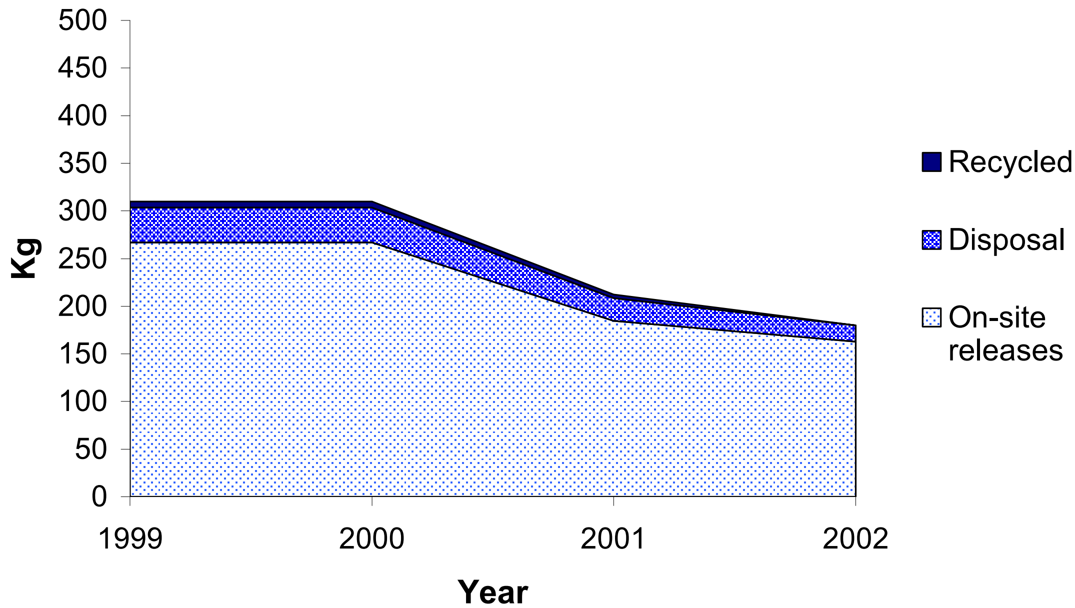
Source: Environment Canada (2004). *Mercury and the Environment*. Available from http://www.ec.gc.ca/MERCURY/EN/index.cfm. Accessed May 29, 2005.

Like other pollutants, much of the mercury deposited in Nova Scotia is released in Quebec, Ontario, or the US. Unlike other important air pollutants, however, mercury is not included among Environment Canada's CACs because it is not released to the environment only as a gas. Data for mercury emissions were, therefore, obtained from the National Pollutant Release Inventory (NPRI).[12]

The NPRI includes releases from stationary, point source emitters that meet reporting requirements. The reporting requirements for mercury (and its compounds) used to be that any "manufacture, process, or otherwise" emitting more than ten tonnes per year had to file a brief stating the amount released to air, water, or land, or sent for final disposal or recycling. In 2000, the NPRI reporting threshold for mercury was lowered to five kilograms, thereby increasing the number of groups that had to report.

Mercury emissions from Nova Scotia's coal-fired power plants declined quite sharply from 2000 to 2002, but emissions from the most polluting plants have remained relatively stable since then (Figure 15-20 and Table 15-2 below). Indeed, the continued use of coal for electricity generation means that excessive quantities of mercury are still emitted by the province's energy sector. The vast majority of mercury emissions in the province still come directly from on-site pollutant releases, with coal-fired power generation accounting for more than 90% of recorded mercury emissions in Nova Scotia.

Figure 15-20. Nova Scotia Power's mercury releases and transfers, 1999–2002



Source: Environment Canada (2005). *National Pollutant Release Inventory (NPRI)*. Available from http://www.ec.gc.ca/pdb/npri/npri_home_e.cfm. Accessed May 29, 2005

Table 15-2 below shows emissions of mercury and its compounds from 2000 to 2007 from the three most polluting Nova Scotia Power coal-fired power plants—Lingan, Trenton, and Point Tupper in Port Hawkesbury.

Table 15-2. Emissions of mercury and its compounds from selected NSPI coal-fired power plants, 2000–2007

YEAR	LINGAN	TRENTON	PT TUPPER	TOTAL
2000	173	54	37	264
2001	118	52	14	184
2002	104	43	15	162
2003	83	49	24	156
2004	87	56	24	167
2005	55	35	13	103
2006	86	49	23	158
2007	82	41	31	154

Source: Environment Canada, National Pollutant Release Inventory, On-line data search. 2000-2007. Available from http://www.ec.gc.ca/pdb/npri/npri_home_e.cfm. Accessed October 25, 2008.

Since industrial emitters are another significant source of mercury emissions, as indicated in Figure 15-19 above, a first order estimate of mercury emissions to the environment from industrial emitters can also be estimated from the NPRI. Table 15-3 below indicates both total and per capita mercury releases from industrial facilities by province, as reported in the NPRI. The table indicates that Nova Scotia's per capita emissions of mercury from industrial sources are about 27% above the national average, and the fifth highest of all ten provinces.

Table 15-3. Industrial facility mercury releases (grams) per capita, Canada and provinces, 2006

	MERCURY RELEASES	
	kg	**gram / capita**
CAN	4,954	0.15
NL	45	0.09
PE	6	0.04
NS	177	0.19
NB	164	0.22
QC	607	0.08
ON	955	0.08
MB	947	0.80
SK	811	0.82
AB	970	0.29
BC	273	0.06

Source: Environment Canada National Pollutant Reporting Inventory (NPRI) On-Line Data Search.Available from http://www.ec.gc.ca/pdb/querysite/query_e.cfm.

Additional mercury emissions originate from the commercial and residential sectors. Fuel combustion in these sectors—as well as the disposal or breakage of consumer products that contain mercury, such as some thermometers, electrical switches, and light bulbs—are important contributors to mercury emissions.

Despite current challenges in tracking mercury emissions, it is recommended that estimates of mercury emissions be included in future updates of the GPI air quality indicators. This is particularly important in light of the need to track progress towards the province's own recently announced targets for mercury reductions. Thus, on September 26, 2007, Nova Scotia announced it would implement the Canadian National Standards for mercury emissions from coal-burning power plants. As also specified in the province's 2007 Environmental Goals and Sustainable Prosperity Act, the national standard requires a reduction in mercury emissions by 70% from pre-2001 levels by 2010.

15.3. Ambient air quality

15.3.1. Introduction

Ambient air quality refers to the concentrations of gases or particles to which the general population is exposed. Improvement in ambient air quality also has a direct effect on reducing potential environmental damage (such as acidification of lakes and forests and mercury in loons and fish, for example) that results from exposure to air pollution. The quality of ambient air within Nova Scotia and the impacts of air pollutants on Nova Scotia can be attributed to emission sources both within and outside the province.

In other words, Nova Scotians have some ability to affect the quality of their own air through controlling domestic emissions, yet still suffer health and environmental impacts due to pollutant emissions from elsewhere. Air pollutants can be carried thousands of miles from one area to another and across borders. This phenomenon is referred to as “long-range atmospheric transport” or “transboundary pollution.”

In general, prevailing winds in North America tend to transport air pollutants northeastwards. Due to such wind patterns, the province is particularly susceptible to transboundary pollution originating in central Canada and the northeastern and midwestern United States. Indeed, the long-range transport of ozone and its precursors from the eastern US and central Canada is one of the largest contributors to poor air quality in the Atlantic region, and studies have shown that in Nova Scotia, between 30% and 90% of smog can come from the US.[13]

15.3.2. Ambient air quality standards and objectives

Ambient air quality objectives are target levels for pollutants occurring in outdoor air. Such objectives are designed to afford a specified amount of protection for humans, other life forms, and/or habitats, such as soil and water. Air quality objectives are generally set to cover both short- and long-term exposure to air pollutants. Comparing Nova Scotia’s outdoor air quality against a variety of ambient air quality objectives is a useful way to highlight performance—both within and outside Nova Scotia—and to monitor the effectiveness of international agreements like the Canada–United States Air Quality Agreement. In this section, we provide an overview of various ambient air quality objectives, which then serve as benchmarks for the GPI ambient air quality indicator.

The Canadian federal government has set national ambient air quality objectives (NAAQOs) that are not legally binding but rather are designed to establish priorities for emission reductions and to provide a uniform measure for assessing air quality in Canada. The NAAQOs, which were established as a three-tiered system of desirable, acceptable, and tolerable objectives, are summarized in Table 15-4 for five criteria air contaminants.

Table 15-4. Canada's National Ambient Air Quality Objectives (NAAQOs)

Pollutant	Averaging Period	Maximum Desirable Concentration (MDC) (long-term goal for air quality and also provides a basis for "keeping clean areas clean")	Maximum Acceptable Concentration (MAC) (protection against the potential effects of air pollution on soil, water, vegetation, animals, and human health and comfort)	Maximum Tolerable Concentration (MTC) (concentrations of air contaminants beyond which action is required to protect human health)
Carbon Monoxide (CO) (ppm)	8-hour	5	13	17
	1-hour	13	31	
Total Suspended Particulate (TSP) ($\mu g/m^3$)	Annual	60	70	
	24-hour		120	400
Sulphur Dioxide (SO_2) (ppb)	Annual	11	23	
	24-hour	57	115	306
	1-hour	172	344	
Nitrogen Dioxide (NO_2) (ppb)	Annual	32	53	
	24-hour		106	160
	1-hour		213	532
Ozone (O_3) (ppb)	Annual		15	
	1-hour	50	82	150

Note: Blank cells indicate that there is no established objective.

The levels at which NAAQOs were set were intended to be changed if new research on human and environmental effects demonstrated effects at lower levels. However, updating of the NAAQOs has not occurred despite the fact that health effects below these thresholds have, in fact, been documented and despite increasing evidence that there are no "safe" exposure levels for some pollutants. In these respects, the NAAQOs, established in the 1970s, are no longer consistent with current scientific knowledge.

The development of Canada-wide Standards (CWSs) by federal, provincial, and territorial Environment Ministers is an ongoing process to develop common environmental standards, including quantitative standards, for protecting the environment and human health from pollutants in ambient air. To date, CWSs for ambient $PM_{2.5}$ and ozone concentrations have been developed and were ratified by the Federal and Provincial Environment Ministers in June of 2000. The 24-hour CWS for $PM_{2.5}$ is $30\mu g/m^3$, and the eight-hour CWS for ground-level ozone is 65ppb (CCME, 1999).

Under the Nova Scotia Environment Act, the Nova Scotia Air Quality Regulations establish criteria for ambient air quality throughout the province. These criteria are expressed as maximum permissible ground-level concentrations and are presented in Table 15-5 below. With the exception of the maximum permissible concentrations for ozone and TSP, each of the Nova Scotia concentrations are slightly lower (and therefore, marginally more stringent) than the NAAQO maximum acceptable concentrations (MACs)—ranging from 1-2 ppm lower for CO to

3-5 ppb lower for SO_2 and NO_2. The concentrations for TSP and ozone are equal to the NAAQO (MACs) for those contaminants.

Table 15-5. Nova Scotia air quality regulations: maximum permissible ground-level concentrations

Pollutant	Averaging Period	Maximum Permissible Ground-Level Concentration	
		μg/m³	ppm or ppb
Carbon Monoxide (CO)	8-hour	12,700	11 ppm
	1-hour	34,600	30 ppm
Total Suspended Particulate (TSP)	Annual*	70	
	24-hour	120	
Sulphur Dioxide (SO_2)	Annual	60	20 ppb
	24-hour	300	110 ppb
	1-hour	900	340 ppb
Nitrogen Dioxide (NO_2	Annual	100	50 ppb
	1-hour	400	210 ppb
Ozone (O_3)	1-hour	160	82 ppb

Source: http://www.gov.ns.ca/just/regulations/regs/envairqt.htm.

Note: Blank cells indicate that there is no established maximum permissible concentration.
*The annual maximum permissible concentration of 70μg/m³ for TSP refers to the annual geometric mean.

Ambient air monitoring activities in Nova Scotia are conducted through the cooperative efforts of the Nova Scotia Department of Environment (NSDOE), Environment Canada, and Nova Scotia Power. The monitoring activities are carried out to obtain ambient pollutant concentration data for comparison to accepted standards for air quality in order to determine whether existing emission controls are effective, to establish new emission control requirements, and to assess Nova Scotia's exposure to transboundary pollution.

15.3.3. Indicators

Data sources: NAPS Network Annual Summary Reports (1990 to 2006); Nova Scotia Power Inc.

Result: Atmospheric concentrations of carbon monoxide, total particulate matter (including PM_{10} and $PM_{2.5}$), and sulphur dioxide have all declined in Nova Scotia since 1990 and remain within accepted guidelines. Nitrogen dioxide concentrations have not declined substantially since 1990 but remain within accepted guidelines. However, ground-level ozone concentrations remain among the highest in the country—largely due to transboundary pollution—and regularly exceed maximum acceptable concentrations.

Ambient air concentration data for Nova Scotia have been compiled for this report from the National Air Pollution Surveillance (NAPS) Network's annual reports, the Nova Scotia Department of Environment (NSDOE) annual ambient air quality reports and air monitoring databases, the National Environmental Indicator Series (NEIS), and Nova Scotia Power (NSP) ambient air monitoring summaries. It is important to note that air monitoring data indicate pollution levels only at the sampling sites and may not necessarily be representative of the air quality of a larger area such as an entire city. Nevertheless, they are the most direct and reliable indicators of air quality currently available.

The following sections summarize the trends in ambient air quality in Nova Scotia based on available monitoring data, and on comparisons of pollutant concentrations with Nova Scotia's maximum permissible ground-level concentrations, Canadian ambient air quality objectives, and CWSs.

Carbon Monoxide

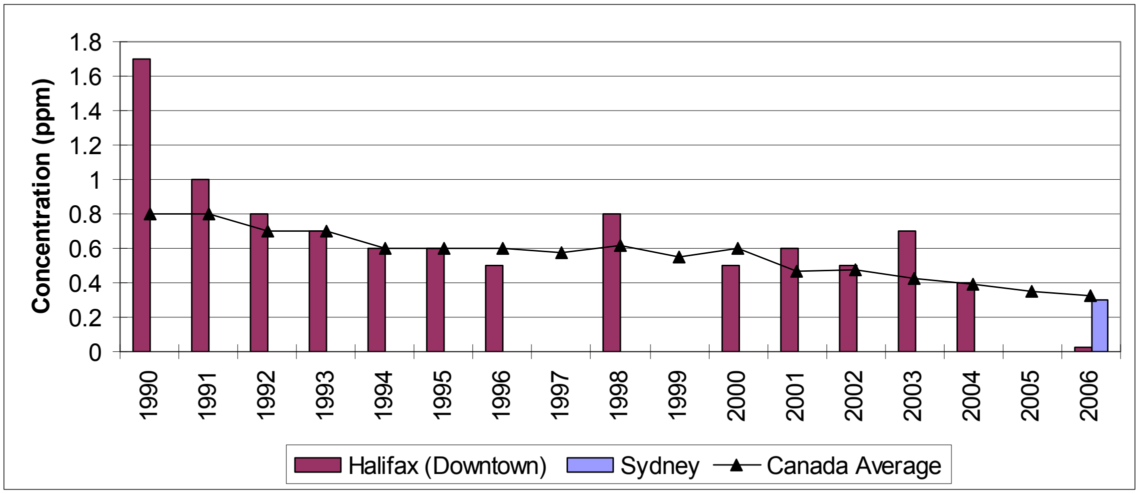
There are currently two ambient air quality monitoring stations that monitor carbon monoxide (CO) in Nova Scotia. A downtown Halifax monitoring station on Barrington Street has been operating since 1977 and a new station in Sydney has been operating since 2006. As well, historical data exist for three additional downtown Halifax monitoring stations. Historical trends in the annual ambient concentration of CO in downtown Halifax and the most recent available data for Sydney are presented in Figure 15-21 below. An average of mean annual CO concentrations recorded at all reporting Canadian monitoring stations across the country are included for comparative purposes.

A clear decreasing trend in ambient CO concentrations in Nova Scotia can be distinguished from Figure 15-21. This trend follows a general declining trend in ambient CO concentrations across Canada. Annual ambient CO concentrations both in Halifax and nationwide have decreased by over 50% since the early 1990s (Figure 15-21), and—when looking at longer term trends—CO concentrations have decreased as much as five times since the early 1980s.

These declines particularly reflect the large reductions in CO emissions that have occurred in Nova Scotia in both the transportation and electricity generation sectors, as well as the reduction in emissions in nearby jurisdictions that contribute to long-range atmospheric transport or "transboundary" pollution.

Maximum recorded one-hour, eight-hour, and annual concentrations observed in Nova Scotia remained well below the Nova Scotia maximum permissible ground-level concentrations standards as well as other Canadian and World Health Organization guidelines. The maximum one-hour CO concentration recorded in 2006 in Sydney, Nova Scotia, was 2.2 ppm—well below the 30 ppm one-hour Nova Scotia maximum permissible ground-level concentration for CO.

Figure 15-21. Annual mean ambient CO concentration (ppm), downtown Halifax (1990–2006) and Sydney (2006)

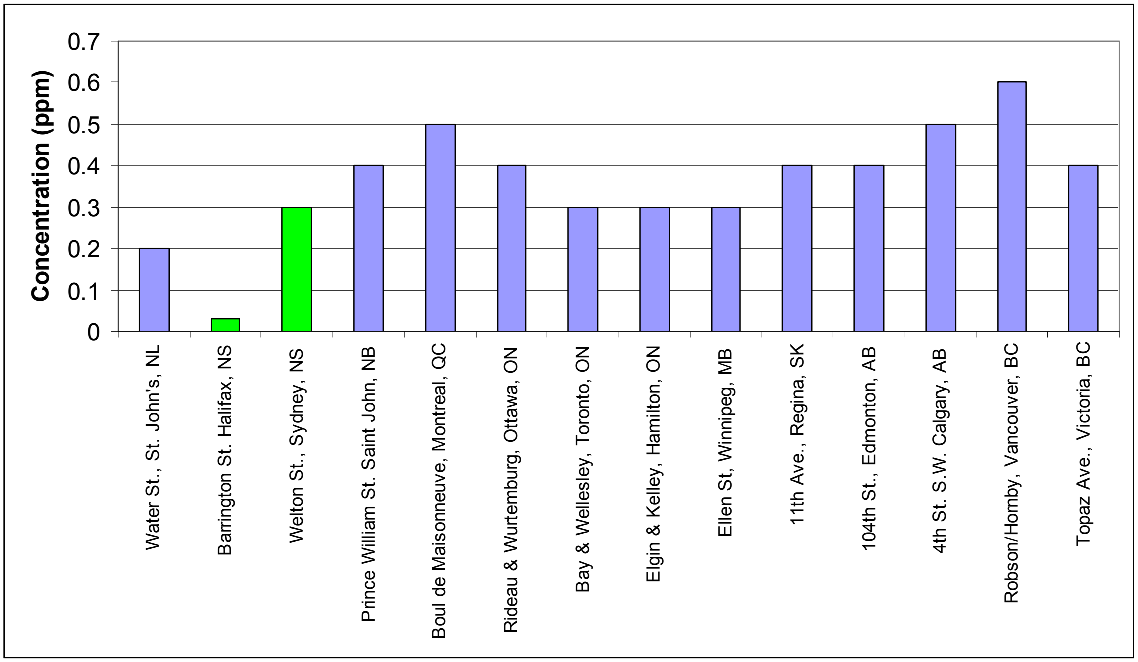


Source: NAPS Network Annual Summary Reports (1990 to 2006). Website: http://www.etc-cte.ec.gc.ca/publications/napsreports_e.html. Accessed October 2008.

Notes: Halifax (Downtown) includes data from the Barrington and Duke, 1657 Barrington Street, Bedford Row Post Office, and City Hall sampling stations. Data missing for 1997 and 1999 and 2005.

Figure 15-22 below compares ambient CO concentrations recorded in 2006 at monitoring sites in Nova Scotia to other selected Canadian cities for comparison. The data indicate that the Barrington Street station recorded CO levels far below and only a small fraction of those in the other selected Canadian cities, while the Sydney station recorded levels in line with monitoring sites in Toronto, Hamilton, and Winnipeg, and below levels in Saint John, Montreal, Ottawa, and cities in the west.

Figure 15-22. Annual mean ambient CO concentration (ppm), select Canadian cities, 2006



Source: 2006 NAPS Network Annual Summary Report. Available from http://www.etc-cte.ec.gc.ca/publications/napsreports_e.html. Accessed October 2008.

Particulate Matter (TPM, PM_{10} and $PM_{2.5}$)

The health risk from particulates is a function of both the size and concentration of the dose inhaled. Particulate matter smaller than 10 microns (PM_{10}) is typically referred to as "inhalable" particulates, since these particles can be breathed into the lungs. Many studies have shown that health effects are more severe for these inhalable, smaller particles than for larger particles. Particulate smaller than 2.5 microns ($PM_{2.5}$) can be breathed even more deeply into the alveoli of the lungs, where they can remain and cause extensive reduction in lung function and other adverse health effects.

Therefore, the ambient air quality monitoring results presented here focus on the smaller fractions of particulate (PM_{10} and $PM_{2.5}$), as these fractions typically contribute to the majority of health impacts and, thus, are classified as "toxic" under the 1999 Canadian Environmental Protection Act (CEPA).

In the NAPS network, there are currently three dichotomous samplers that monitor PM_{10} in Nova Scotia and two dichotomous samplers that monitor $PM_{2.5}$. Historical trends in the annual ambient concentrations of PM_{10} and $PM_{2.5}$ are presented in Figures 15-23 and 15-24, respectively.

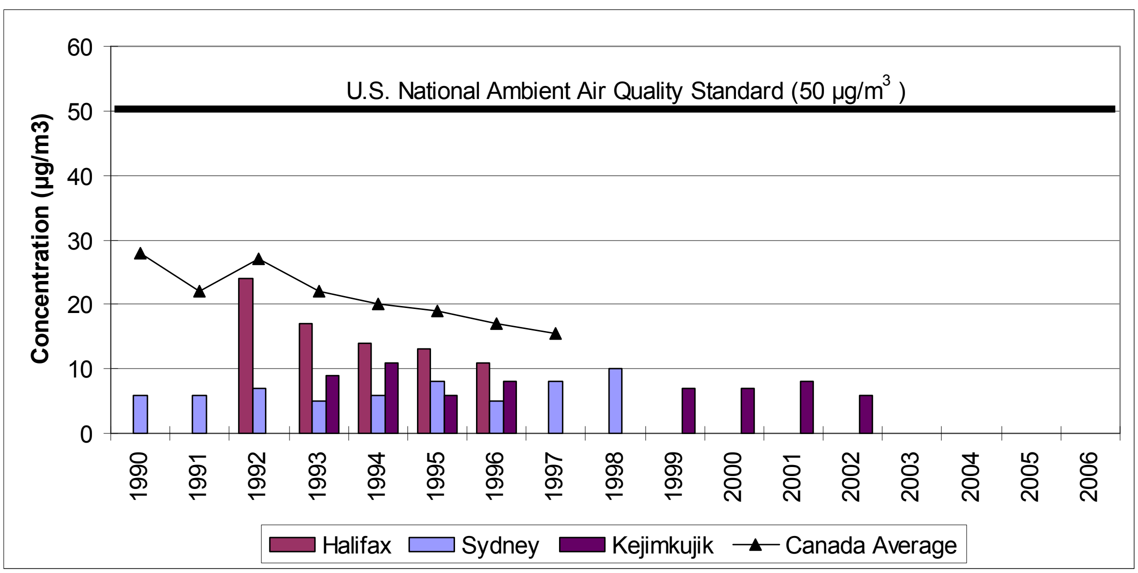
An average of mean annual PM_{10} and $PM_{2.5}$ concentrations recorded at all NAP reporting monitoring stations across the country from 1990–1997 is included in the figures below for comparative purposes, but these annual mean PM_{10} and $PM_{2.5}$ concentrations have not been compiled in the last decade.

As well, since no annual Canadian or Nova Scotian ambient air quality standards exist for PM_{10} and $PM_{2.5}$, the US national ambient air quality maximum acceptable concentration standards of 50 $\mu g/m^3$ for PM_{10} and 15 for $\mu g/m^3$ for $PM_{2.5}$ are shown for comparison purposes. A 24-hour CWS for $PM_{2.5}$ of 30$\mu g/m^3$ has been established, but no annual standard.

It is clear from Figures 15-23 and 15-24 below that recorded annual mean levels of ambient PM_{10} and $PM_{2.5}$ concentrations in Nova Scotia have declined steadily since the early 1990s and remain well below the US standards for these small particulates.

It is also clear from these two figures that data for recent years are sparse and inconclusive. As noted in GPI Atlantic's 2004 air quality report, it is of considerable concern that air quality monitoring in the province appears to have become less regular and consistent than previously. These concerns are amplified by the stated objective of Nova Scotia's April 2007 Environmental Goals and Sustainable Prosperity Act to "achieve international recognition for having one of the cleanest and most sustainable environments in the world by the year 2020," and by the specific pollutant emission reduction targets contained in that act. Regular and consistent monitoring of all CACs and mercury is essential for the province to be able to assess progress towards, and eventually verify, its targets and claims.

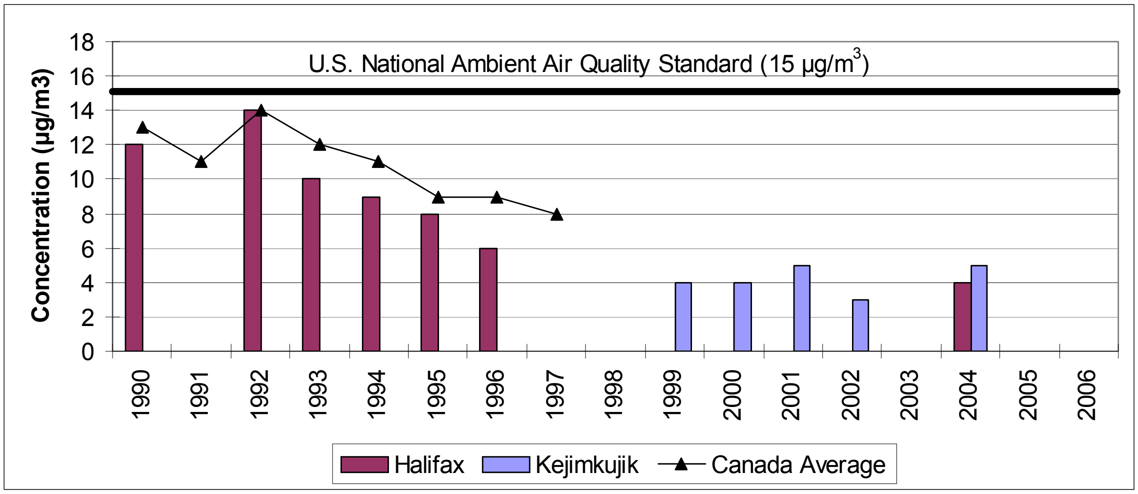
Figure 15-23. Annual mean ambient PM_{10} concentration ($\mu g/m^3$), select sites in Nova Scotia, 1990–2004



Source: NAPS Network Annual Summary Reports (1990 to 2006). Available from http://www.etc-cte.ec.gc.ca/publications/napsreports_e.html. Accessed October 2008.

Notes: Monitoring data are not complete for all years. Where there is no concentration value shown for a given year or location, the station was either not monitored for that year or there were insufficient data to estimate an annual average.

Figure 15-24. Annual mean ambient $PM_{2.5}$ concentration (µg/m³), select sites in Nova Scotia, 1990–2004



Source: NAPS Network Annual Summary Reports (1990 to 2006. Available from http://www.etc-cte.ec.gc.ca/publications/napsreports_e.html. Accessed October 2008.

Notes: Monitoring data are not complete for all years. Where there is no concentration value shown for a given year or location, the station was either not monitored for that year or there were insufficient data to estimate an annual average.

Sulphur Oxides (SO_X)

There are currently three NAP ambient monitoring stations and over 16 Nova Scotia Power monitoring stations that monitor sulphur dioxide concentrations in Nova Scotia. The downtown Halifax monitoring station is the only station in Nova Scotia for which long-term trends can be determined, as it has reported ambient air quality concentrations going back to 1975.

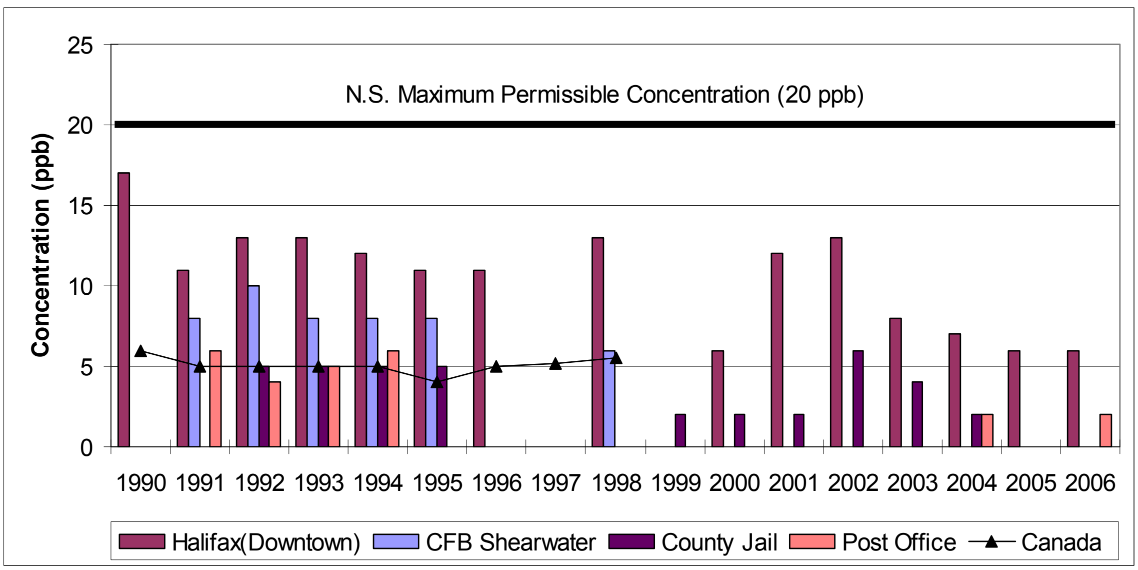
Annual mean ambient sulphur dioxide (SO_2) concentrations for selected Nova Scotia monitoring sites are presented in Figures 15-25 and 15-26 below. The results indicate that recorded mean ambient SO_2 concentrations at all monitoring stations in Nova Scotia fell within the province's maximum permissible concentration guidelines. Nevertheless, it is also apparent that SO_2 levels recorded on Barrington Street remained relatively stable between 1991 and 2002 at between half and two-thirds the province's maximum permissible concentrations, and only recently declined substantially to about half the levels recorded in 2001–2002.

The recent declines in ambient SO_2 concentrations reflect the substantial reductions in SO_2 emissions that have occurred in Nova Scotia in both the transportation and electricity generation sectors in recent years, as well as the reduction in emissions in other jurisdictions that contribute to long-range atmospheric transport or transboundary pollution. The reduction in transboundary

SO_2 pollution is partly the result of targets under the Canada–United States Air Quality Agreement.

In light of Nova Scotia's extraordinarily high per capita levels of sulphur oxide emissions noted above—the highest in the country and far in excess of jurisdictions that are less reliant on coal-fired power plants for electricity generation—regular and consistent monitoring of ambient SO_2 concentrations is particularly important in this province. As well, the province's stated goal to reduce SO_2 emissions by fifty per cent by the year 2010 from sources existing in 2001, as legislated in the 2007 Environmental Goals and Sustainable Prosperity Act, requires particularly careful air quality monitoring in the coming years to assess the degree to which the intended reductions are also reducing ambient SO_2 levels and improving air quality in the province.

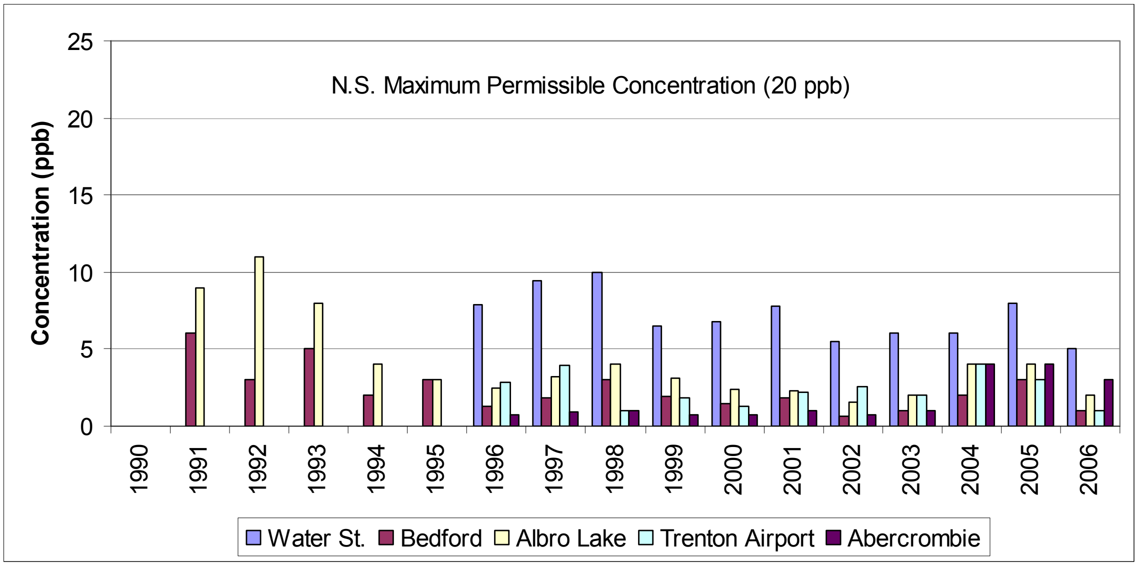
Figure 15-25. Annual mean ambient SO_2 concentrations (ppb), four NAP monitoring stations, 1990–2006



Source: NAPS Network Annual Summary Reports (1990 to 2006). Available from http://www.etc-cte.ec.gc.ca/publications/napsreports_e.html. Accessed October 2008.

Notes: Monitoring data are not complete for all years. Where there is no concentration value shown for a given year or location, the station was either not monitored for that year or there were insufficient data to estimate an annual average.

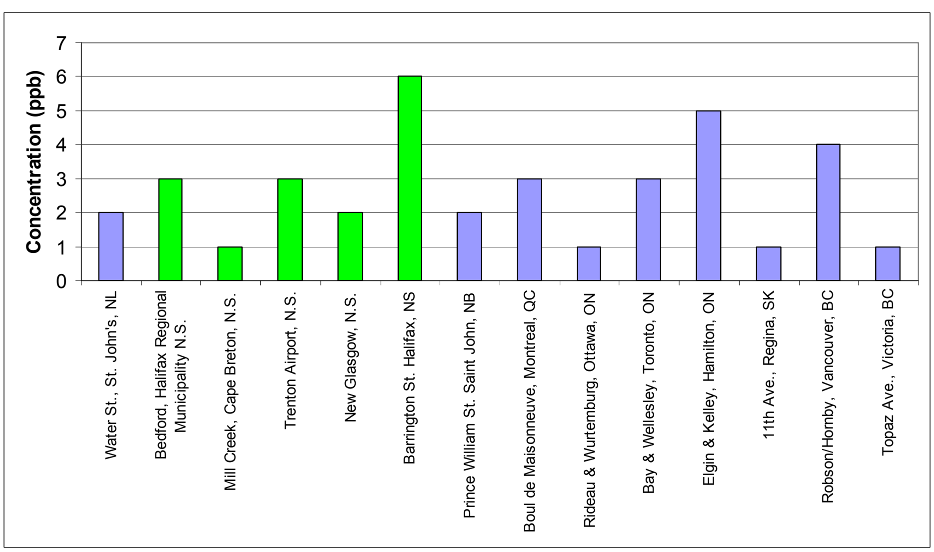
Figure 15-26. Annual mean ambient SO_2 concentrations (ppb), five Nova Scotia Power monitoring stations, 1990–2006



Source: Allison Fitzpatrick, NSPI. Personal communication February 26, 2008, with GPI Atlantic.
Notes: Monitoring data are not complete for all years. Where there is no concentration value shown for a given year or location, the station was either not monitored for that year or there were insufficient data to estimate an annual average.

Figure 15-27 below compares ambient SO_2 concentrations recorded in 2005 at monitoring sites in Nova Scotia with those in other selected Canadian cities. Results indicate the highest recorded levels in downtown Halifax among the selected cities nationwide.

Figure 15-27. Annual mean ambient SO_2 concentration (ppb), select Canadian cities, 2005



Source: 2005 NAPS Network Annual Summary Report. Available from http://www.etc-cte.ec.gc.ca/publications/napsreports_e.html. Accessed October 2008; personal communication February 26, 2008, between Allison Fitzpatrick (NSPI) and GPI Atlantic.

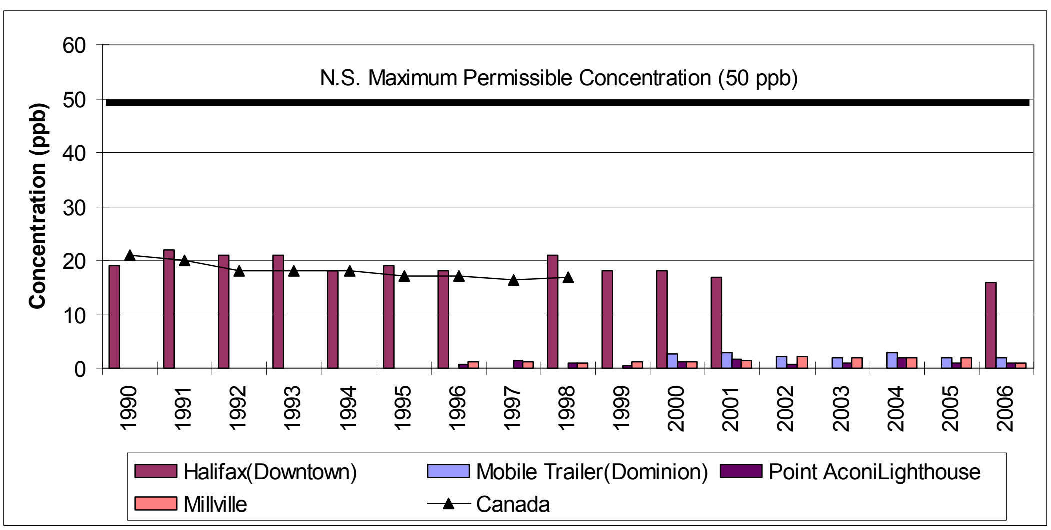
In the most recent years since 2000, only one NAP monitoring station in Nova Scotia (Barrington St, Halifax) has exceeded the NAAQO maximum desirable one-hour concentration for SO_2 (172 ppb), and there have been no recorded exceedances of the one-hour NAAQO maximum acceptable concentration (344 ppb) or the one-hour maximum permissible ground-level concentration (340 ppb) in Nova Scotia.

Nitrogen Oxides (NO_X)

There is currently one NAP ambient monitoring station and four Nova Scotia Power monitoring stations that monitor nitrogen oxide concentrations in Nova Scotia. The downtown Halifax monitoring station is the only station in Nova Scotia for which long-term trends can be determined, as it has reported ambient air quality since 1976. Annual mean ambient nitrogen dioxide (NO_2) concentrations for Nova Scotia monitoring sites that have accumulated more than four years of data are presented in Figure 15-28 below.

Figure 15-28 indicates that ambient annual mean NO_2 concentrations have remained relatively stable in Nova Scotia since 1990. All NAP and Nova Scotia Power monitoring stations in recent years since 2000 have reported one-hour concentrations less than NAAQO maximum acceptable concentration (213 ppb) and less than the Nova Scotia maximum permissible ground-level concentration (210 ppb). Nevertheless, it is apparent from Figure 15-28 that NO_2 levels in downtown Halifax are several times higher than in other parts of the province.

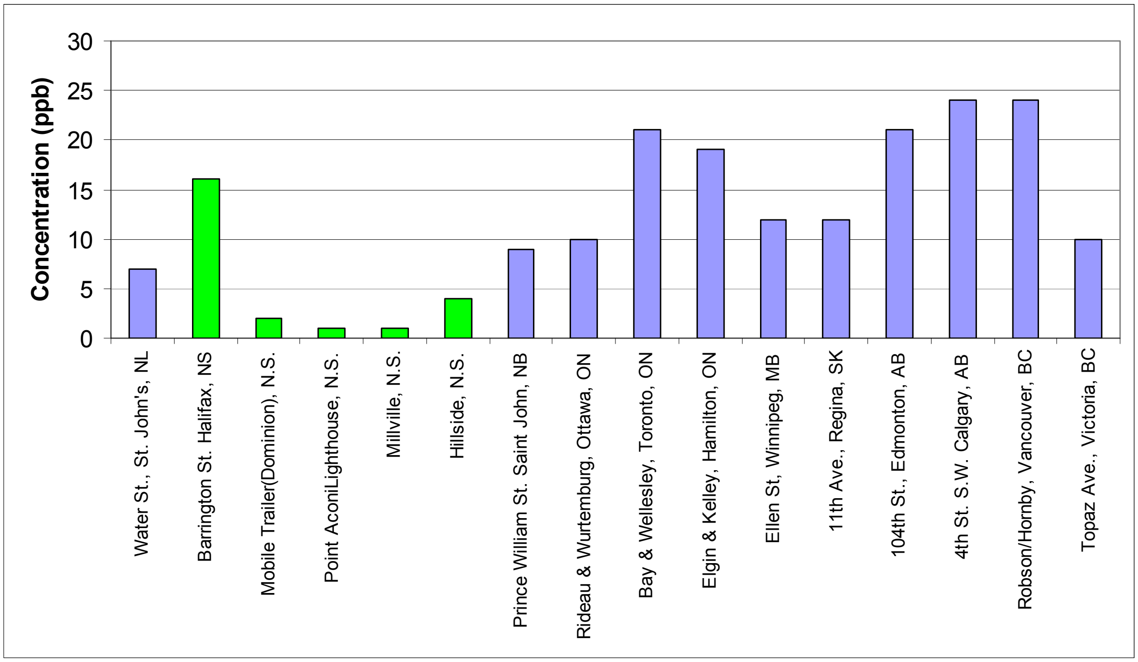
Figure 15-28. Annual mean ambient NO_2 concentrations (ppb), select sites in Nova Scotia, 1990–2006



Source: NAPS Network Annual Summary Reports (1990 to 2006). Available from http://www.etc-cte.ec.gc.ca/publications/napsreports_e.html. Accessed October 2008.
Notes: Monitoring data are not complete for all years. Where there is no concentration value shown for a given year or location, the station was either not monitored for that year or there were insufficient data to estimate an annual average.

Figure 15-29 below compares annual ambient NO_2 concentrations recorded in 2005 at monitoring sites in Nova Scotia compared with other selected Canadian cities. With the exception of downtown Halifax, all other Nova Scotia monitoring sites recorded NO_2 levels well below those in the selected Canadian cities indicated in Figure 15-29. Levels in downtown Halifax were higher than in Saint John, Ottawa, Winnipeg, or Regina, but below levels in Toronto, Hamilton, Edmonton, Calgary, and Vancouver.

Figure 15-29. Annual mean ambient NO_2 concentration (ppb), select Canadian cities, 2005



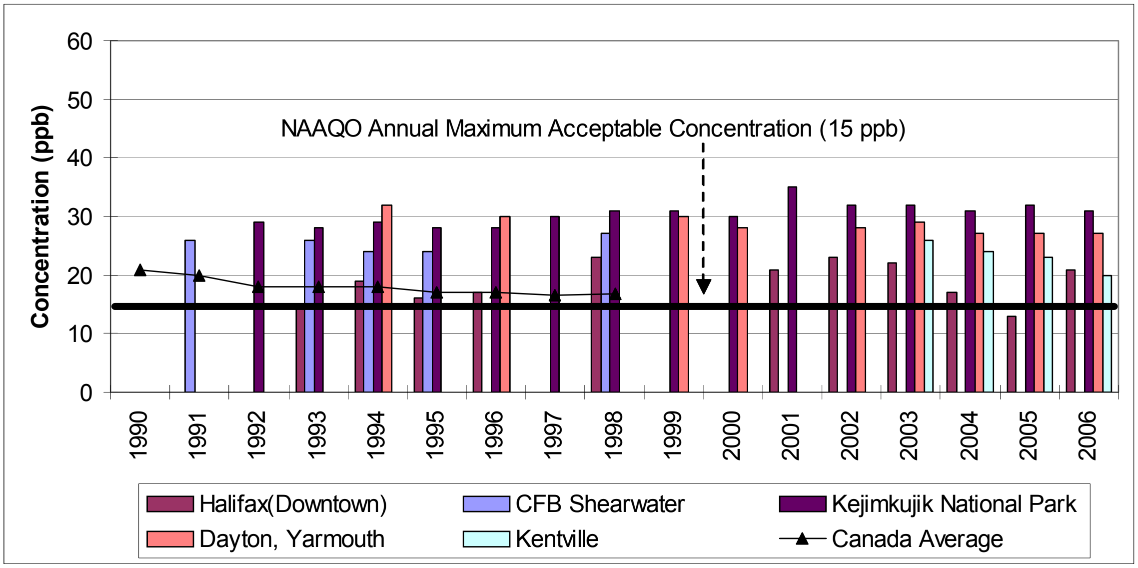
Source: 2005 NAPS Network Annual Summary Report. Available from http://www.etc-cte.ec.gc.ca/publications/napsreports_e.html. Accessed October 2008; personal communication February 26, 2008, between Allison Fitzpatrick (NSPI) and GPI Atlantic.

Ozone (O_3)

There are currently seven NAP ambient monitoring stations that monitor ozone in Nova Scotia. The downtown Halifax and Shearwater monitoring stations have been collecting ambient air quality data since the late 1970s. Annual mean ambient ozone concentrations for Nova Scotia monitoring sites are presented in Figure 15-30 below.

Figure 15-30 indicates that ambient annual mean ozone concentrations have remained relatively stable in Nova Scotia since the early 1990s and well above the NAAQO annual maximum acceptable concentration of 15 ppb. In fact, ozone levels recorded at Kejimkujik National Park in recent years have consistently been more than twice as high the NAAQO annual maximum acceptable concentration.

Figure 15-30. Annual mean ambient ozone (O_3) concentrations (ppb), select sites in Nova Scotia, 1990–2006



Source: NAPS Network Annual Summary Reports (1990 to 2006). Available from http://www.etc-cte.ec.gc.ca/publications/napsreports_e.html. Accessed October 2008.

Notes: Monitoring data are not complete for all years. Where there is no concentration value shown for a given year or location, the station was either not monitored for that year or there were insufficient data to estimate an annual average.

Nova Scotia's consistently high recorded levels of ozone are a major concern because ground-level ozone, even at low levels for short periods, has been linked with a broad spectrum of human health effects. Ozone can also injure plants and damage materials, and it is the major component of smog. For a detailed description of the health and environmental impacts of gound-level ozone, see Section 2.6 of the 2004 GPI air quality report. In light of Nova Scotia's high recorded ambient levels of ground-level ozone, a few key effects are summarized here.

Because of its reactivity, ozone can injure biological tissues and cells. When inhaled, ozone can inflame and damage the lining of the lungs, causing symptoms such as wheezing, coughing, shortness of breath, throat irritation, and pain on deep inspiration. Repeated exposure to ozone pollution for several months may cause permanent lung damage.[14]

Documented health effects of ozone exposure include:

- Nausea
- Eye irritation
- Headache
- Increased respiratory illness such as bronchitis, asthma, pneumonia, and emphysema

- Decreased lung function, including decreased exercise capacity, premature aging of the lungs, and possible long-term development of chronic lung disease
- Reduction of the body's defences against infection (for example, ozone can increase the susceptibility of asthmatics to common allergens)
- Exacerbation of cardiovascular disease
- Exacerbation of respiratory disease such as asthma
- Increased incidence of hospital admissions
- Increased incidence of emergency department visits
- Increased incidence of cardiovascular- and respiratory-related premature mortality

As well, ozone exposure has been shown to compromise plant growth, reproduction, and overall health, and make plants more susceptible to disease, pests, and environmental stresses. Ground-level ozone has been shown to reduce agricultural yields for many economically important crops, including soybeans, kidney beans, wheat, cotton, corn, peanuts, potatoes, sorghum, and turnips.[15]

Ozone exposure can also reduce photosynthesis in trees, damage tree foliage, reduce tree productivity and growth, and alter the productivity, successional patterns, species composition, energy resource flow patterns, and biogeochemical patterns of forests. Ozone damage in Canada may be responsible for reducing the timber yield of sensitive species such as maple, ash, white spruce, white pine, poplar, white birch, and red oak, and is thought to be contributing to forest decline in some parts of Canada.[16]

Table 15-6 below summarizes the number of one-hour exceedances of the NAAQOs for ozone recorded at all NAP monitoring stations between 2000 and 2006. While ambient ground-level ozone levels in Nova Scotia appear to have remained fairly stable during this time period, as seen in Figure 15-30 above, it is clear from Table 15-6 that ambient ozone levels regularly exceed the one-hour maximum desirable concentration and occasionally exceed the one-hour maximum acceptable concentration that can cause respiratory problems and injury to vegetation. As seen in Figure 15-30 above, ozone levels also regularly exceed the annual maximum acceptable concentration level.

Table 15-6. Recorded exceedances of NAAQOs for ozone, 2000–2006

YEAR	NUMBER OF NAP MONITORING STATIONS	NUMBER OF EXCEEDANCES OF NAAQO FOR OZONE AT ALL MONITORING STATIONS	
		1-hour Maximum Desirable Concentration	1-hour Maximum Acceptable Concentration
2000	4	688	5
2001	5	139	0
2002	5	1397	59
2003	8	1487	17
2004	8	889	7
2005	7	629	5
2006	9	1242	9

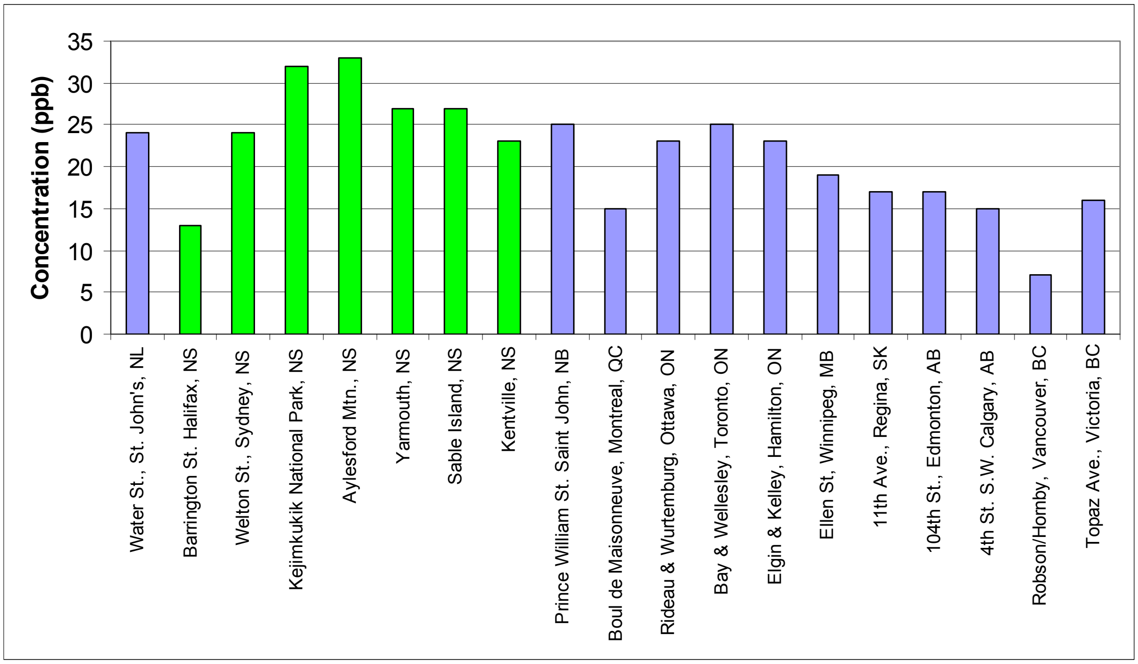
Source: NAPS Network Annual Summary Reports (1990 to 2006). Available from http://www.etc-cte.ec.gc.ca/publications/napsreports_e.html. Accessed October 2008.

Figure 15-31 below compares annual ambient ozone concentrations recorded in 2005 at monitoring sites in Nova Scotia with those in other selected Canadian cities. It is seen that ambient ozone concentrations in Nova Scotia—particularly in southern parts of the region—are generally above levels recorded in other parts of the country, with Kejimkujik National Park and Aylesford Mountain in the Annapolis Valley recording some of the highest levels in Canada.

These high recorded levels in parts of rural Nova Scotia are largely caused by transboundary pollution. Ground-level ozone is actually a secondary pollutant—produced in the air in the presence of sunlight by interactions between two or more primary pollutants, or by reaction with normal atmospheric constituents. Thus, non-methane hydrocarbons (NM-VOC), or volatile organic compounds (VOCs), and nitrogen oxides (NO_X) react in the presence of sunlight to form ground-level ozone.

Thus, it is the long-range transport of NO_X, VOCs, and ground-level ozone by prevailing winds into Nova Scotia from central Canadian and US. sources that strongly influences the high levels of ambient ozone concentrations recorded within Nova Scotia. It is thought that global climate change and projected higher temperatures will likely contribute to higher levels of ground-level ozone, with concomitant increased adverse health effects.

Figure 15-31. Annual mean ambient ozone concentration (ppb), select Canadian cities, 2005



Source: 2005 NAPS Network Annual Summary Report. Available from http://www.etc-cte.ec.gc.ca/publications/napsreports_e.html. Accessed October 2008.

15.4. Economic costs of air pollution

Data sources: California Energy Commission (CEC) (1993). Order Adopting Residual Emission Values for South Coast Air Quality Management District. Docket No. 90-ER-92S, January, 1993. Cited in Tellus Institute, 1994. Development of Externality Values for Energy Resource Planning in Ontario: Air Pollutants. Prepared for Ontario Externalities Collaborative, June 27, 1994. Boston, MA, 39pp; Klein, M. (1997a). Environmental Externalities for Sustainable Energy. Paper No. 97-IAGT-502, presented at the 12th Symposium on Industrial Applications of Gas Turbines, Banff, Alberta, October 15-17 1997; Klein, M. (1997b). Environmental Externalities for Sustainable Energy. Presentation notes for the 12th Symposium on Industrial Applications of Gas Turbines, Banff, Alberta, October 15-17 1997; MacRae, K.M. (1997). Natural Gas Utilization for Selected Electric Power Generating Units in Nova Scotia: Economics and Emissions. Special Report 97-3, October 1997. Canadian Energy Research Institute, Calgary; Ken Church Engineering (1997). Externalities and Energy Efficiency: An Introductory Investigation into the Effect of Externalities on Industrial Energy Efficiency Projects of Eastern Ontario. Project 97-007, Contract No. K.2340-7-0018, December, 1997. Ottawa, Canada; BC Hydro (1993). BC Hydro Resource Acquisition Policy. Cited in Tellus Institute, 1994, Development of Externality Values for Energy Resource Planning in Ontario: Introductory Report. Prepared for Ontario Externalities Collaborative, January 10, 1994. Boston, MA, 30pp; Emissions Evaluation. Prepared by Alchemy Consulting Inc. for IBI Group, Vancouver, BC.

Result: Health and environmental damages due to Nova Scotia's air pollutant emissions in 2005 were valued at more than a half a billion dollars, or $560 for each Nova Scotian. Sulphur oxide emissions—primarily from Nova Scotia Power's coal-fired power plants—accounted for more than 40% of all air pollution costs. As emissions continue to decline, estimated air pollution costs in 2015 are projected to be 25% less than in 2000 and 40% less than in 1990.

An extensive literature has developed over the years that links ambient air quality to human health and environmental impacts and then attempts to monetize these impacts in terms of economic costs. GPI Atlantic's 2004 *Ambient Air Quality Accounts for the Nova Scotia GPI* reviewed a wide range of literature sources on damage cost estimates and methods, and provided an indication of the potential economic costs of poor air quality in Nova Scotia. In this summary chapter, we update the estimates of the economic costs of air pollution using more recent emissions data.

While there is considerable uncertainty associated with the damage cost estimates presented in this indicator, as outlined in the numerous caveats described in the 2004 GPI report, it is nevertheless highly useful to attempt to value the damages associated with air pollution in economic terms. Specifically, these estimates can assist decisions-makers to quantify the specific environmental and social impacts of air pollution and to assess the cost-effectiveness and potential benefits of policies designed to improve ambient air quality. The economic valuation of pollution costs and pollution reduction benefits is particularly important in light of the province's commitment since 2006 to harmonize the goals of environmental quality and economic prosperity.

Estimates of the economic costs of air pollution are based on the damage cost approach used in the original 2004 GPI report. This method essentially establishes a mathematical relationship between ambient air quality, the associated human health and environmental impacts of pollution, and the economic costs of those impacts—expressed on a per tonne basis for the different CACs and then aggregated. Below, we provide a brief overview of this approach and update the 2004 estimates based on the most recent available data.

The damage cost approach begins with the understanding that polluted ambient air triggers human health and environmental impacts that carry economic costs. Although new work by Environment Canada will allow the establishment of a direct relationship between ambient air quality within a particular jurisdiction and the economic costs borne by that jurisdiction, the damage cost calculations undertaken here are actually based on emissions, and thus assess the economic costs of the pollutant emissions generated within Nova Scotia (regardless of where those costs are borne) rather than the economic costs borne by Nova Scotians as a result of ambient air quality within the province (a considerable portion of which may originate elsewhere).

In other words, we assess that portion of pollution-attributable economic costs for which Nova Scotians are responsible through their own emissions. This is the portion over which Nova Scotians have control. This approach also corresponds with that of the province's 2007 Environmental Goals and Sustainable Prosperity Act, which sets emission reduction targets for key air pollutants. The emissions-based estimates undertaken here will, therefore, allow the province to assess the economic benefits of its projected emission reductions, expressed as damages avoided, compared to current emission levels.

In this update, current emissions and future projections from Section 15.2 above are used for CO, TPM, SO_X, NO_X, and VOCs. As discussed above, these emission estimates were compiled for the years 1990, 1995, 2000, and 2005 from the Canadian Emission Inventory of Common Air Contaminants, and projections for 2010 and 2015 were taken from Environment Canada's Common Air Contaminants Baseline Forecast. Table 15-7 below aggregates—in five-year blocks—the total estimated cumulative Nova Scotia emissions for the five CACs that are used to estimate the economic costs of air pollution in Nova Scotia presented below.

Table 15-7. Past and projected Nova Scotia Criteria Air Contaminant (CAC) emissions (kt), 1990–2014

POLLUTANT	EMISSIONS (KILOTONNES)					
	1990–1994	1995–1999	2000–2004	2005–2009	2010–2014	TOTAL
CO	2,047	1,657	1,401	1,276	1,231	**7,612**
TPM	208	172	170	168	209	**927**
SO_X	871	832	780	609	470	**3,560**
NO_X	386	375	388	376	268	**1,793**
VOCs	360	285	243	231	228	**1,347**

The next step in the analysis is to relate these emissions to human health and environmental impacts and their associated costs. Those impacts are explained in detail in the 2004 GPI air quality report. However, because they are the basis for understanding economic costs, the physical human health and environmental impacts of each major CAC are outlined and summarized in the appendix to this chapter in Section 15.5.

Based on the literature on air pollution damage costs, a unit damage cost impact for each type of CAC emission is established and then multiplied by the updated emissions data presented in this chapter. The appropriate unit damage costs identified in the 2004 GPI report have been updated here to constant 2006 dollars. The rationales for selecting particular low and high range damage costs for each CAC are presented in the 2004 GPI report. Table 15-8 below presents the low and high range of damage cost estimates from the 2004 report expressed in constant 2006 dollars ($2006) to allow for comparisons of emission costs and savings over time.

Table 15-8. Economic damage cost estimates of Criteria Air Contaminants used in present study (C$2006)

POLLUTANT	$C2006/TONNE		REFERENCES[17]	
	Low	High	Low	High
CO	$2	$6	CEC, 1993	CEC, 1993
TPM	$2,372	$5,795	Klein, 1997a,b; MacRae, 1997	Klein, 1999
SO_X	$1,544	$11,746	Ken Church Engineering, 1997	BC Hydro Resource Acquisition Policy, 1993
NO_X	$1,577	$13,928	BC Hydro, 1993	Ken Church Engineering, 1997
VOCs	$2,237	$9,218	Alchemy Consulting Inc., 2001	CEC, 1993

The per tonne low and high damage cost estimates were then applied to the total Nova Scotia emissions (from Section 15.2 above) for each pollutant in five-year blocks to estimate the aggregate past and projected damage costs of Nova Scotia's air pollutant emissions in constant 2006 dollars (see Tables 15-9 and 15-10 below). Per capita damage costs of air pollutant emissions were also estimated, and are presented in Tables 15-11 and 15-12 below ($C2006/capita).

In Tables 15-10 and 15-12 below, the "total" column represents the accumulated damages expected as a result of the cumulative 25-year emissions. The "total" row in all four tables below represents the damage costs expected as a result of the combined emissions of the five different pollutants during each particular five-year time period.

Table 15-9. Past and projected undiscounted economic costs ($C2006 millions) attributable to Nova Scotia CAC emissions ($C2006 millions), 1990–2004

CAC	ECONOMIC COSTS ($C2006 MILLIONS)					
	1990–1994		1995–1999		2000–2004	
	Low	High	Low	High	Low	High
CO	$4.6	$11.5	$3.7	$9.3	$3.1	$7.8
PM	$494	$1,208	$407	$995	$403	$986
SO_X	$1,344	$10,229	$1,284	$9,768	$1,204	$9,158
NO_X	$609	$5,376	$592	$5,224	$612	$5,407
VOCs	$806	$3,320	$637	$2,624	$544	$2,240
TOTAL	**$3,258**	**$20,144**	**$2,923**	**$18,620**	**$2,766**	**$17,798**

Table 15-10. Past and projected undiscounted economic costs ($C2006 millions) attributable to Nova Scotia CAC emissions ($C2006 millions), 2005–2014

CAC	ECONOMIC COSTS ($C2006 MILLIONS)					
	2005–2009		2010–2014		TOTAL	
	Low	High	Low	High	Low	High
CO	$2.9	$7.1	$2.8	$6.9	$17	$43
PM	$398	$972	$495	$1,210	$2,198	$5,371
SO_X	$940	$7,152	$725	$5,515	$5,496	$41,821
NO_X	$593	$5,236	$423	$3,735	$2,829	$24,978
VOCs	$517	$2,128	$510	$2,103	$3,013	$12,414
TOTAL	**$2,450**	**$15,495**	**$2,156**	**$12,570**	**$13,554**	**$84,627**

Table 15-11. Past and projected undiscounted per capita economic costs ($C2006 millions) attributable to Nova Scotia CAC emissions ($C2006), 1990–2004

CAC	ECONOMIC COSTS ($C2006)					
	1990–1994		1995–1999		2000–2004	
	Low	High	Low	High	Low	High
CO	$5.0	$12.5	$4.0	$10.0	$3.4	$8.4
PM	$539	$1,317	$438	$1,069	$432	$1,055
SO_X	$1,466	$11,154	$1,380	$10,497	$1,288	$9,797
NO_X	$664	$5,862	$636	$5,614	$655	$5,785
VOCs	$879	$3,620	$685	$2,820	$582	$2,396
TOTAL	**$3,553**	**$21,966**	**$3,142**	**$20,011**	**$2,959**	**$19,041**

Table 15-12. Past and projected undiscounted per capita economic costs ($C2006 millions) attributable to Nova Scotia CAC emissions ($C2006), 2005–2014

CAC	ECONOMIC COSTS ($C2006)					
	2005–2009		2010–2014		TOTAL	
	Low	High	Low	High	Low	High
CO	$3.0	$7.6	$2.9	$7.3	$18	$46
PM	$424	$1,036	$525	$1,283	$2,357	$5,760
SO_X	$1,001	$7,619	$769	$5,851	$5,904	$44,919
NO_X	$632	$5,578	$449	$3,963	$3,035	$26,803
VOCs	$550	$2,267	$541	$2,231	$3,237	$13,334
TOTAL	**$2,611**	**$16,509**	**$2,287**	**$13,335**	**$14,551**	**$90,862**

Over the most recent five-year period for which actual data are available (2000-2004), Nova Scotia's emissions of five criteria air contaminants (CO, TPM, SO_X, NO_X, and VOCs) produced a cumulative estimated $2.8 billion to $18 billion in projected economic costs, depending on whether low- or high-end unit damage costs are applied. On a per capita basis, damages attributable to each Nova Scotian were approximately $3,000 to $19,000 in air pollutant costs in the same time period.

By far the largest single contributor to these air pollution costs was SO_X emissions, which resulted in an estimated $1.2 to $9.1 billion in cumulative damages over these five years—accounting for 44% of total emission costs using low-end estimates and more than half of total costs using the higher end estimates.

The good news, as clearly indicated in Tables 15-8 and 15-9 above, is that air pollution damage costs have fallen in each five-year period in tandem with the overall decline in pollutant emissions in Nova Scotia, and they are projected to fall further as Nova Scotia attains the emission targets set in the Environmental Goals and Sustainable Prosperity Act.

Thus, the undiscounted economic costs attributable to cumulative projected emissions in Nova Scotia between 2010 and 2014 are expected to be between \$2.3 billion and \$13 billion—approximately 25–30% less than in the 2000-2004 period and almost 40% less than the 1990-1994 period. This reduction in pollution-attributable economic costs can be regarded as damages avoided, and therefore as savings that will manifest in improved human health and environmental quality, avoided health care costs, and enhanced productivity, compared to a "business as usual" scenario without further emission reductions.

SO_X emissions will again constitute the largest contributor to air pollution damages for the 2010-2014 time period. However, the projected decline in SO_X emissions will be the main driver of the decrease in overall pollution-related economic costs in the coming decade. In accord with the Nova Scotia Environmental Goals and Sustainable Prosperity Act mandate that "sulphur dioxide emissions will be reduced by fifty per cent by the year 2010 from sources existing in 2001," SO_X-related costs will drop to 34% of total pollution damage costs in 2010-2014 at the low end and to 44% at the high end—down from 44% and 51%, respectively, in 2000–2004.

Over the 25-year period (1990-2014), total Nova Scotia emissions of the five CACs are estimated to result in a staggering \$14 billion to \$85 billion in total cumulative damages—constituting a massive long-term drain on the economy in excess health care costs, lost economic productivity, and environmental damages like acid rain impacts on lakes, rivers, and forests. On a per capita basis, cumulative damages attributable to each Nova Scotian are estimated to be approximately \$15,000 to \$91,000 over this 25-year period.

The economic costs of Nova Scotia's air pollution emissions in a single year are significant—exceeding an estimated half a billion dollars (or \$560 for each Nova Scotian) in 2005 alone. The estimated damage costs for 2005 CAC emissions (the most recent year for which exact data are available) are presented in Table 15-13 below.

Table 15-13. Damage costs (\$C2006 millions) and per capita damage costs (\$C2006) attributable to Noval Scotia's 2005 Criteria Air Contaminant emissions

POLLUTANT	DAMAGE COSTS (\$C2006 MILLIONS)		PER CAPITA DAMAGE COSTS (\$C2006/CAPITA)	
	Low	High	Low	High
CO	\$0.6	\$1.4	\$0.6	\$1.5
PM	\$67.4	\$164.6	\$72.0	\$175.9
SO_X	\$216.7	\$1,648.7	\$231.5	\$1,761.4
NO_X	\$139.4	\$1,230.4	\$148.9	\$1,314.6
VOCs	\$103.5	\$426.3	\$110.5	\$455.4
TOTAL	**\$527**	**\$3,471**	**\$564**	**\$3,709**

As noted, the results presented in Tables 15-8 to 15-13 above clearly show that sulphur oxides continue to be the most costly pollutant currently emitted in Nova Scotia—accounting for approximately 40–50% of all air pollution related economic costs. Although there has been a clear declining trend in SO_X emissions since 1990, the sharpest reductions are expected to occur during the present period in accord with legislated requirements. The preliminary observations from the above economic estimates confirm that avoiding, preventing, and reducing SO_X emissions will be highly cost-effective in reducing cumulative potential damage costs attributable to Nova Scotian pollutant emissions.

In 2005, the overwhelming majority of SO_X emissions were from the non-industrial fuel combustion sector (81% of total provincial SO_X emissions). By far the largest sub-component of emissions within the non-industrial fuel combustion sector is electric power generation, which by itself accounts for almost 75% of total SO_X emissions in Nova Scotia. It is clear that policies that target SO_X emission reductions in the electricity generation sector could result in significantly improved air quality for Nova Scotians. Measures that would reduce SO_X in the electricity sector—ranging from the use of low sulphur fuels and sulphur scrubbing of exhaust streams to energy conservation and efficiency, shifts to renewable energy, and district heating—all hold significant promise to reduce overall damages attributable to air pollution.

15.5. Appendix: health and environmental effects of air pollutants

Appendix Table 15-1. Health and environmental effects of Criteria Air Contaminants (CACs) and mercury

CRITERIA AIR CONTAMINANT	KEY HEALTH AND ENVIRONMENTAL EFFECTS
Indicator a. Carbon Monoxide (CO)	The toxic effects of CO are due to its preferential combination with the heme component of red blood cells to form carboxyhemoglobin, which reduces the capacity of the red blood cells to carry oxygen to tissues. Tissues with high oxygen demand are the most sensitive to the effects of CO: heart, brain, and exercising skeletal muscle. High levels of CO (usually occurring indoors) can result in headache, drowsiness, and cardiac arrhythmias (any irregularity in the natural rhythm of the heart). At sufficiently high levels, CO can lead to coma and death. Studies have shown that healthy adults exposed to increased levels of CO can exhibit decreased aerobic capacity; impaired work capacity; and reduced visual perception, manual dexterity, and performance of complex sensory-motor tasks (Health Canada, 1998). Health effects associated with relatively low-level, short-term exposure to CO include decreased athletic performance and aggravated cardiac symptoms. Small increases in CO exposure could adversely affect myocardial function and produce ischemia (a local loss of blood flow), and these effects may have no safe threshold (Environment Canada and Health

CRITERIA AIR CONTAMINANT	KEY HEALTH AND ENVIRONMENTAL EFFECTS
	Canada, 1994). In other words, there is no safe level of exposure to carbon monoxide. At the levels typically found in large cities, CO may increase hospital admissions for cardiac diseases, and there is also evidence of an association with premature deaths (Environment Canada and Health Canada, 1994; Health Canada, 2001a). Exposure to CO is considered most harmful to people with severe anemia, chronic lung disease such as chronic obstructive pulmonary disease (COPD),[18] coronary artery disease, arteriosclerosis, chronic angina,[19] and ischemic heart disease (Environment Canada and Health Canada, 1994; Health Canada, 1998). Other risk groups include pregnant women, fetuses, newborn infants, and people with cardiovascular or respiratory diseases—especially the elderly and young children.
Indicator b. Total Particulate Matter (TPM or PM) or Total Suspended Particulate (TSP) *Indicator c.* Particulate Matter ≤10 microns (PM_{10}) *Indicator d.* Particulate Matter ≤2.5 microns ($PM_{2.5}$)	PM_{10} and $PM_{2.5}$ are considered to be "toxic" under the 1999 Canadian Environmental Protection Act (CEPA)[20] (Environment Canada and Health Canada, 2000). There are several mechanisms by which inhaled PM may exert a toxic effect on humans (NSDOE, 1987; Health Canada, 1998; Smith and Sloss, 1998): • may be intrinsically toxic due to inherent chemical and/or physical characteristics • may interfere with one or more of the clearance mechanisms in the respiratory tract, which can lead to other pollutants having a greater than normal effect • may act as carriers of an absorbed (attached) toxic substance • free-radical activity on the surface of particles causes an increase in surface area, which may compromise epithelial integrity and lead to uptake of particles into the interstitium • have strong aerosol acidity (number of acid- or acid-coated particles, and the total acid dose to a cell) • may interact with other pollutants in the air and act synergistically (i.e., the effect of two or more contaminants acting together may be greater than the sum of the effects attributable to each contaminant separately) Short-term exposure to airborne PM is associated with a variety of adverse effects, including eye, nose, and throat irritation; breathing difficulties; reduced lung function; and asthma exacerbation (worsening of asthma symptoms). PM may cause a wide spectrum of immunological disorders, and can aggravate lung infections, possibly by reducing the body's ability to fight infection (OMA, 1998). Exposure to particulates is also associated with increases in the number of doctors' office visits, emergency room visits, the number of hospital admissions of people with cardiac and respiratory disease, and incidences of premature mortality (OMA, 1998 and Health Canada, 2001a). The finer particles pose the greatest threat to human health because they can travel deepest into the lungs. Exposure to PM has also been shown to cause

CRITERIA AIR CONTAMINANT	KEY HEALTH AND ENVIRONMENTAL EFFECTS
	increases in chronic cough and bronchitis and in respiratory-related activity restrictions, which lead to increased numbers of lost work days and school absences (Environment Canada and Health Canada, 1999b). Long-term exposure to PM is associated with decreased lung function and increased mortality rates. Longer term, sub-chronic, or chronic exposures have been associated with increases in mortality, respiratory disease symptoms, and decrements in lung function (Environment Canada and Health Canada, 1999b). The risk of developing respiratory tract cancers may be increased with long-term exposure. Particulates may contain mutagenic and carcinogenic compounds, or these compounds may be adsorbed onto their surfaces. Particles containing polycyclic aromatic hydrocarbons (PAHs), nitrosamines, and nitroaromatics have been linked to respiratory cancer (Health Canada, 1998). Groups that are particularly susceptible to the effects of PM include the elderly, those with chronic pulmonary or cardiovascular disease, the very young, asthmatics, smokers, and people with respiratory infections or bronchitis. PM_{10} exposure has been positively associated with daily mortality rates from cardiovascular and respiratory diseases, and long-term $PM_{2.5}$ exposure has been significantly associated with cardiopulmonary and lung cancer mortality. $PM_{2.5}$, in particular, are deposited in the respiratory bronchioles and alveoli, and can cause adverse health effects (studies cited in Band, et al., 2003). PM can also affect vegetation by physical smothering of the leaf surface, physical blocking of stomata, and induction of a chemical effect due to particle composition. Indirect effects include disturbances of soil pH and ionic composition, nutrient imbalances through particle deposition to soils, and reduced light intensity due to particle loads in air (USEPA, 2002e). The most obvious effect of particulate deposition on vegetation, including trees and agricultural crops, is physical smothering of the leaf surface (Environment Canada and Health Canada, 1999b). Particle accumulation on the leaf surface causes reduced light transmission, affecting photosynthesis, and may increase the plant's susceptibility to disease. The effects of PM on materials have been investigated for metals, wood, stone, painted surfaces, electronics, and fabrics. The deposition of PM on these materials may cause soiling and discoloration, thus reducing their aesthetic appeal and necessitating cleaning and repainting. The presence of PM has been linked to enhanced speed of corrosion on metal surfaces, altered paint durability, accelerated stone corrosion, and corrosion and failure of electronics (Environment Canada and Health Canada, 1999b). Increasing concentrations of particles and gases in air can also result in reduced visual range. The presence of particles in the air reduces the distance at which we can see the colour, clarity, and contrast of distant

CRITERIA AIR CONTAMINANT	KEY HEALTH AND ENVIRONMENTAL EFFECTS
	objects because the particles absorb light and scatter in the atmosphere. In more polluted areas, PM can reduce the range of visibility by over 300 km (Commissioner of the Environment and Sustainable Development, 2000). Visibility is one of the most readily perceived indicators of poor air quality by the public (Environment Canada and Health Canada, 1999b). Degradation of visibility has economic implications, and may lead to loss of tourism, lower property values, and reduced quality of life.
Indicator e. Sulphur Dioxide (SO_2)	Because SO_2 is very soluble in water, when inhaled, it will rapidly dissolve in the secretions covering the cells of the upper respiratory tract (nose, mouth, throat, trachea, and bronchi) and cause tissue irritation and congestion at relatively high levels of exposure (FPACAQ, 1987). SO_2 in ambient air will not produce adverse effects in healthy individuals (Health Canada, 1998). At lower levels of exposure, hypersensitive individuals, particularly asthmatics and persons with lung disease, may experience breathing difficulties. Groups that are particularly sensitive to SO_2 exposure include people with asthma who are active outdoors, children, the elderly, and people with heart or lung disease (USEPA, 2002f). Eye irritation, shortness of breath, and reduction of lung function can also result from SO_2 exposure. There is some evidence that exposure to elevated SO_2 levels may increase the incidence of premature death (Health Canada, 2001a). SO_2 can react with water vapour and other chemicals in the air to form very fine particles of sulphate. These airborne particles form a key element of urban smog and are a significant health hazard (Environment Canada, 2002a). Significant associations have been found between increased sulphate levels and an increase in the number of acute-care respiratory hospital admissions (Health Canada, 1998). Exposure to sulphate particles is also associated with a higher incidence of premature death (USEPA, 2002f). The human health concerns related to acid rain are derived primarily from the precursors SO_2 and NO_X. The major impacts of acid rain are on soil, aquatic ecosystems, plants, and materials. About four million square kilometres (46% of Canada's total surface area) are highly sensitive to acid rain (NEIS, 1999a). Much of this area is in eastern Canada. Acid rain is a particular problem in eastern Canada because many of the water and soil systems in the region lack natural alkalinity—such as an adequate lime base—and, therefore, cannot neutralize or "buffer" against acid rain naturally. Provinces that are part of the Canadian Precambrian Shield, like Ontario, Quebec, New Brunswick, and Nova Scotia, are affected the most because their water and soil systems cannot effectively fight the damaging consequences of acid rain (Environment Canada, 2002a). In Nova Scotia, the south shore is especially sensitive due to natural acidification by organic acids (Environment Canada, 1998b). Acid rain is a less serious problem in western Canada because of lower overall exposure to acidic

CRITERIA AIR CONTAMINANT	KEY HEALTH AND ENVIRONMENTAL EFFECTS
	pollutants and a generally less acid-sensitive environment (NEIS, 1999a). The more acidic a lake becomes, the fewer species it can support. Plankton and invertebrates, such as crayfish and clams, are among the first to die as a result of acidification. When the pH of a lake drops below 5, more than 75% of its fish species gradually disappear (Environment Canada, 2002e). Smallmouth bass, walleye, brook trout, and salmon are more sensitive to acidity than other species and tend to disappear first (Environment Canada, 2002a). Although there are likely additional causal factors and conditions, like loss of forest cover, climate change, and over-fishing, the dramatic decline in salmon and brook trout populations in Nova Scotia in the last 20 years is consistent with results expected from acidification of some of the province's water bodies (Wilson, 2000b).[21] Mass fish mortalities can occur during the spring snow melt, when acidic pollutants that have built up in the snow over the winter begin to drain into waterways (episodic acidification). Acidity can also affect the reproductive success of fish species. Some effects include failure to spawn, reduced egg deposition, decreased survival rate of hatchlings or fry, and deformities in young fish (Environment Canada, 2002a). Fish may lose the ability to regulate their own body chemistry and can become more susceptible to disease. The effects of acid rain on aquatic ecosystems are summarized in Table 1 of the original 2004 GPI air quality report. As fish stocks dwindle, so do populations of loons and other water birds that feed on them. Almost 80% of Nova Scotia's lakes with greater than one hectare of surface area are susceptible to acidification (NSDOE, 1998). It is estimated that as many as 14,000 lakes in eastern Canada are acidic (USEPA, 2002b). Acid deposition has had a significant impact on Atlantic salmon habitat. Since 1950, one-third of Atlantic salmon habitat in Nova Scotia has been lost to acidification—a loss of 9,000–14,000 fish per year to the salmon fishery (NSDOE, 1998).
Indicator f. Nitrogen Oxides (NO_X)	The major concern about NO_X emissions is the role they play in the formation of ground-level ozone. NO_X are also a concern because they can contribute to the acidification of precipitation. (See the 2004 GPI air quality report for a discussion of the human health and non-health effects of ground-level ozone and acid rain.) NO and NO_2 are the most important of the NO_X with respect to direct impacts on human health. NO_2 has a greater impact on human health than does NO (Health Canada, 1998). People with asthma and chronic obstructive pulmonary disease (COPD), children, and the elderly may be at increased risk of suffering the adverse health effects of NO_X. Prolonged exposure to high concentrations of NO_X can affect the body's ability to defend itself against bacterial and viral infection, and is associated with an

CRITERIA AIR CONTAINANT	KEY HEALTH AND ENVIRONMENTAL EFFECTS
	increased incidence of respiratory illness (Health Canada, 1997). Nitric acid and related particles can affect the human respiratory system, making breathing difficult, damaging lung tissue, and causing premature death (USEPA, 2002d). These small particles can also penetrate deeply into sensitive parts of the lungs, and can cause or worsen respiratory diseases such as asthma, emphysema, and bronchitis, and aggravate existing heart disease (Health Canada, 2001a; USEPA, 2002d). In air, NO_X reacts with common organic chemicals to form a variety of toxic products (e.g., nitrate radical, nitroarenes, and nitrosamines), some of which may cause biological mutations (USEPA, 2002d). Increased nitrogen loading in water bodies accelerates eutrophication,[22] which leads to oxygen depletion and reduces fish and shellfish populations. NO_X emissions in the air are one of the largest sources of nitrogen pollution in Chesapeake Bay (USEPA, 2002d). NO and NO_2 contribute to the formation of acidic precipitation, which can affect the growth and health of forests (see the 2004 GPI air quality report). Excessive nitrogen deposition can also harm forests in other ways: vigorous growth stimulated by nitrogen fertilization may result in nutrient deficiency; nitrogen compounds can alter physiological and anatomical development; and excessive nitrogen can increase the susceptibility of trees to freezing or dessication in winter (MacKenzie and El-Ashry, 1989). NO_2 can affect visibility because it is an intensely coloured gas and absorbs light over the entire visible spectrum. Nitrate particles can also block the transmission of light, reducing visibility (USEPA, 2002d). NO_X exposure can cause the corrosion of metals, fading of fabric dyes, and degradation of textile fibres, rubber products, and polyurethanes. Nitrous oxide (N_2O) is a greenhouse gas (GHG)[23] and can accumulate in the atmosphere with other GHGs, such as carbon dioxide (CO_2), impacting the global climate system. N_2O has 310 times the ability of CO_2 to trap heat.[24] That is, each tonne of N_2O emitted has much greater potential to enhance the greenhouse effect than does a tonne of CO_2. Climate change can lead to increased risks to human health, a rise in sea level, and other adverse changes to plant and animal habitat.
Indicator g. Volatile Organic Compounds (VOCs)	VOCs can be classified according to whether they are a direct human health concern, whether they can promote ground-level ozone formation, or both. Among the potentially toxic VOCs are known human carcinogens such as benzene. Health Canada has classified methylene chloride as a probable human carcinogen. Trichloroethylene and tetrachloroethylene have been shown to cause cancer in laboratory animals, but the health risk to humans is not known (Health Canada, 1997).

CRITERIA AIR CONTAMINANT	KEY HEALTH AND ENVIRONMENTAL EFFECTS
	Numerous studies have demonstrated the association between occupational exposure to benzene and human health impacts. Occupational benzene exposure has been shown to cause hematotoxic effects, effects on the immune system (such as decreases in T lymphocytes, alterations in serum immunoglobulins, and benzene-induced autoimmunity and allergy effects), neurotoxic effects, and incidences of leukemia in workers from the petrochemical, graphic, and rubber industries, as well as those who work with chemicals or in oil refineries (Government of Canada et al., 1993a). However, the health effects of exposure to environmental levels of benzene are unknown. The highest reported concentration of benzene in urban air in Canada is over 100,000 times less than the level at which adverse effects have been observed in laboratory mammals (Health Canada, 1997), and is almost 240,000 times lower than the lowest concentration reported to be lethal to plants, terrestrial invertebrates, and mammals following acute laboratory exposure to benzene in air (Government of Canada et al., 1993a). Long-term exposure to high levels of trichloroethylene in the workplace is associated with adverse liver and cardiovascular effects, kidney damage, and other diseases (Health Canada, 1997). Short-term exposure to high levels of tetrachloroethylene is associated with symptoms ranging from eye, throat, and nasal irritation to dizziness and nausea. At very high concentrations and after long-term exposure, tetrachloroethylene can cause cancer in some laboratory animals, although it is unclear whether these results are applicable to humans (Health Canada, 1997). Short-term exposure to elevated concentrations of methylene chloride vapours can cause sluggishness, irritability, light-headedness, nausea, and headaches (Health Canada, 1997). Indoor air contributes to the exposure of the general population to benzene, trichloroethylene, tetrachloroethylene, and methylene chloride considerably more than outdoor air (Government of Canada et al., 1993a,b,c,d). Trichloroethylene, tetrachloroethylene, and methylene chloride have short half-lives in the atmosphere and are, therefore, not thought to contribute to the depletion of stratospheric ozone, to the formation of ground-level ozone, or to global climate change (Government of Canada et al., 1993b,c,d). Benzene does not contribute directly to the depletion of stratospheric ozone or climate change (Government of Canada et al., 1993a). There are some data suggesting that atmospheric concentrations of trichloroethylene and tetrachloroethylene may be sufficient to cause adverse effects to terrestrial plants, notably trees, in Canada, particularly in urban areas (Government of Canada et al., 1993c,d).
Indicator h. Mercury	Mercury is considered toxic under the Canadian Environmental Protection Act (CEPA) (Environment Canada, 2005a). There is no safe threshold for

CRITERIA AIR CONTAMINANT	KEY HEALTH AND ENVIRONMENTAL EFFECTS
(Hg) (not a CAC)	mercury, as very low concentrations can be toxic to the environment and human health (Environment Canada, 2004b). Pregnant women, fetuses, and children are most at risk from mercury poisoning. The main pathway to mercury poisoning in human beings is through low-level, background exposure from mercury vapours, while the most common form of ingestion is through the consumption of contaminated fish and other meats (Pollution Probe, 2003; Health Canada, 2002). The toxic effects have the gravest impact on the central nervous system, and have been linked to neurological and developmental damage (Environment Canada, 2005a, 2004b). Acute exposures have been linked to "permanent brain damage, central nervous system disorders, memory loss, heart disease, kidney failure, liver damage, loss of vision, loss of sensation and tremors" (Pollution Probe, 2003, p. 35). Mercury may also be an endocrine disruptor (Environment Canada, 2005a; Pollution Probe, 2003). Exposures that are low-level but chronic can cause neurological, reproductive, behavioural, and learning problems (Pollution Probe, 2003). Pollution Probe (2003) reports that mercury in aquatic ecosystems is a particular concern. Though mercury concentrations in terrestrial environments have been elevated by human activity, levels are usually not high enough to threaten wildlife. However, certain aquatic environments promote the transformation of mercury into methylmercury, a more toxic substance, which then bioaccumulates in fish, marine mammals, and fish-eating species (e.g., otters, loons, mink, and osprey). Although there has been more research on the human health effects of mercury and on the dangers to human health of ingesting fish with high levels of mercury, neurotoxin reactions have also been found in wildlife, and similar health effects to those experienced by humans are considered likely in many species. High levels of mercury have also been found in predatory saltwater species such as tuna (UNEP, 2003).

Sources: See list at end of appendix.

Appendix Table 15-2. Summary of possible adverse impacts of air pollution

POLLUTANT	HUMAN HEALTH IMPACTS	NON-HEALTH IMPACTS
Carbon Monoxide (CO)	• Cardiovascular hospital admission (CHA) • Premature mortality	

Particulate Matter (PM)	• Premature mortality
	  ◦ Respiratory
	  ◦ Cardiovascular
	• Emergency room visits (ERV)
	  ◦ Respiratory
		• Household materials soiling
		• Visibility (change in visual range)
		  ◦ Recreational
		  ◦ Residential
		• Materials damage

POLLUTANT	HUMAN HEALTH IMPACTS	NON-HEALTH IMPACTS
	° Cardiovascular • Hospital admissions ° Respiratory hospital admissions (RHA) ° Asthma ° Chronic obstructive pulmonary disease (COPD) ° Pneumonia ° Cardiac hospital admissions (CHA) ° Coronary artery disease[a] ° Dysrhythmias[b] ° Congestive heart failure • Doctor's office visits ° Child bronchitis ° Chronic respiratory disease ° Chronic bronchitis ° Child asthma attacks ° Adult asthma attacks ° Acute respiratory symptoms (ARS)[c] • Asthma symptom days (ASD)[d] • Restricted activity days (RAD)[e] • Minor restricted activity days (MRAD)[f]	• Change in crop production • Change in forest productivity • Change in fishery performance
Sulphur Dioxide (SO_2)	• Child cough days • Adult chest discomfort days	• Materials damage • Damage to monuments and buildings of cultural value • Change in crop production • Change in biodiversity through acidification—forests and freshwaters • Change in forest productivity • Change in fishery performance
Nitrogen Oxides (NO_X)	• Phlegm impacts • Eye irritation impacts • Respiratory illness	• Contribution to acid rain, ground-level ozone and smog, eutrophication • Contribution to climate change (N_20)
Volatile Organic Compounds (VOCs)	• Cancer risk	• Contribution to the formation of ground-level ozone and smog[g]
Ground-level Ozone (O_3)	• Premature mortality ° Respiratory ° Cardiovascular • Emergency room visits (ERV)	• Agriculture crop damage—yield change (e.g., corn, soybeans, wheat, barley, rye, oats, potato, sugar beet)

POLLUTANT	HUMAN HEALTH IMPACTS	NON-HEALTH IMPACTS
	○ Respiratory ○ Cardiovascular • Hospital admissions ○ Respiratory hospital admissions (RHA) ○ Asthma ○ Chronic obstructive pulmonary disease (COPD) ○ Pneumonia ○ Cardiac hospital admissions (CHA) ○ Coronary artery disease[a] ○ Dysrhythmias[b] ○ Congestive heart failure • Doctor's office visits ○ Child bronchitis ○ Chronic respiratory disease ○ Chronic bronchitis ○ Child asthma attacks ○ Adult asthma attacks ○ Acute respiratory symptoms (ARS)[c] • Asthma symptom days (ASD)[d] • Restricted activity days (RAD)[e] • Minor restricted activity days (MRAD)[f]	• Materials damage • Change in biodiversity through effects on interspecies competition—forests and freshwaters • Effects on forests—crown dieback, foliar damage, reduced biomass, elevated tree mortality
Polycyclic Aromatic Hydrocarbons[g]	• Probable cancer risk associated with some PAHs • Chronic bronchitis • Dermal effects	
Dioxins and Furans[g]	• Numbness, nausea, headaches, loss of hearing • Sleep disturbances, tiredness • Depression • Loss of appetite • Dermal effects • Activation / fluctuation of liver enzymes • Tissue damage • Pulmonary deficiency • Reproductive effects • Cancer risk	

Sources: See list at end of appendix.

Notes:

a) Coronary artery disease: narrowing or blocking of the arteries or blood vessels that supply blood to the heart.

b) Dysrhythmia: alteration in the rhythm of the heart.
c) Acute respiratory symptoms (ARS): respiratory-related symptoms such as chest discomfort, coughing, and wheezing.
d) Asthma symptom day (ASD): exacerbation of asthma symptoms in individuals with diagnosed asthma.
e) Restricted activity days (RAD): days spent in bed, missed from work, or days when activities are restricted due to illness.
f) Minor restricted activity days (MRAD): days on which some, but not all, activities are restricted because of illness.
g) For health and environmental impacts of ground-level ozone and smog, of polycyclic aromatic hydrocarbons, of dioxins and furans, see Sections 2.6, 2.7, and 2.8 of the 2004 GPI Air Quality report.

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16. Water Pollutant Releases, Water Quality, and Impacts

For the original GPI Atlantic reports on water quality, please see the following:

The GPI Water Quality Accounts: Nova Scotia's Water Resource Values and the Damage Costs of Declining Water Resources and Water Quality (July, 2000)
http://gpiatlantic.org/pdf/water/waterquality.pdf

The Costs and Benefits of Sewage Treatment and Source Control for Halifax Harbour (2000)
http://gpiatlantic.org/pdf/water/halharbour.pdf

Headline Indicators

1. Releases of water pollutants by industry, agriculture, and municipalities
2. Municipal water supply compliance to Canadian drinking water quality guidelines
3. Quality of rivers, lakes, and wetlands
4. Economic value of water resources and costs of water pollution and resource loss

16.1. Introduction

Note to Reader: Please see the appendix to this chapter for a list of acronyms and Section 23.3 for additional references.

Water is essential for human health—in fact, about 2.5 litres per person each day are necessary for survival and health (Health Canada 1997). We use water not only to sustain physical health, but also as the most basic cleaning agent; as a source of food, such as fish and shellfish; and for relaxation and enjoyment. As well, lakes, rivers, wetlands, and coastal areas provide habitat for thousands of organisms from bacteria and fungi to amphibians, fish, birds, and mammals.

Some contaminants are found naturally in water—for example, some water bodies may have traces of arsenic present. However, most current aquatic and human health hazards result from contaminants released to the environment by humans. These include pesticides and other organic compounds, metals, fluoride, radionuclides, microorganisms, nutrients (nitrates, phosphates), and other substances.

There are many sources of water pollutants. Substances in the air, such as toxic chemicals and lead, are collected in the rain that falls. Water collects substances as it runs across natural and man-made surfaces, producing runoff. In urban areas, water runoff increases the concentration of substances such as nutrients, sediments, petroleum products, and road salts in lakes, rivers, and groundwater—degrading their quality. Industrial, farming, and forestry activities can also increase concentrations of toxic chemicals, nutrients, pesticides, and suspended sediments in water sources, which in turn can lead to increased erosion, habitat degradation, eutrophication of lakes and rivers, and low dissolved oxygen in water ways. Improper treatment of municipal sewage wastes can also lead to increased concentrations of pathogens such as bacteria and viruses in waterways.

All of these potential impacts of water pollution impose various economic and social costs—including the cost of treating illnesses that range from typhoid, cholera, and dysentery in countries where contaminants enter the drinking water supply to minor respiratory and skin diseases, costs to restore and clean contaminated drinking water supplies, costs of reduced fish and shellfish catches, increased flooding and flood control costs, and loss of opportunities for recreational water use.

While Canadians generally took the quality of their drinking water for granted until the late 1990s, the tragedy of Walkerton, Ontario, which resulted in seven deaths and 2,000 serious illnesses when E. coli contaminated the town's water supply, brought renewed attention to the issue, and indicated the very serious potential consequences and costs of water contamination even in advanced industrialized economies. Beyond the human suffering, the economic costs of this tragedy were enormous, including a billion-dollar lawsuit on behalf of injured families; hospital and medical costs to treat E.coli victims; business revenue losses; legal costs and a Commission of Inquiry; the cost of repairs to the drinking water supply and infrastructure; the costs of bottled water and bussing students to nearby schools; property price declines; and the cost of cleanup of cattle and pig farms and feedlots.

Historically, increasing water demand and declining water quality have been addressed by developing new sources of water. However, the economic and environmental costs of developing new water sources have increasingly been seen as unsustainable to meet future needs and demands. Instead, policy attention has increasingly focussed on protecting and improving existing water supply systems to make them more efficient, equitable, safe, accessible, and environmentally benign.

Water quality is generally assessed and analysed according to three main categories:

- drinking water,
- recreational water, and
- aquatic habitat.

All three relate to the health of both aquatic ecosystems and the living organisms, including humans, which depend on their water resources. In Canada, water quality guidelines have been developed to cover each of these three main categories.

Nova Scotia has also been working collaboratively with federal and provincial partners in reporting on water quality through the National Canadian Environmental Sustainability Indicators (CESI) program. This new database, which did not exist when GPI Atlantic developed its first GPI Water Quality Accounts for Nova Scotia in 1999–2000, now provides data on water quality across Canada, in the Maritimes, and for selected water bodies in Nova Scotia—thereby providing an important new source of information for this update and for the Nova Scotia Genuine Progress Index. In particular, this update references the Canadian Water Quality Index (WQI) developed through CESI, which provides data on five Nova Scotia water bodies that are assessed for the protection of aquatic life, drinking water quality, livestock watering, and crop irrigation uses.

Despite these positive developments, there is still not nearly enough readily available and current data to construct a definitive physical account of water quality for the Province. For example, the most recent detailed WQI information available for Nova Scotia through CESI is for 2000–01. More research will certainly need to be conducted to develop and populate appropriate indicators of water quality and a full cost account of the value of water resources and the costs of water pollution in Nova Scotia. To the extent possible given existing data limitations, this report updates key water quality indicators and economic valuations from the July 2000 GPI Water Quality Accounts for Nova Scotia.

Indicators of Progress

Three key indicators are used to provide an overview of progress on water quality in Nova Scotia, and to assess the impacts of changes in water quality:

Headline Indicator 1: Release of Water Pollutants. The trend in releases of pollutants that can impact water quality in Nova Scotia is an important indicator, as it demonstrates how the province has managed releases that are within its control over time.

Headline Indicator 2: Drinking Water Quality. The provision of safe drinking water with minimal water pollutant concentrations for human consumption has a direct effect on human health-related impacts. To that end, drinking water quality in Nova Scotia is compared to Canadian guidelines for a large number of potential water pollutants.

Headline Indicator 3: Water Quality of Rivers, Lakes, and Wetlands. Water pollution can impact the health of river, lake and wetland ecosystems. These water ecosystems are important sources of both drinking water and water used for agricultural and industrial activities. They also support productive fisheries and provide wildlife habitat and recreational opportunities. Damage caused by water pollution to these ecosystems can have direct impacts on the health, abundance and diversity of these ecosystems, and can lead to their degradation or destruction, which in turn imperils human activities dependent on their health. As a result, there are a number of indirect economic losses associated with degraded aquatic ecosystems including economic losses from the reduction of fish catches and closure of beaches. (Note: The quality of the marine environment off Nova Scotia's coast is not addressed in this chapter but in the fisheries chapter.)

The last section of this chapter updates the GPI "full cost accounting" of water quality. This account attempts to assess, to the degree possible, the potential total value of the province's ecologically sound water resources, the total amount that is spent to avoid contamination of these water resources, and the total costs incurred due to losses in water resource and declines in water quality.

16.2. Release of water pollutants

Data sources: Commission for Environmental Cooperation Report. 2004. *Taking Stock: North American Pollutant Releases and Transfers*; and Nova Scotia Environment and Labour Report. 2008. *Towards a Water Resources Management Strategy for Nova Scotia*.

Results: According to available data, pollutant releases to surface waters in Nova Scotia in 2004 increased by 380% from releases in 1995. However, changes in inventory methodologies and the pollutants included in the inventory are likely largely responsible for the magnitude of this apparent increase. In the same period, on-site pollutant releases to land decreased by over 93% from 435 tonnes in 1995 to 30 tonnes in 2004. It is also unclear in the case of on-site pollutant releases whether significant changes in inventory methodologies and included pollutants have occurred, and therefore whether the comparative data actually offer a fair comparison.

Currently, 25% of Nova Scotia's sewage is handled through 125 municipal wastewater treatment facilities, which treat approximately 357,000 cubic metres of wastewater per day. Onsite septic systems treat 45% of sewage, while raw sewage discharges make-up the remaining 30% of sewage generated in the Province.

The main sources of water pollution in Nova Scotia can be attributed to the release of industrial effluents, discharges from municipal sewers, and run-off from agricultural fields. Each of these three main sources of water pollutants is reviewed below.

16.2.1. Industrial releases of water pollutants

Based on 2004 data for North American pollutant releases and transfers (CEC 2007), 240 tonnes of pollutants were discharged from industrial sources to Nova Scotia surface waters in that year (0.2% of the North American total). These releases to surface waters included discharges to streams, rivers, lakes, oceans, and other bodies of water from both point sources, such as industrial discharge pipes, and non-point sources, such as stormwater runoff. These releases do not include releases to sewers or other off-site wastewater treatment facilities. The 2004 pollutant release to surface waters in Nova Scotia represented a 380% increase from releases in 1995 (50 tonnes). However, changes in inventory methodologies and the pollutants included in the inventory are likely largely responsible for the magnitude of this apparent increase.

Nova Scotia was ranked 42nd among 65 states and provinces in total surface water discharges (CEC 2007). According to the CEC ranking system, the jurisdiction with the highest level of discharge is ranked first, so the province's 42nd-place CEC ranking indicates that Nova Scotia has lower surface water discharges than the North American mean.

However, North American states and provinces clearly have very different sizes and populations. So per capita rankings will produce fairer comparisons. On a per capita basis, Nova Scotia was ranked 32nd in 2004, compared to 46th in 1995—indicating an apparent increase in per capita discharges over time *relative to* other states and provinces, since a higher ranking signifies relatively larger pollutant discharges per capita. Again, however, changes in inventory methods and inconsistencies between jurisdictions on included pollutants may affect these rankings.

The largest industrial surface water discharges in Nova Scotia by chemical are presented in Table 16-1 below. Approximately 98% of reported industrial surface water discharges by mass in Nova Scotia are nitric acid and nitrogen compounds from the pulp and paper sector.

Table 16-1. Top ten chemical surface water discharges by mass (kg), Nova Scotia, 2004

CHEMICAL NAME	2004 ON-SITE SURFACE WATER DISCHARGES (KG)
Nitric acid and nitrate compounds	237,563
Manganese (and its compounds)	2,579
Phenol	1,116
Acetaldehyde	539
Zinc (and its compounds)	208
Copper (and its compounds)	140
Chloromethane	30
Nickel (and its compounds)	18
Vanadium (and its compounds)	12
Lead (and its compounds) (reported under lower threshold)	1.12
TOTAL	**242,206**

Source: North American pollutant releases and transfers data (CEC 2007)

On-site industrial pollutant releases to land (including pollutants disposed in landfills and land treatment applications in which a waste is applied to soil for biological degradation), and offsite pollutant transfers (including pollutants transferred for treatment prior to disposal, or shipped for disposal off-site) also have the potential to impact water quality negatively.

On-site industrial pollutant releases to land decreased by 93% from 435 tonnes in 1995 to 30 tonnes in 2004. Offsite pollutant transfers increased by 46% from 101 tonnes in 1995 to 147 tonnes in 2004.

Assuming that all three forms of industrial pollutant releases—surface water discharges, on-site land releases, and off-site pollutant transfers—measurably affect surface and ground water quality, then total pollutant releases impacting water quality in Nova Scotia decreased by 29%, from 585 tonnes in 1995 to 417 tonnes in 2004. Again, the caveat must be added that changes in inventory methodologies and included pollutants for discharges to surface water render such comparisons over time suspect, and they are only included here because they are referenced by the Commission for Environmental Cooperation (2007).

Similarly, it must be noted that changes in inventory methodologies and included pollutants for on-site land releases and for off-site pollutant transfers may also contribute to incompatible comparisons between different inventory years and potentially between different states and provinces. These caveats must therefore be borne in mind in the following ranking, which references total industrial pollutant releases.

According to the Commission for Environmental Cooperation (2007), Nova Scotia ranked 23rd among 65 North American states and provinces in terms of total industrial pollutant releases (i.e., to surface water, land, and off-site transfers). For Nova Scotia to be ranked among the top 40% of industrial polluters in North America in absolute terms indicates a relatively high level of pollutant releases for such a small province. This poor ranking is attributable primarily to pulp and paper industry discharges to surface water, which are responsible for 57% of total industrial pollutant releases in the province.

16.2.2. Agricultural releases of water pollutants

The intensification of agricultural practices—in particular, the growing use of fertilizers and pesticides, and the specialization and concentration of crop and livestock production—has had an increasing impact on water quality in Nova Scotia. The main agricultural water pollutants that are released include nitrates, phosphorus, and pesticides.

Water pollution is often a result of applying fertilizers in excess of crop needs. In fact, there are many tried and tested agricultural management approaches that can effectively prevent and control nutrient losses from agricultural land to surface and ground water, indicating that such agriculture-based water pollution is largely avoidable.

Since an estimate of the amount of agricultural fertilizer applied in Nova Scotia might provide at least an indirect indication of the potential for water pollution from this source, and of possible application in excess of crop needs, it would be useful to gather this information. Unfortunately, no data are presently available to estimate the total amount of fertilizer that is applied to agricultural land in Nova Scotia. Sales data of nitrogen and phosphate fertilizers could possibly be used as a surrogate for the total amount applied. However, Statistics Canada presently only publishes aggregated sales data for Atlantic Canada as a whole. Thus, even indirect estimates of the potential for water pollution from agricultural sources in Nova Scotia are not presently possible.

16.2.3. Municipal releases of water pollutants

Proper wastewater collection and treatment is an essential part of maintaining human and environmental health. In Nova Scotia, shellfish harvesting is regularly restricted due to bacteriological contamination, and beaches are closed to recreational activities each summer mainly due to untreated sewage discharge and malfunctioning septic systems.

There are approximately 125 municipal wastewater treatment facilities in Nova Scotia handling over 357,000 cubic metres of wastewater per day. Currently, 25% of Nova Scotia's sewage is handled through such central treatment. Onsite septic systems treat an additional 45% of the province's sewage, and raw sewage discharges account for the remaining 30%, of the sewage generated in the province. The Halifax Regional Municipality's Harbour Solutions Project will reduce raw sewage discharges from 30% to 10% of total generated sewage in the province and will increase central treatment from 25% to 45% of total generated sewage (NSEL, 2008).

Wastewater treatment facilities can be classified according to the level at which they are able to treat incoming wastewater. Primary treatment is the lowest level of treatment and involves the use of sedimentation tanks or other flow inhibitors that allow solids in the wastewater to settle due to gravity. Primary treatment can be enhanced using chemicals in which flocculants are introduced into the wastewater to remove additional pollutants and improve effluent quality. Secondary treatment is more advanced than primary treatment, and is designed to remove biodegradable organic matter and suspended solids in an aerobic environment using microorganisms to break down organic matter.

Approximately 62% of the sewage treatment facilities in the province are presently mechanical secondary treatment facilities. Lagoons provide an additional 31% of the sewage treatment. Only 7% of the treatment facilities provide primary, or enhanced primary, treatment.[1] The Government of Nova Scotia, through its 2007 Environmental Goals and Sustainable Prosperity Act, has committed to ensuring that all wastewater treatment facility discharges in the province will be provided at least primary treatment by 2017 (section 2l).[2]

16.3. Municipal water supply compliance to Canadian drinking water quality guidelines

Data sources: Audit of water quality chemical testing (2001) and database of chemical sampling (2002–2008) of municipal water supplies, provided by Nova Scotia Department of Environment (NSDOE).

Result: Most drinking water quality indicators point towards a marked improvement in drinking water quality in Nova Scotia over the past decade. The percentage of the population served by municipal water supplies that exceed the Maximum Acceptable Concentrations (MAC) for trihalomethanes has decreased substantially—from more than 40% in the mid-1990s to less than 4% today. In terms of bacteriological standards, over 99% of municipal water samples tested for coliform bacteria from 2002 to 2007 tested negative, representing an improvement from 2000 when 97.1% of municipal water samples tested negative. These improvements are largely attributable to the implementation of the Nova Scotia Drinking Water Strategy in 2002.

Results also indicate a marked improvement in the aesthetic quality of municipal drinking water in Nova Scotia, as defined by meeting the Aesthetic Objectives of the Guidelines for Canadian Drinking Water Quality (GCDWQ). Between 1996 and 2001, the proportion of Nova Scotians served by municipal drinking water that did not comply with these Aesthetic Objectives fell by half—from nearly 66% of Nova Scotians served by non-compliant municipal water supplies in 1996, to 33% in 2001.

The trend in compliance with the GCDWQ Maximum Acceptable Concentrations (MAC) for the chemical and physical parameters of health related drinking water criteria was more difficult to ascertain for this update. This is due both to data limitations and errors (which became apparent in the course of research for this update) in the interpretation of turbidity sampling results for 1986 and 1996, as reported in GPI Atlantic's original 2000 GPI Water Quality Accounts, and to many changes in regulations and testing methods between 1986 and 2008. Facilities must now test for more than 70 health-based parameters, many of which were not tested in earlier years. A major challenge in comparing data over time, therefore, is considering the effects of these changing guidelines and new testing procedures. For example, mercury and uranium were not reported in 1986 and 1996 but are reported now, and new guidelines were established for lead in 1992, antimony in 1997, and arsenic in 2001 and 2006. In addition, the accuracy of laboratory test methods has also substantially improved over time. As a result, compliance with GCDWQ chemical and physical standards over time cannot be directly compared without accounting for the fact that test methods and accuracy, reported substances, and maximum acceptable concentration limits have changed.

The earlier 2000 GPI Water Quality Accounts report had indicated that 16% of the provincial population served by municipal water supplies in 1996 and 25% in 1986 did not conform to these criteria. However, updating the results without inclusion of turbidity criteria, as is done in 2001, indicates that the provincial population served by municipal water supplies not in compliance with GCDWQ health-related criteria was actually 3.4% in 1996, rather than the 16% indicated when turbidity results are included, and it was 0% in 1986 based on the maximum acceptable concentration limits that were in force at that time.

An analysis of the most recent complete set of annual data for 2001 indicates that three municipal water supplies out of a total of 79 province-wide exceeded the health-related drinking water criteria for either antimony, uranium, or mercury. These three municipalities that did not conform to health related criteria in the Guidelines for Canadian Drinking Water Quality (GCDWQ) account for just 0.8% of the provincial population served by municipal water supplies.

Drinking water quality and its impact on wellbeing are evaluated primarily on the basis of established standards for drinking water quality. To that end, Nova Scotia's water supplies are monitored and examined for compliance with the Guidelines for Canadian Drinking Water Quality (GCDWQ) in terms of general health-related criteria, turbidity criteria, and aesthetic objectives, and they are also monitored regularly for bacteriological content and for THM (trihalomethane compounds) levels.

Since 2000, drinking water system facilities have been responsible for their own sampling and analysis, though the Nova Scotia Department of Environment (NSDOE) continues to perform audits. In 2002, the Nova Scotia Government released its *Drinking Water Strategy for Nova Scotia*, which identified actions to conserve and protect water resources and to improve drinking water safety in Nova Scotia. These actions included improved operator training, updating of watershed protection plans, development of compliance monitoring programs, development of boil water advisory protocols, and accreditation of water testing laboratories.

Overall, results indicate a marked improvement in the quality of Nova Scotia's municipal drinking water supplies in the last 20 years. The development and implementation of the Nova Scotia Drinking Water Strategy in 2002, in particular, has led to improvements in the province's drinking water quality across a wide range of dimensions in recent years.

The Nova Scotia strategy, like similar actions across the country, was partially a response to the nationwide alarm created by the Walkerton tragedy in Ontario, which killed seven and sickened 2,000 following E. coli contamination of the town's water supply, and particularly to strong criticism that emerged in Ontario at the time of inadequate monitoring and training, and of sharp cuts to the Ontario Ministry of Environment's drinking water quality programs prior to the tragedy.

To that end, actions that have already been completed under the 2002 Nova Scotia Drinking Water Strategy include: development of a consistent system of approvals for municipal water supplies that require sampling plans for all health-related drinking water quality parameters based on the vulnerability of the source to contamination; annual reviews of these sampling plans; twice per year audits of municipal water supplies; and risk-based audits for 1,800 smaller public drinking water supplies registered with the Province (NSDOE, 2005).

Nova Scotia Environment has described the progress of the strategy as follows:

> [T]he NS Drinking Water Strategy that was released in 2002 [. . .] was a major initiative to address drinking water safety in this province. Since then, government and municipalities have invested hundreds of millions of dollars in treatment plant upgrades, hiring of certified operators, source water protection plans, more monitoring.[3]

Approximately 62% of Nova Scotia's total population is currently dependent on municipal drinking water supplies. In total there were 79 municipal drinking water supplies serving a population of 507,800 in 2001, and 87 municipal drinking water supplies serving a population of 587,500 in 2006. The remaining 38% of the province's population is reliant on individual systems—mostly private wells.

Because it is so essential to health and wellbeing, the quality and availability of drinking water is a key measure of progress and value in the Nova Scotia Genuine Progress Index —both as an indicator and as a valuation of natural capital and component of provincial wealth. If the value of the province's natural capital in water depreciates, either through depletion or degradation of water resources, then our natural wealth has diminished and genuine progress has been compromised. Although resources did not allow comparative analysis of this measure for this update, future GPI research and water quality account updates should attempt to develop comparisons of Nova Scotia's water quality—both drinking water and water sources—with the water quality of other provinces.

The following criteria and indicators attempt to provide a relatively comprehensive portrait of the different dimensions of Nova Scotia's water quality insofar as data allow. Unfortunately, there are currently not enough readily available data and information to construct a definitive physical account of water quality and its value for the province. GPI Atlantic hopes that future development of these water quality accounts, and improvements in data sources, methodologies, and measuring instruments, will produce ever more accurate assessments of the state of our water resources over time. In the meantime, the following can hopefully provide at least a potential framework for such further developmental work.

16.3.1. Water quality objectives and standards

Water quality is defined by its chemical, physical, and biological content. However, the characteristics of water change over seasons and over geographic regions. In Canada, water quality guidelines for drinking water, recreational water, and the protection of aquatic life have been developed.[4] These guidelines are presented in Tables 16-2 to 16-5 below.

Canada's drinking water guidelines are revised and updated on an on-going basis by the Federal–Provincial Committee on Drinking Water. The Guidelines for Canadian Drinking Water Quality (GCDWQ) outline maximum acceptable concentrations (MAC) and aesthetic objectives for the physical, microbiological, chemical, and radiological parameters of drinking water supplies, as well as for turbidity.

MACs indicate the highest concentration of a substance in drinking water that is considered safe for human use, based on scientific evidence that exposures to contaminants above the MAC may have unacceptable health impacts. Aesthetic objectives (AO) apply to substances or characteristics of drinking water "that may affect its acceptance by consumers or interfere with practices for supplying good water" (Health Canada 1997b). It should be noted that if the concentration of any substance listed in Table 16-4 below is well above an AO, there is also the possibility of a health risk.

The Canadian drinking water quality guidelines are reviewed each year to ensure that the latest technology and knowledge of health impacts are applied. The latest Guidelines for Canadian Drinking Water Quality (GCDWQ) were published in May 2008. Evaluating whether or not our drinking water supplies comply with these guidelines is an important indicator of the quality of municipal drinking water.

Table 16-2. GCDWQ bacteriological guidelines

PARAMETER	MAXIMUM ACCEPTABLE CONCENTRATION (MAC)
Escherichia coli (public, semi-public, and private drinking water systems)	none detectable per 100 mL
Total coliforms (water leaving a treatment plant in a public system and throughout semi-public and private supply systems)	none detectable per 100 mL
Heterotrophic plate count (HPC) bacteria	increases in HPC concentrations above baseline levels are considered undesirable

Source: Health Canada. Website: http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/sum_guide-res_recom/micro-eng.php. Accessed October, 2008.

Table 16-3. GCDWQ turbidity guidelines

PARAMETER	MAXIMUM ACCEPTABLE CONCENTRATION (MAC)
For chemically assisted filtration	=> 0.3 NTU in at least 95% of the measurements, and not exceeding 1.0 NTU at any time
For slow sand or diatomaceous earth filtration	=>1.0 NTU in at least 95% of the measurements, and not exceeding 3.0 NTU at any time
For membrane filtration	=> 0.1 NTU in at least 99% of the measurements and not exceeding 0.3 NTU at any time

Source: Health Canada. Website: http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/sum_guide-res_recom/micro-eng.php. Accessed October 2008.

Notes: These turbidity guidelines came into effect in 2003 and only apply to "individual filter turbidity" of surface water supplies and to ‘groundwater under the direct influence’ of surface water (GUDI). Before 2003, the maximum acceptable turbidity value was 1.0 NTU, which applied to treated water for all water sources (e.g., surface water, GUDI, groundwater).

Table 16-4. GCDWQ guidelines for chemical and physical parameters

PARAMETER	MAXIMUM ACCEPTABLE CONCENTRATION (MAC)	AESTHETIC OBJECTIVES (AO) OR OPERATIONAL GUIDANCE VALUES (OG)
Aldicarb	0.009 mg/L	
Aldrin + dieldrin	0.0007 mg/L	
Aluminium[a]		[0.1/0.2] mg/L
*Antimony	0.006 mg/L	
Arsenic	0.010 mg/L	
*Atrazine + metabolites	0.005 mg/L	
Azinphos-methyl	0.02 mg/L	
Barium	1 mg/L	
Bendiocarb	0.04 mg/L	
Benzene	0.005 mg/L	
Benzo[a]pyrene	0.00001 mg/L	
*Boron	5 mg/L	
*Bromate	0.01 mg/L	
Bromodichloromethane (BDCM)	0.016 mg/L	
*Bromoxynil	0.005 mg/L	
Cadmium	0.005 mg/L	
Carbaryl	0.09 mg/L	
Carbofuran	0.09 mg/L	
Carbon tetrachloride	0.005 mg/L	
Chloramines--total	3 mg/L	
Chlorate	1.0 mg/L	
Chloride		≤250 mg/L
Chlorite	1.0 mg/L	
Chlorpyrifos	0.09 mg/L	
Chromium	0.05 mg/L	
Colour[b]		≤15 TCU
Copper		≤1.0 mg/L
*Cyanazine	0.01 mg/L	
Cyanide	0.2 mg/L	
Cyanobacterial toxins-Microcystin-LR	0.0015 mg/L	
Diazinon	0.02 mg/L	
Dicamba	0.12 mg/L	
1,2-Dichlorobenzene	0.2 mg/L	≤0.003 mg/L
1,4-Dichlorobenzene	0.005 mg/L	≤0.001 mg/L
*1,2-Dichloroethane	0.005 mg/L	
1,1-Dichloroethylene	0.014 mg/L	
Dichloromethane	0.05 mg/L	
2,4-Dichlorophenol,	0.9 mg/L	≤0.0003 mg/L
*2,4-Dichlorophenoxyacetic acid (2,4 -D)	0.1 mg/L	
Diclofop-methyl	0.009 mg/L	
*Dimethoate	0.02 mg/L	
Dinoseb	0.01 mg/L	
Diquat	0.07 mg/L	

PARAMETER	MAXIMUM ACCEPTABLE CONCENTRATION (MAC)	AESTHETIC OBJECTIVES (AO) OR OPERATIONAL GUIDANCE VALUES (OG)
Diuron	0.15 mg/L	
Ethylbenzene		≤0.0024 mg/L
Fluoride	1.5 mg/L	
*Glyphosate	0.28 mg/L	
Haloacetic Acids-Total (HAAs)	0.080 mg/L	
Iron		≤0.3 mg/L
Lead	0.01 mg/L	
Malathion	0.19 mg/L	
Manganese		≤0.05 mg/L
Mercury	0.001 mg/L	
Methoxychlor	0.9 mg/L	
Methyl tertiary-butyl ether (MTBE)		0.015 mg/L
*Metolachlor	0.05 mg/L	
Metribuzin	0.08 mg/L	
Monochlorobenzene	0.08 mg/L	
Nitrate[c]	45 mg/L	
Nitrilotriacetic acid (NTA)	0.4 mg/L	
Odour		Inoffensive
*Paraquat (as dichloride)	0.01 mg/L	
Parathion	0.05 mg/L	
Pentachlorophenol	0.06 mg/L	
pH		6.5-8.5 mg/L
Phorate	0.002 mg/L	
*Picloram	0.19 mg/L	
Selenium	0.01 mg/L	
*Simazine	0.01 mg/L	
Sodium		≤200 mg/L
Sulphate		≤500 mg/L
Sulphide (as H_2S)		≤0.05 mg/L
Taste		Inoffensive
Temperature		≤15°C
*Terbufos	0.001 mg/L	
Tetrachloroethylene	0.03 mg/L	
2,3,4,6-Tetrachlorophenol	0.1 mg/L	≤0.001 mg/L
Toluene		≤0.024 mg/L
Total dissolved solids (TDS)		≤500 mg/L
Trichloroethylene	0.005 mg/L	
2,4,6-Trichlorophenol	0.005 mg/L	0.002 mg/L
*Trifluralin	0.045 mg/L	
Trihalomethanes-total (THMs)[d]	0.100 mg/L	
*Uranium	0.02 mg/L	
Vinyl chloride	0.002 mg/L	
Xylenes--total		≤0.3 mg/L
Zinc		≤5.0 mg/L

Source: Health Canada. Website: http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/sum_guide-res_recom/micro-eng.php Accessed October, 2008.

Notes:
* Interim maximum acceptable concentration (IMAC)
a) Only applies to drinking water treatment plants using aluminium-based coagulants. The lower operational guidance value of 0.1 mg/L applies to conventional treatment plants, while the 0.2 mg/L value applies to other types of treatment systems. The guideline is based on an annual average of 12 monthly samples.
b) TCU = true colour unit.
c) Equivalent to 10 mg/L as nitrate-nitrogen. Where nitrate and nitrite are determined separately, levels of nitrite should not exceed 3.2 mg/L.
d) Expressed as a running annual average of a minimum of four quarterly samples. The guideline is based on the risk associated with chloroform—the trihalomethane most often present and in greatest concentration in drinking water.

Table 16-5. GCDWQ guidelines for Canadian recreational water quality

PARAMETER	MAXIMUM ACCEPTABLE CONCENTRATION (MAC)
Escherichia coli and fecal coliforms (Indicator Organism for Fresh Waters)	geometric mean of at least 5 samples within 30 days— should not exceed 2000 E. coli/L.
Enterocci (Indicator Organism for Marine Waters)	geometric mean of at least five samples within 30 days— should not exceed 350 enterococci/L.

Source: Health Canada. Website: http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/sum_guide-res_recom/micro-eng.php. Accessed October 2008.

16.3.2. Compliance based on health standards for chemicals with MAC limits

Evaluating whether or not Canadian drinking water supplies comply with health standard guidelines is an important indicator of the quality of municipal drinking water. The last full audit of drinking water system supplies in Nova Scotia was conducted in 2001. These data can be used to update results that were presented in GPI Atlantic's original 2000 GPI Water Quality Accounts report. Additional sampling data collected since 2001 are also reviewed briefly here to assess whether exceedances of the guidelines at specific municipal water supplies have since been addressed and rectified and whether new issues have emerged.

Between 1986 and 2008 there were a number of changes to regulations governing drinking water supplies. Facilities must now test for more than 70 health-based parameters, many of which were not tested in earlier years. A major challenge in comparing data over time, therefore, is considering the effects of these changing guidelines and new testing procedures. For example, mercury and uranium were not reported in 1986 and 1996 but are reported now, and new guidelines were established for lead in 1992, antimony in 1997, and arsenic in 2001 and 2006. In addition, the accuracy of laboratory test methods has also substantially improved over time. As a result, compliance with GCDWQ chemical and physical standards over time cannot be directly compared without accounting for the fact that test methods and accuracy, reported substances, and maximum acceptable concentration limits have changed.

In the course of updating the original 2000 GPI Water Quality Accounts report, it was discovered that the Maximum Acceptable Concentration (MAC) criteria for turbidity that were in force before 2003 had been incorrectly interpreted and that the 1986 and 1996 results reported in GPI

Atlantic's 2000 report likely overestimated the extent to which municipal water supplies did not conform to GCDWQ objectives for health standards. Specifically, the previous report assumed that a MAC of 1.0 NTU[5] applied to all water reported. However, this interpretation was not correct, as the turbidity MAC of 1.0 NTU was intended to be applied only to treated water. Additional information provided by NSDOE indicates that the total population served by municipal water supplies that exceeded other health-based criteria were also incorrectly tabulated in the original 2000 GPI report, and these results have therefore also been corrected and updated here.

In order to update the previously reported 1986 and 1996 results, it is therefore necessary to remove the turbidity criterion that was inappropriately applied to samples from water intakes. Fortunately, this can be accomplished for the 1996 results as data are available for the number of samples and proportion of population served by supplies that exceeded the 1.0 NTU turbidity criterion.

For 1996, the 2000 GPI Water Quality Accounts reported that 6 of 78 municipal water supplies exceeded the MAC criteria for turbidity. These six municipal water supplies corresponded to 15.4% of the total Nova Scotia population served by municipal water supplies. If the turbidity criterion is removed in light of its prior incorrect application, it is found that four of the 78 municipal water supplies exceeded the GCDWQ criteria for lead, and one municipal water supply exceeded the criteria for fluoride. This would result in 3.4% of the total population served by municipal water supplies in Nova Scotia in 1996 being served by water supplies not conforming to the guidelines for chemical and physical parameters that were in force at the time.

The 2000 GPI water quality report also reported that 24% of the provincial population served by municipal water supplies in 1986 was served by systems that had samples that did not conform to the guidelines for chemical and physical parameters. However, in this case the turbidity criterion was also incorrectly interpreted. Again, removing the turbidity criterion to reflect its incorrect application, and relying only on the health-based criteria that were in force at the time, it is found that no municipal water supplies exceeded the 1986 guidelines for chemical and physical parameters.

In 2001, one or more of the treated samples for three municipal water supplies (4%) of a total of 79 province-wide, did not meet one or more health-related MAC standards of the GCDWQ. Table 16-6 below indicates the number of municipalities that recorded at least one exceedance of the MAC for each relevant pollutant and the population served by these municipal water supplies. The three municipalities together account for just 0.8% of the provincial population served by municipal water supplies. It should be noted that this indicator specifically does not include health standards for bacteria and total trihalomethanes (THM), which are separately reported and summarized in sections 15.3.3 and 15.3.4 below.

Table 16-6. Exceedances of health standards for water supplies, by municipality and population served, Nova Scotia, 2001

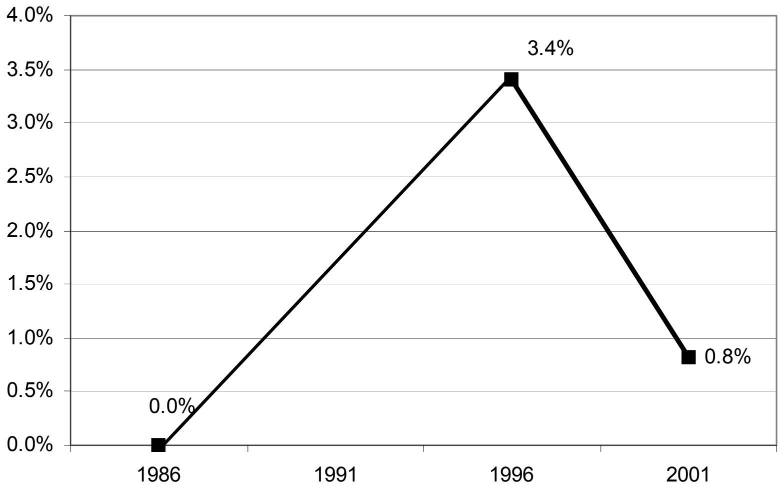
PARAMETER	NUMBER OF MUNICIPALITIES AND POPULATION NOT MEETING GCDWQ OBJECTIVES FOR HEALTH STANDARDS[1]	
	Municipalities	**Population**
ANTIMONY	1	1,500
URANIUM	1	360
MERCURY	1	2,300
TOTAL	**3**	**4,160**

Source: Nova Scotia Department of Environment. Drinking Water Systems Database

Notes: [1] Health standards for bacteria and THMs are not included in the table and are evaluated by indicators in sections 15.3.3 and 15.3.4 below.

Figure 16-1 below indicates the trend in the percentage of the provincial population served by municipal water systems that were not in compliance with the GCDWQ objectives for health related standards that were in force at the time, bearing in mind that these standards were different in 1986, 1996, and 2001 (see Table 16-4 above for most recent standards). The trend, with turbidity results removed, appears to indicate that the population served by municipal drinking water systems not in compliance with the guidelines for chemical and physical parameters in force at the time increased from 0% in 1986 to 3.4% in 1996, and then deceased to 0.8% in 2001. However, as noted above, these apparent trends are suspect because of major changes over time in testing methods and accuracy, reported substances, and maximum acceptable concentration limits.

Figure 16-1. Population served by municipal drinking water systems not in compliance with GCDWQ Objectives for health related standards that were in force at the time of testing (%), Nova Scotia, 1986, 1996, and 2001



In terms of health-related criteria only, 3 of Nova Scotia's 79 municipal water supplies (4%) exceeded the criteria for antimony, uranium, or mercury in 2001 (one substance in each of the three municipalities, as indicated in Table 16-6 above). Based on the population served by each municipal water system, 0.8% of the Nova Scotia population served by municipal water supplies was served by a supply that did not conform to the health related criteria on at least one count. In 1996, by comparison, 5 of 78 municipal water supplies—accounting for 3.4% of the population served by municipal water supplies—exceeded the criteria for maximum acceptable concentrations of lead (four supplies) and fluoride (one supply) in that year.

It should be noted that the data presented here are drawn from the last and most recent full provincial audit of all municipal water systems conducted in 2001, and that changes in the quality of drinking water have occurred since that time. More recent information on water quality testing since 2001 is available through the NSDOE. While these data can identify individual facilities that were not in compliance with GCDWQ criteria at the particular time of testing, the data unfortunately cannot be used to establish a province-wide trend past 2001, as required by this indicator, since they do not assess compliance for *all* municipal facilities in the Province in any given year.

A review of the most recent sampling data from 2002 to 2008 indicates that the substances exceeding the health-related guidelines in the three particular municipalities in 2001, as indicated in Table 16-6 above (when one municipality was in exceedance of the antimony MAC, one of the uranium MAC, and one of the mercury MAC), were no longer detected in these municipal water supplies in subsequent sampling in later years. In other words, these particular problems appear to have been rectified. However, sampling data from 2002 to 2008 also indicate that at least one exceedance of the MACs for antimony, fluoride, and lead has occurred in at least one municipal water supply in at least one of those years. One municipal water supply may also have exceeded the new arsenic guideline of 0.010 mg/L approved in May 2006; however, these data have not yet been confirmed.

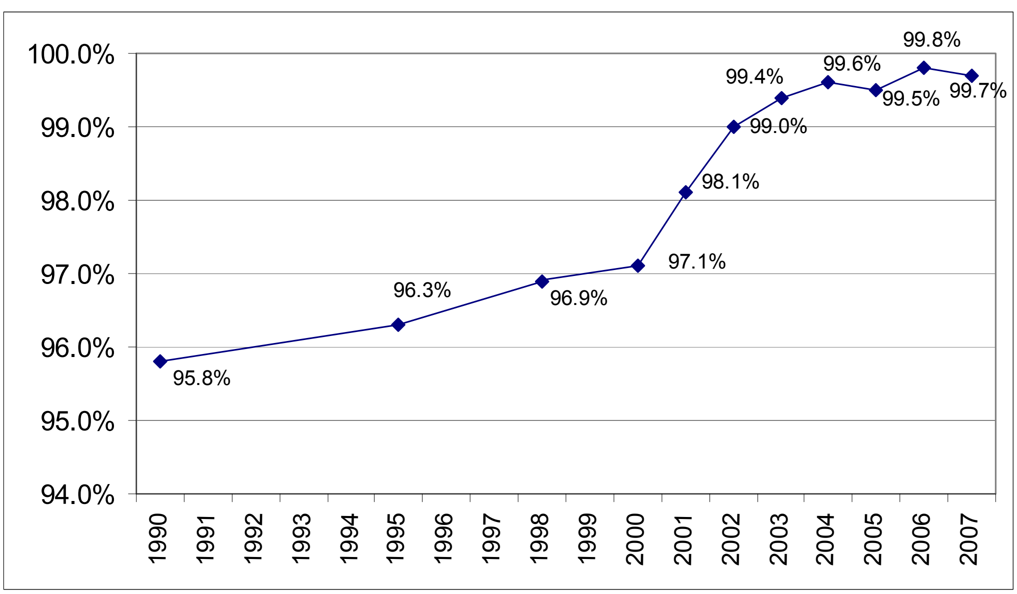
16.3.3. Compliance based on bacteriological standards

Bacterial content in water is indicated by the presence or absence of indicator bacteria called coliform organisms. The presence of coliform bacteria is indicative of the presence of more problematic bacteria that have the potential to cause illness and disease. Therefore, if a drinking water supply is free of these bacterial indicators, it is probable that the water is also free of other more dangerous bacteria and pathogens.

Currently there are more than 20,000 bacteria samples collected from municipal water supplies every year. Figure 16-2 below indicates the percentage of municipal water samples that have tested negative for coliform bacteria since 1990.

The trend in Figure 16-2 below clearly indicates a marked improvement in the water quality of municipal drinking water supplies for this indicator—especially since the development and implementation of the Nova Scotia Drinking Water Strategy in 2002. In the last two years for which data are available, 99.7–99.8% of samples have tested negative for coliform bacteria—up from less than 96% in 1990.

Figure 16-2. Municipal water samples testing negative for coliform bacteria (%), Nova Scotia, 1990–2007

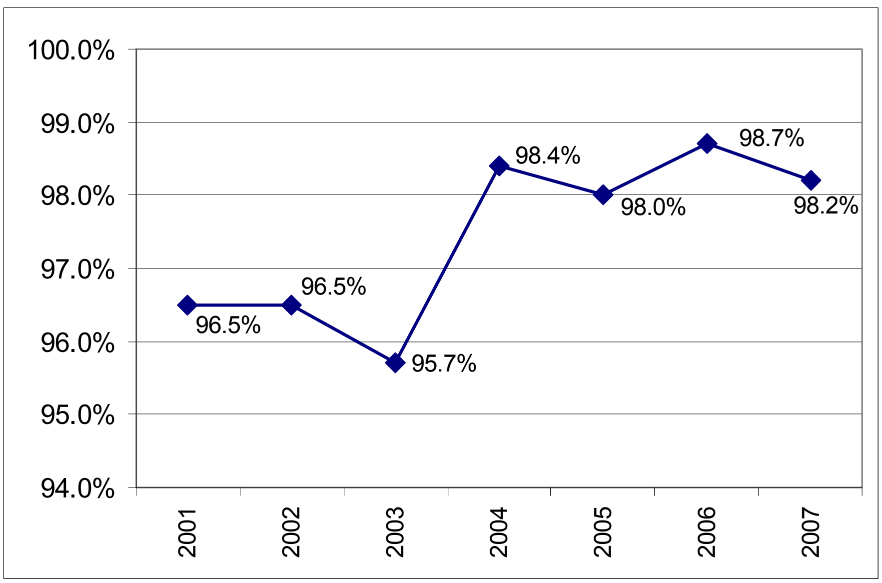


Source: Nova Scotia Department of Environment. Personal email communication October 10, 2008 with Christina L. Mosher.

Since 2001 the government of Nova Scotia has also conducted public reporting of bacteriological testing results based on population served rather than just the number of samples that are negative for coliform. Figure 16-3 below indicates the percentage of the population served by municipal drinking water supplies that meet the health-based criteria for bacteriological quality as stated in the GCDWQ at all times in each calendar year.

Figure 16-3 below shows a marked improvement in this indicator since 2003. In each of the last four years for which population-based data are available (2004–07), at least 98% of Nova Scotians served by municipal drinking water supplies were served by supplies that met the GCDWQ health-based criteria for bacteriological quality at all times in each of those years—up from 96% in 2003.

Figure 16-3. Population served by municipal drinking water supplies that meet health-based criteria for bacteriological quality (%), Nova Scotia, 2001–2007



Source: Nova Scotia Department of Environment. Personal Email Communication October 10, 2008 with Christina L Mosher.

16.3.4. Compliance with standards for trihalomethane compounds

Trihalomethane compounds (THMs) are created when chlorine reacts with organic material in water. Chlorination, a common method of water treatment in Canada, is used to disinfect drinking water in order to kill micro-organisms such as bacteria and viruses that can cause serious illnesses and even death in some cases. On the other hand, studies have indicated that trihalomethane compounds are suspected to increase the chance of bladder cancer by 1.3% after exposure to high THMs over at least 25 years. This increased risk is slight, but it does cause a health concern. Accordingly, THMs in drinking water are regularly monitored as an important indicator of the quality of municipal drinking water.

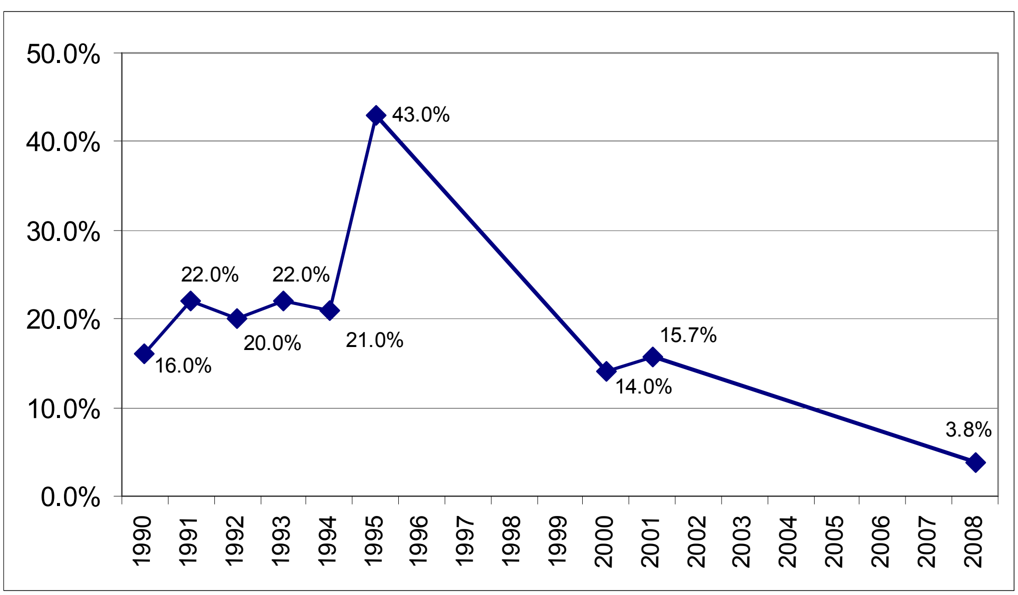
The GCDWQ health-based maximum acceptable concentration (MAC) for THMs is 100 µg/L based on a running annual quarterly average. The percentage of Nova Scotia's population served by municipal water supplies with THMs above this MAC is indicated in Figure 16-4 for the period between 1990 and 2008 and for the years in which data are available.

Current tracking of the running annual quarterly average THM values for municipal drinking water supplies (as of June 2008) indicates 15 facilities exceeding the guideline and serving a population of 22,480. This result is based on 78% of the municipal supplies which are now testing for and reporting on THMs, and represents 3.8% of the entire population served by municipal drinking water supplies in Nova Scotia.

Figure 16-4 clearly indicates a marked decrease in the percentage of Nova Scotians served by municipal water supplies that do not meet the GCDWQ health standard for THMs—from 43% in 1995 to less than 4% today. This signifies a very substantial improvement in municipal drinking water quality for this indicator, as for all health-related indicators examined.

Overall, the results for all health-related drinking water quality indicators together point to genuine and significant progress in municipal drinking water safety and quality over the last 15-20 years in Nova Scotia, and a very high rate of compliance with all facets of the GCDWQ health criteria—chemicals, bacteria, and THMs.

Figure 16-4. Population served by municipal drinking water supplies with THMs above the maximum acceptable concentration (%), Nova Scotia, 1990–2008



Source: Nova Scotia Department of Environment. Personal email communication October 10, 2008 with Christina L. Mosher.

16.3.5. Compliance with water quality aesthetic objectives

Aesthetic objectives (AO) apply to substances or characteristics of drinking water "that may affect its acceptance by consumers or interfere with practices for supplying good water" (Health Canada 1997b). While not an indicator of health risks, aesthetic objectives can still provide an indication of the quality of drinking water from a consumer perspective. Also, as noted above, there may be the possibility of a health risk in cases where the concentration of any substance affecting aesthetic objectives is well above an AO.

In 2001, one or more of the treated samples for 23 municipal water supplies, (29%) of a total of 80 province-wide, did not meet one or more aesthetic objectives of the Guidelines for Canadian Drinking Water Quality (GCDWQ). Table 16-7 below indicates the number of municipalities that recorded at least one exceedance of an Aesthetic Objective for each relevant parameter, and the population served by these municipal water supplies. Table 16-7 indicates that 167,121 Nova Scotians (or 33% of the 507,800 Nova Scotians served by municipal drinking water supplies in 2001) were subject to drinking water that did not meet one or more aesthetic objectives of the GCDWQ.

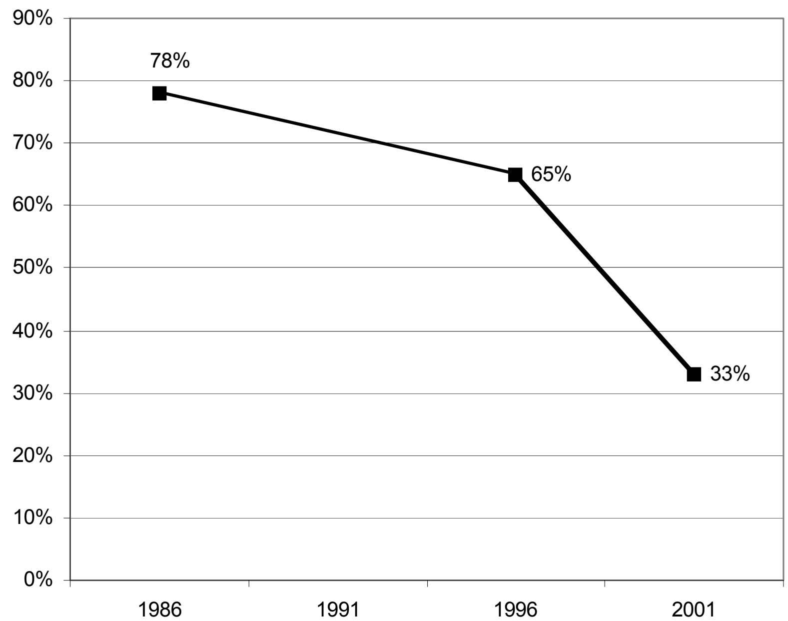
Table 16-7. Exceedances of aesthetic objectives for water supplies, by municipality and population, Nova Scotia, 2001

PARAMETER	NUMBER OF MUNICIPALITIES AND POPULATION NOT MEETING GCDWQ FOR AESTHETIC OBJECTIVES	
	Municipalities	Population
TURBIDITY	1	650
IRON	6	44,825
MANGANESE	5	14,435
COLOUR	10	59,149
pH	12	118,437
TOTAL	**22**	**167,121**

Source: Nova Scotia Department of Environment. Drinking Water Systems Database.

Figure 16-5 below indicates the trend in the percentage of Nova Scotians served by Municipal Water Systems that are not in compliance with one or more aesthetic objectives (AO) of the GCDWQ. Results point to a marked improvement in AO compliance over time—from nearly 80% of Nova Scotians served by non-compliant municipal water supplies in 1986 to 66% in 1996 to 33% in 2001. It is likely that the implementation of the Nova Scotia Drinking Water Strategy in 2002 has resulted in further improvements in this area, but province-wide data are not available to assess this, since 2001 marked the last full audit of drinking water system supplies in Nova Scotia.

Figure 16-5. Population served by municipal drinking water systems that are not in compliance with one or more aesthetic objectives of the GCDWQ (%), Nova Scotia, 1986, 1991, 1996, and 2001



Source: Nova Scotia Department of Environment. Drinking Water Systems Database.

16.4. Surface water quality (rivers, lakes, and wetlands)

Data sources: Nova Scotia Natural Resources Wetland Inventory Database (2007); Surveys of Recreational Fishing in Canada (1990-2007) from Department of Fisheries and Oceans Canada; Canada–U.S. Air Quality Agreement Progress Report 2006 from Environment Canada.

Result: Significant decreases in sulphate deposition have been measured in Nova Scotian lakes in the past decade. However, the recovery of alkalinity and pH has not occurred to the extent necessary to reduce acid deposition below critical loads (harmful levels) and to ensure the recovery of aquatic and terrestrial ecosystems. Recreational fishing catches of Atlantic salmon and brook trout that are impacted by acid rain have continued to decline steadily.

A comprehensive inventory of Nova Scotia's wetlands, which provide many important ecological and economic services, has been completed, and shows that, as of 2007, there are estimated to be approximately 377,000 hectares of wetlands in Nova Scotia. This represents an estimated loss of 17% of freshwater wetlands and 62% of saltwater wetlands from the original area of wetlands in Nova Scotia.

Healthy aquatic ecosystems are defined as "those where human disturbances have not impaired the natural functioning (e.g., nutrient cycling) nor appreciably altered the structure (e.g., species composition) of the system" (Environment Canada 2000). This section considers the trends in acidification of Nova Scotia's lakes, loss of wetland ecosystems, beach closures, shellfishing closures, and Atlantic salmon and brook trout populations. While the previous section reported highly positive trends in municipal drinking water quality, which is amenable to human intervention "at the end of the pipe," so to speak, this section reports on the quality of provincial water sources and water bodies "at the front end of the pipe."

Future research should also consider the effects of other pollutants that are affecting Nova Scotia's lakes and rivers. For example, common loons in Nova Scotia currently have the highest blood mercury concentrations of any loon population in North America (Nocera and Taylor 1998), and trends in this key indicator species or its prey might become a core genuine progress indicator in the future to assess whether efforts to cut mercury emissions are reducing pollutant depositions in Nova Scotia lakes. In the meantime, the following indicators reflect the limited available data on the health of the province's aquatic ecosystems.

16.4.1. Canadian Council of Ministers of the Environment (CCME) Water Quality Index

The government of Canada through the Canadian Environmental Sustainability Indicators (CESI) initiative, has developed a national Water Quality Index (WQI). This index was endorsed and adopted by the Canadian Council of Ministers of the Environment (CCME) in 2001.

The CCME WQI is intended to translate large numbers of complex water quality data, measured against water quality guidelines, into a simple overall rating of freshwater quality for a given site and time period. The index combines three different aspects of water quality:

- the "scope", which is the percentage of water quality variables with observations exceeding the guidelines,
- the "frequency", which is the percentage of total observations exceeding guidelines; and
- the "amplitude", which is the amount by which observations exceed the guidelines.

The results are then converted into a qualitative scale that can be used to rate sites. A high rating (excellent to good) indicates a low number of exceedances, while a low rating (marginal or poor) indicates a high number of exceedances.

Based on this index, the water quality of selected water bodies in Nova Scotia were rated for the protection of aquatic life, as well as source drinking water (before treatment), and livestock watering and crop irrigation uses. The latest detailed information available for Nova Scotia is for the period 2000 and 2001 (CCME, 2004), when a total of four rivers and one lake in Nova Scotia (St. Mary's River, Northeast Margaree River, Annapolis River, Tusket River, and Pockwock Lake)[6] were part of the overall Canadian index.

The overall Water Quality Index rating of the Nova Scotia water bodies that were assessed in 2000–2001 is "Fair" for the protection of aquatic life, mostly because aluminium, iron, and copper are found at concentrations that often exceed CCME guidelines. The pH of many water bodies also frequently fails to meet the CCME guideline of 6.5 for the protection of aquatic life.

In the majority of cases (St. Mary's River, Northeast Margaree River, Tusket River, and Pockwock Lake), the elevated concentrations of selected metals and the lower pH levels, which are reflected in lower Water Quality Index values, appear to be the result of normal background levels associated with wetlands, naturally occurring organic acids, and geological sources. In contrast, the Annapolis River has relatively good pH levels due to geological and ground water characteristics.

The water quality for purposes of crop irrigation and livestock watering is generally rated as excellent for the selected water bodies. The "source of drinking water" index for untreated water was rated good for the Northeast Margaree River, and fair for the four other water bodies.

16.4.2. Acidification of lakes

Many regions of Nova Scotia are particularly sensitive to acid rain due to the poor acid-buffering capacities of the underlying bedrock and soils. Two common air pollutants—sulphur dioxide and nitrogen oxides—are the major cause of acid rain. The main sources of these pollutants are coal-fired power plants, nickel and copper smelters, and motor vehicles. Both pollutants can stay in the air for days and can travel up to thousands of kilometres. They reach land or water surfaces through precipitation, which can then adversely affect soil, water, plants, and buildings. Most acid rain falls in the eastern part of Canada, since the largest sources of sulphur dioxide and nitrogen oxides are found in the eastern part of North America, and winds that can carry the pollutants generally flow in a easterly direction (Environment Canada 1999c).

Acidified rivers and lakes are limited in their ability to support aquatic life and recreational uses. Most species of plants and animals have a small range of pH tolerance in their habitat requirements. As more Nova Scotia rivers and lakes are affected by acidification, habitat for several species of fish and amphibians, and potential water uses are diminished.

In 1991, the United States and Canada signed the Canada–U.S. Air Quality Agreement (Environment Canada 1999b). Under this agreement, the U.S. committed to reducing sulphur dioxide (SO_2) emissions by approximately 10 million tons from 1980 levels by the year 2000. In addition, there was an agreement to set a permanent national emissions cap of 8.95 million tons of sulphur dioxide per year for electric utilities by 2010. Canada agreed to reduce sulphur dioxide emissions in the seven easternmost provinces to 2.3 million tonnes per year by 1994, and to set a cap on sulphur dioxide emissions in the seven easternmost provinces of 2.3 million tonnes per year from 1995 through December 31, 1999.

Both Canada and the U.S. have achieved the required emission reductions under the agreement to date. In the first five years—from 1991 to 1996—total Canadian emissions decreased from about 3.0 million tonnes to about 2.4 million tonnes—a 20% overall reduction. By 2004, SO_2 emissions in the seven easternmost provinces of Canada were 28 percent below the eastern Canada cap and 50% below emissions in 1980. By 2005, the United States had reduced SO_2 emissions by 5.5 million tons—or by 35 percent compared with 1990 levels and by more than 40 percent compared to 1980 levels.

Despite meeting these targets, acid rain continues to damage sensitive ecosystems in Atlantic Canada, and three provinces—Nova Scotia, Quebec, and Ontario—therefore developed tighter regulations in 2005 to further reduce emissions from major acid rain-causing sources. Nova Scotia's targets are now embodied in the 2007 Environmental Goals and Sustainable Prosperity Act, which specifies that "sulphur dioxide emissions will be reduced by fifty per cent by the year 2010 from sources existing in 2001."

While significant decreases in sulphate deposition have been recorded in the majority of lakes that are monitored in Nova Scotia by Environment Canada, the recovery of alkalinity and pH has not occurred to the extent necessary to reduce acid deposition below critical loads (harmful levels) and to ensure the recovery of aquatic and terrestrial ecosystems. Many areas in Nova

Scotia still receive more sulphate than its natural systems can tolerate. The problem is particularly acute in the south-western portion of the province where weather systems deposit long-range transported sulphate and where water bodies have a poor ability to neutralize acids. As of 2002, no lakes in this area have shown evidence of biological recovery in response to decreased levels of sulphate deposition. This suggests that even the current lower levels of sulphate deposition—10.5 kg / hectare / year—are above a critical threshold for recovery (Ginn, 2007).

16.4.3. Loss of wetlands

Wetlands provide habitat and important ecological and economic functions that require recognition, valuation, protection, and enhancement of their value. With regard to water resources, wetlands provide important treatment and filtration functions that improve the quality of water. For example, wetlands have the ability to store large volumes of water, to filter water, and to release water slowly, and they therefore also provide important flood protection functions.

The vital economic functions performed by wetlands therefore include the following:

- Flood prevention
- shoreline protection and erosion prevention
- storm control
- water purification
- storage and recycling of human waste
- spawning and nursery habitat for fish and shellfish
- carbon sequestration and storage
- sanctuary, breeding grounds, and nursery habitat for terrestrial, near-shore, and migratory birds
- feeding habitat for terrestrial wildlife
- nutrient recycling, production, and storage
- recreation, education, and science
- waste treatment
- food production

A "healthy" wetland can be defined as one that performs all these functions optimally. If wetlands are to be properly recognized for the vital economic and social values inherent in these functions—and thus conserved and protected in order to preserve those values—some system of valuation is essential.

Nova Scotia lost large tracts of salt marsh to the dyking activities of the original Acadian settlers who converted salt marshes to productive agricultural land. The loss of wetlands, however, brings the loss of the important ecological functions they perform, which in turn, protect and enhance our water resources. In addition, as noted above, wetlands provide important bird habitat for local and migratory populations. Saltwater wetlands along the Nova Scotia coast, where heavy wave and wind action work to erode the shore line, provide vital protection from erosion processes, and help store and prevent the loss of valuable nutrients and minerals.

Currently there are over 35,000 freshwater wetlands in Nova Scotia, which represents about fifteen per cent of the province's total land area. The State of the Nova Scotia Environment (1998) estimated that losses of freshwater wetland habitat in Atlantic Canada since European settlement range from 16 to 18%. Additionally, a 62% loss in the provincial area of saltwater wetlands has been estimated by the Nova Scotia Department of Natural Resources.

A wetland inventory has been updated since the 1998 release of The State of the Nova Scotia Environment. Using the new inventory, and assuming that a mid range of 17% of freshwater wetland area has been lost in Nova Scotia (based on the estimates for Atlantic Canada cited above), it can be estimated that the original area of freshwater and saltwater wetlands in Nova Scotia was about 486,000 hectares. Overall this would represent a total loss of approximately 22% of original fresh and salt wetlands since colonization—or approximately 108,000 ha in total across Nova Scotia—based on the 378,000 ha of remaining wetlands in the Province.

Bill No. 146—the Environmental Goals and Sustainable Prosperity Act (2007)—specifies that a policy of preventing further net loss of wetlands will be established by the year 2009. The area of Nova Scotia's existing freshwater and saltwater wetlands based on the most recent available information from the Nova Scotia Wetland Inventory Database (2007) is presented in Table 16-8 below.

Table 16-8. Area of existing wetlands (ha), Nova Scotia, 2006

TYPE OF WETLAND	WETLAND CLASSIFICATION	TOTAL AREA IN HECTARES (HA)
Freshwater Wetlands	Bog or Fen	129,855
	Swamp	128,817
	Marsh	72,235
	Fen	25,509
Saltwater Wetlands	Salt Marsh	15,270
Freshwater or Saltwater Wetlands	Open Water	6,220
TOTAL		**377,906**

Source: Nova Scotia Natural Resources. 2007. *Nova Scotia Wetland Inventory Database*.

16.4.4. Trends in beach closures

Some beaches in Nova Scotia are located near municipal or domestic wastewater treatment facilities or raw sewer outfalls. These effluent sources can result in an increase the bacterial content of the surrounding water, especially if there is a lack of advanced wastewater treatment (i.e., primary treatment versus secondary or tertiary treatment). Beach closures occur mostly in the summer months when air and water temperatures increase, thereby resulting in conditions conducive to bacterial growth. The subsequent increase in evaporation rates also results in lower water levels—thus further increasing bacteriological concentrations—at the same time when beach use is the highest.

During episodes of high bacterial growth, some beaches are closed in Nova Scotia to protect human health, based upon water quality monitoring and the Guidelines for Canadian Recreational Water Quality (see Table 16-5 above). As a result, beach closures are an indicator of recreational water quality and can also be used as an economic valuation measure to assess potential lost recreational and tourism opportunities.

Beach closure data for Nova Scotia beaches could not readily be obtained and updated at this time, since they are not presently compiled and publicly available in the form of composite trends over time. Some raw data on provincial park beach closures and on some municipal beach closures for the last five to ten years are accessible through the Weekly Logbooks maintained by the Nova Scotia Lifeguard Service (NSLS). Unfortunately time and resources did not permit a close perusal of these raw data in the NSLS offices, although the NSLS has kindly offered to make them available to GPI Atlantic. As well, it must be noted that many provincial sites were not tested during this period, and there are therefore no closures or data for those untested sites, adding to the challenge of compiling aggregate trend lines for the province. (Paul D'Eon, Director, Nova Scotia Lifeguard Service. Personal communication. 14 October, 2008). It is hoped that more consistent data collection, testing, monitoring, and analysis in the future may allow trends for this important indicator to be assessed in future updates of the GPI Water Quality Accounts, as resources become available.

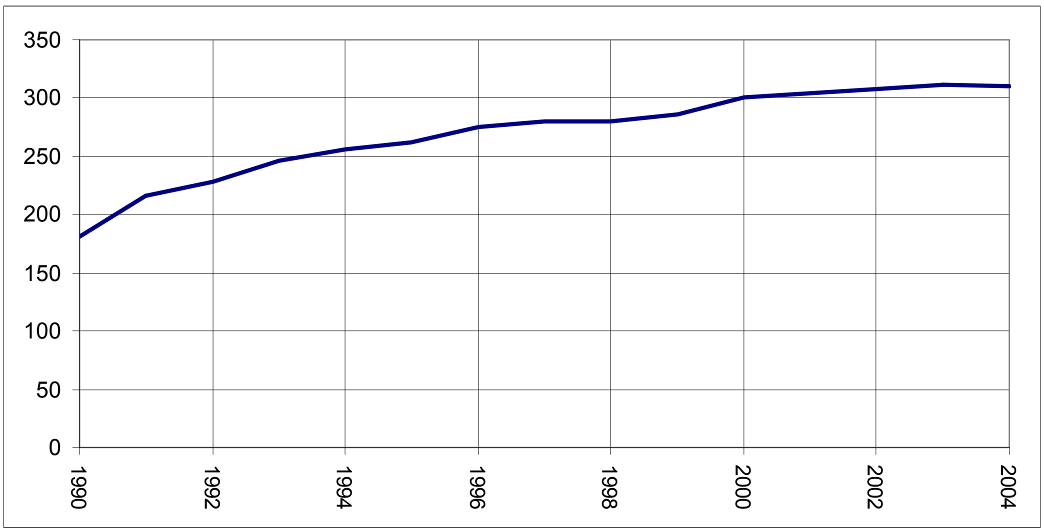
16.4.5. Area closed to shellfishing

Disposal of untreated sewage into our marine waterways and other water pollution can lead to high bacterial levels that impact filter feeding organisms like oysters, mussels and soft shell clams living within estuaries and along mud flats in Nova Scotia. Consumption of shellfish from contaminated areas can cause serious illness, generating public health issues. As a result, many shellfish areas are often closed in Nova Scotia, creating serious negative impacts and costs to the environment, the community, and the economy.

The State of the Nova Scotia Environment Report (1998) notes that Nova Scotia has the highest *number* of closed shellfishing areas in the Atlantic provinces, accounting for about half the region's total. However, the report does not record the relative size of the Atlantic closures for comparative purposes, though it does indicate that 700 sq. km. were closed to shellfish harvesting in Nova Scotia in 1995. The most recent available data on the total *size* of shellfish beds closed annually to shellfishing in Nova Scotia collected by Environment Canada (1999) indicate that this closed area had increased by 264 sq. km. by 1999—amounting to a 38% increase in area in four years.

Environment Canada also collects and publishes data on the numbers of closed shellfisheries through its Shellfish Water Quality Protection Program (SWQPP). The number of shellfishery locations that were closed in Nova Scotia from 1990 to 2004 is indicated in Figure 16-6 below, and show a steady increase in closures over time. Closures increased approximately 70% from 1990 to 2004.

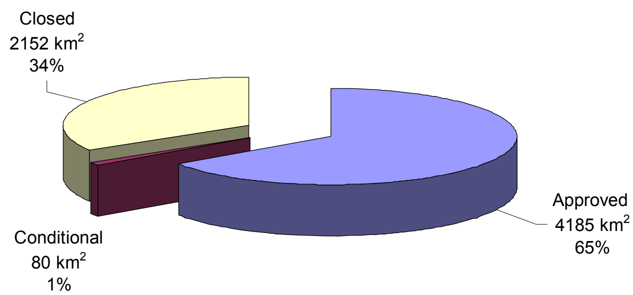
Figure 16-6. Shellfish Fishery Closures, Nova Scotia, 1990–2004



Source: Environment Canada Shellfish Water Quality Program. Website Accessed December, 2008. http://www.atl.ec.gc.ca/epb/sfish/sfish.html.

Available data do not indicate the total area of the closed shellfishery locations in Nova Scotia in recent years—with 1999 data the most recent available on size for the province, as noted above. However, the total area of shellfisheries that are closed, conditionally open, and approved for harvest are provided by Environment Canada for the entire Atlantic region. Figure 16-7 below provides the status of shellfishery areas in Atlantic Canada in April 2004, and indicates that just under two-thirds are open to harvesting, while just over one-third are closed.

Figure 16-7. Shellfish Fishery Area Classification (km²), Atlantic Canada, 2004



Source: Environment Canada Shellfish Water Quality Program. Website Accessed December, 2008. http://www.atl.ec.gc.ca/epb/sfish/sfish.html.

From the perspective of sustainable development, the "goal" for this indicator is zero closed areas—the same as the "pre-impact" condition of the resource. From that perspective, the current trend is away from sustainability, and indicates increased adverse impacts and higher economic losses attributable to water pollution than can be considered desirable.

16.4.6. Commercial and recreational fisheries

Wild Atlantic Salmon

Atlantic salmon are a good indicator species for water quality in Nova Scotia's traditional salmon-spawning rivers, because salmon are sensitive to acidity. They have difficulty reproducing in water with a pH less than 5.6, while a pH of 5.0 is toxic to them. Wild Atlantic salmon are no longer a commercial species in the Maritimes, and recreational salmon fishing is greatly restricted. Since 1973, the number of wild Atlantic salmon returning to North American rivers fell dramatically by 74% from 1,601,000 to an all-time low in 2001 of 418,000. Atlantic salmon numbers since 2001 seem to have steadied overall, and in recent years some areas in Nova Scotia have seen an improvement in returning salmon numbers.

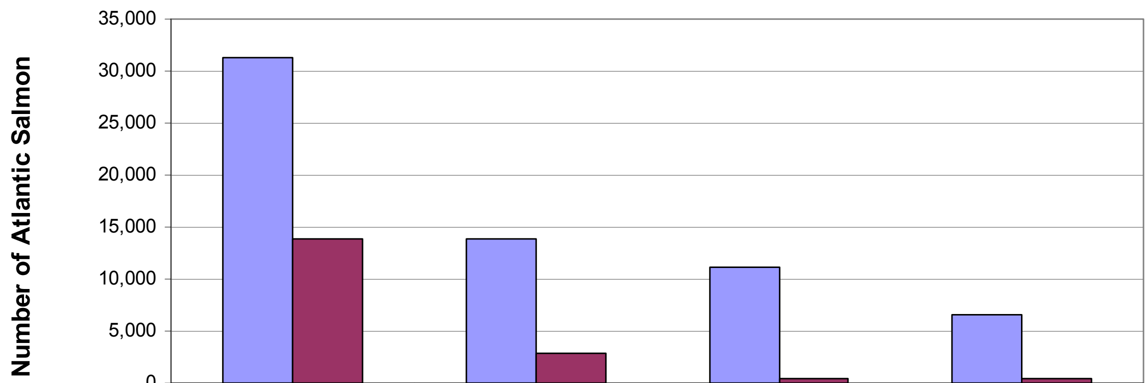
Salmon in the Bay of Fundy and outer Nova Scotia Coast have decreased dramatically to the point of collapse, and it is uncertain whether populations will recover without dedicated restoration efforts. In the inner Bay of Fundy, salmon returns continue to be low, with fewer than 200 adult salmon returning in 2005 to 32 traditional salmon-spawning rivers in the region—down from 40,000 in the 1980s (Atlantic Salmon Federation, 2006). In the outer Bay of Fundy rivers—also known as the Western Fundy rivers—salmon population status is now critical. In the

Magaguadavic River in New Brunswick, which is regularly monitored by Atlantic Salmon Federation, only nine wild salmon returned in 2005 compared to a run of 800 to 1000 in the 1980s, while at the St. Croix River in New Brunswick, only six wild salmon were counted.

By contrast, in Nova Scotia rivers that empty into the southern Gulf of St. Lawrence (like the Wallace, Philip, and East Rivers), juvenile salmon densities have improved by more than 10% overall since 1985 after declining in the 1970s and early 1980s, and this improvement was maintained in 2005, according to the report on the Status of North American Wild Atlantic Salmon in 2006 prepared by the Atlantic Salmon Federation . On the Atlantic coast of Nova Scotia (the Southern Uplands), however, the impact of acid rain continues to threaten salmon spawning rivers.

Overall, recreational fishing catches and releases of Atlantic Salmon in Nova Scotia have fallen dramatically since 1990, as shown in Figure 16-8 below. While other factors, such as over-fishing, climate change, and loss of old forests (possibly increasing water temperatures through loss of shade cover), have also likely contributed to the collapse in recreational Atlantic salmon fishing, water pollution—particularly due to acidification—has been shown to be a significant factor in the sharp decline.

Figure 16-8. Wild Atlantic salmon catches and releases, Nova Scotia, 1990–2005



	1990	1995	2000	2005
Caught	31,320	13,818	11,162	6,569
Kept	13,896	2,921	427	375

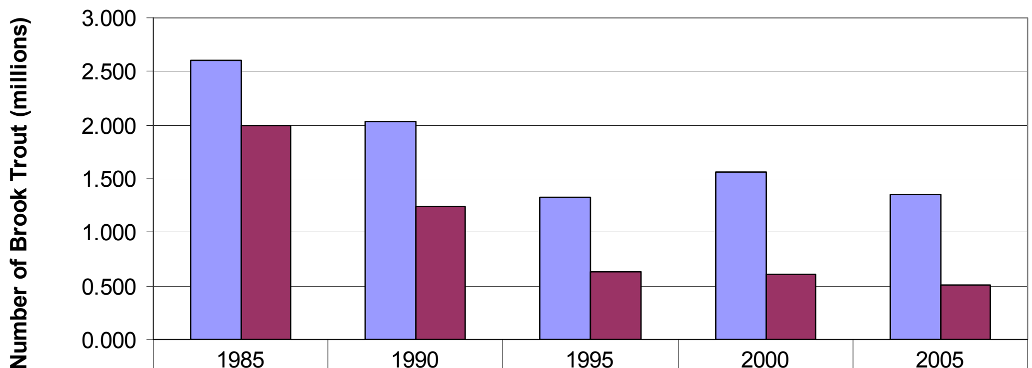
Source: Department of Fisheries and Oceans Canada. Surveys of Recreational Fishing in Canada. 2007. Website: http://www.dfo-mpo.gc.ca/communic/statistics/recreational/canada/2005/index_e.htm

Brook Trout Population

Recreational brook trout catches are also presented here as an indicator of brook trout populations in Nova Scotia, and—by implication—of water quality in Nova Scotia rivers. The annual brook trout catches recorded by the DFO have also declined dramatically in tandem with salmon declines. As noted above, this decline may also be partially due to over-fishing, climate change, and loss of old forests (since brook trout are a shade-dependent species), as well as the result of the acidification of rivers.

Since 1985, the number of brook trout caught in the Province has declined by 50% from 2.6 million to 1.3 million. Figure 16-9 below presents the recreational fishing harvests of brook trout since 1985, including both total number caught and total number kept.

Figure 16-9. Brook trout catches and releases (millions), Nova Scotia, 1985–2005



	1985	1990	1995	2000	2005
Caught	2.600	2.036	1.325	1.560	1.352
Kept	2.000	1.243	0.632	0.602	0.514

Source: Department of Fisheries and Oceans Canada. Surveys of Recreational Fishing in Canada. 2007. Website: http://www.dfo-mpo.gc.ca/communic/statistics/recreational/canada/2005/index_e.htm

16.5. Full cost accounting of water resources and pollution

The overall economic value of water resources and water quality in Nova Scotia is considered in the following section. Needless to say, the actual economic value of clean water to human society and to all living organisms is "priceless," as we are dependent on water for life itself. As well, money is a poor tool to assess the value of any non-market resource. Despite these major caveats, we nevertheless attempt to assign an economic value to our water resources, simply because failure to do so has been shown to take these resources for granted in both the policy and public arenas, to undervalue them (indeed to assign them, by implication, an economic value of zero), and thus to blunt the efforts and funding required to protect, conserve, and restore these precious resources.

In an industrialized society, we rely heavily on all our natural assets, including water, not only for our basic personal daily needs (i.e., drinking, bathing etc.), but also for our manufactured economy. For example, tar sands oil extraction in Alberta is heavily reliant on water. In addition, most of our wastes are disposed either directly into water bodies or into terrestrial areas in ways that frequently affect nearby water resources—both surface and ground water. Aquatic ecosystems are also important to sustain marine life and diversity which, in turn, affect the health of human society, including production of vital food sources. In these and many other ways, human society is completely dependent for its survival and prosperity on the abundance and health of the earth's water resources, while human activities often pollute, degrade, and/or deplete these resources.

The effects of water pollution are extensive and varied. Water pollution-related impacts also impose various economic costs, including costs to treat illnesses that range from typhoid, cholera, and dysentery in countries without safe drinking water to minor respiratory and skin diseases; costs to restore, clean, and filter contaminated drinking water supplies; reduced revenues from fishing; increased flooding and flood control costs; and loss of opportunities for recreational water use.

Unless such costs are properly accounted for using full-cost accounting methods, they will remain invisible, receive insufficient policy attention, and create price distortions that render the market economy inefficient by under-pricing economic activities that do not reflect the true costs of production. This last consideration is particularly relevant to those wishing to reduce the role of government in the economy, since heavy-handed government regulation and taxpayer-funded clean up costs will inevitably be required to compensate for failures to include pollution costs in market prices. Inclusion of such costs would create direct market incentives to producers to curb pollution. For all these reasons, we conclude with at least a preliminary effort to account for the value of Nova Scotia's water resources, and for the costs of their depletion and contamination.

GPI Atlantic's July 2000 report on the *Water Quality Accounts for the Nova Scotia Genuine Progress Index* reviewed in some detail the potential impacts of water resource depletion and pollution on freshwater and marine biodiversity as well as on human health and the economy. A summary of potential sources and adverse impacts of water pollution is identified is provided in Table 16-9 below.

Table 16-9. Potential sources and adverse impacts of water pollution

<table>
<tr><th>SOURCES OF WATER POLLUTION</th><th>ENVIRONMENTAL PARAMETER CHANGE</th><th>RESULTING IMPACTS</th></tr>
<tr><td>Industrial Water Pollution

▪ Road Construction and Maintenance
▪ Timber Harvesting
▪ Pesticide and Fertilizer Application
▪ Fire Management</td>
<td rowspan="3">▪ Increased Nutrients
▪ Increased Sedimentation
▪ Increased Erosion
▪ Habitat Loss/Degradation (wetlands, seagrasses, coral reefs)
▪ Eutrophication of Lakes and Rivers
▪ Increased Toxic Chemicals and bioaccumulation of toxins (pesticides, heavy metals, oils)
▪ Increased Water Temperature
▪ Increased Pathogens (bacteria, viruses)
▪ Low Dissolved Oxygen in Water</td>
<td rowspan="3">▪ Loss of Species Abundance
▪ Loss of Species Diversity
▪ Shellfish Bed Closures
▪ Swimming Beach Closures
▪ Decline in Species Health
▪ Fish Kills
▪ Algal Blooms (including toxic algae)
▪ Human Disease Outbreaks
▪ Flooding
▪ Reduced Crop Production
▪ Increased Risk of Cancer and Health Related Ailments
▪ Unpleasant Tastes and Odour of Drinking Water</td></tr>
<tr><td>Agriculture

▪ Fertilizer and Pesticide Application
▪ Concentrated Animal Feeding Lots
▪ Soil tillage
▪ Grazing Activities
▪ Irrigation</td></tr>
<tr><td>Municipal (Sewage Systems, Urbanization)

▪ Liquid and Solid Waste Disposal
▪ Stream Bank Modification
▪ Stream Channel Modification
▪ Dam Construction and Maintenance
▪ Land Clearing
▪ Road and Building Construction
▪ Fertilizer and Pesticide Application
▪ Road Salt Application
▪ Destruction and Degradation of Natural Vegetation, Wetlands and Riparian Areas
▪ Septic Tank Use</td></tr>
</table>

Source: Table was constructed based on information from the GPI 2000 water quality report and Environment Canada. 2001. *The State of Municipal Wastewater Effluents in Canada*. Website accessed October, 2008 http://www.ec.gc.ca/soer-ree/English/soer/MWWE.cfm.

Water resources, therefore, have many social, economic, and ecological values that are subject to depreciation if depleted or degraded. Because the value of water resources is dependent on both the abundance and quality of clean, healthy water, periodic investment is necessary to maintain, protect, and restore this natural asset, just as it is to maintain and enhance the value of manufactured capital assets.

To maintain and protect our natural water assets (i.e., capital), it is necessary, from the GPI perspective, to invest in "defensive" and "avoidance" expenditures. The cost-effectiveness of these expenditures can be assessed in relation to a quantification of the costs of declines in water ecosystem services and water quality. A wide range of valuations methods exists in the ecological economics literature and in various efforts to assess the value of water resources and the costs of their depletion and degradation. For example:

- Some costs can be directly quantified using market-related proxies—like the effect of water quality decline on property values for example.
- Indirect market-related valuation techniques also exist for some cost estimates, like the effect of water quality decline on recreational opportunities (e.g., swimming) and on wilderness areas.
- Replacement valuation methods can be used to assess engineering costs for facilities like filtration plants when natural water bodies lose their capacity to provide such functions for free.
- Non-market valuation techniques such as contingent value or willingness-to-pay (WTP) are also helpful in estimating non-use values like existence and option values.

The original Nova Scotia GPI Water Quality Accounts (July 2000) attempted—to the extent possible based on data availability at the time and methodological feasibility—to include as many values related to water resources as possible, along with costs associated with the loss and pollution of water resources. In many cases, estimates for Nova Scotia were derived from extrapolations from economic valuations undertaken in other studies and jurisdictions. Defensive environmental expenditures (costs that should be incurred to halt pollutant additions to water resources) and avoidance expenditures (actual costs for preventing environmental deterioration) were also included in the analysis.

The updated water quality account is presented in Table 16-10 below. All costs, expenditures, and valuations have been updated and reported in 2006 dollars using appropriate conversions from the Nova Scotia Consumer Price Index. Please see GPI Atlantic's original July 2000 Water Quality Accounts for detailed explanations on how each valuation is derived. Where these costs, expenditures, or valuations have been modified based on new information available since the original 2000 GPI report, the new data and their sources are presented below.

Table 16-10. Updated water quality account (2006$)

A) WATER VALUES (IF WATER RESOURCES ARE ECOLOGICALLY SOUND)	
Lakes and rivers	at least $3.8 billion/year in ecosystem services
Wetlands—freshwater and saltwater	1) at least $10.2 billion/year in ecosystem services (updated using 2007 wetland inventory data in Section 4 above)
	2) a minimum of $15.3 million/year in economic value
Water-based Recreation	$184 million/year based on actual expenditures and willingness to pay for water-based recreation
Historical Atlantic Salmon Recreational Fishing	$3.8 million/year based on value of salmon recreational catch in the 1980s
TOTAL VALUES	**Total water ecosystem values = $14.2 billion/year** (excludes the economic value for wetlands based on WTP—$15.3 million, and the Atlantic Salmon recreational fishing value—$3.8 million per year, because of possible double-counting in wetland ecosystem service value and water-based recreation value respectively.
B) DEFENSIVE EXPENDITURES (TO AVOID CONTAMINATION OF WATER)	
Investment Necessary for Improvements in Wastewater Disposal Treatment	$585 million in government expenditures to upgrade existing wastewater treatment facilities from primary treatment to secondary/tertiary treatment (updated based on cost estimates to meet proposed federal regulatory framework for wastewater (CCME, 2008)
Pollution Abatement and Control (PAC)	$221 million/year in government expenditures on water pollution abatement and control
Prevention and Protection	$9.3 million/year in business expenditures on water pollution prevention and protection
Inspection, Monitoring and Enforcement	$5.9 million/year in government expenditures for inspection, monitoring, and enforcement of water quality
TOTAL	**$236 million/year, plus necessary capital investment of $585 million**
C) WATER INTAKE COSTS: INCREASES WHEN (A) WATER VALUES OR (B)	

(DEFENSIVE EXP.) DECREASE	
Municipal Water Supply	$9.9 million/year in operating costs (a provincial extrapolation for treatment, monitoring and protection, based on HRM's expenditure); plus necessary investment for upgrades of $140.5 million in capital costs)
Household Water Filtering and Bottled Water	at least $40.3 million/year in household expenditures for bottled water and water filtration equipment
Industrial Water Intake	$3.9 million/year in industry expenditures on water intake treatment costs
Domestic On-Site Community Water Supply	unknown, but a capital investment of at least $26.0 million is needed for upgrades
TOTAL	**$54.1 million/year in operating costs, plus a necessary capital investment of $167 million**

D) COSTS INCURRED DUE TO A LOSS IN WATER RESOURCE VALUE AND WATER QUALITY DECLINE	
1) DAMAGE COSTS	
Contaminated Well Claims	$672,000/year in government expenditures to settle well claims due to salt contamination
Shellfishery Closures	$10.5 million/year; plus cumulative cost of $129 million from 1990 to 2006 for lost industry revenue
Beach Closures	at least $68,700 per year; plus $126,400 over the past 5 years associated with lost recreational opportunity and willingness to pay
Recreational Fishing	$2.7 million/year in lost industry revenue from angler expenditures
Wetlands	$3.4 billion/year, plus cumulative loss of $55 billion from 1990 to 2006 in lost ecosystem services (updated based on 2007 wetland inventory in Section 4)
TOTAL	**$3.44 billion/year, plus $55 billion in cumulative losses over 16 years due to wetland losses and $129 million in cumulative shellfish and beach closure losses**
2) RESTORATION COSTS	
Atlantic Salmon Rivers	$10.6 million/year, plus $293 million for south-western region in government and private expenditures to restore salmon rivers

3) HEALTH COSTS	
Water-Related Illness	at least $3.7 million/year in government costs to provide health care services
TOTAL ANNUAL COSTS DUE TO DECLINE IN WATER RESOURCE VALUES AND/OR INSUFFICIENT INVESTMENT IN DEFENSIVE EXPENDITURES	**$3.74 billion/year IN DAMAGE, RESTORATION, AND HEALTH COSTS, AND IN DEFENSIVE EXPENDITURES AND WATER INTAKE COSTS** (Note that 91.5% of these costs are attributable to wetland loss. The very high value attributed to wetland functions and their loss is based on assessments in the ecological economics literature. Please see original NS GPI Water Quality Accounts, Sections 12.2.4–12.2.7 for an explanation of these sources.)

Note to Reader: Please see Section 23.3 for additional references.

16.6. Appendix: list of acronyms

AO - aesthetic objectives
ASF - Atlantic Salmon Federation
BOD - biological (biochemical) oxygen demand
CEC - Commission for Environmental Cooperation
CCME - Canadian Council of Ministers of the Environment
GCDWQ - Guidelines for Canadian Drinking Water Quality
GPI - Genuine Progress Index
HRM - Halifax Regional Municipality
IMAC - interim maximum acceptable concentration
MAC - maximum acceptable concentration
NSDOE - Nova Scotia Department of Environment
NSDEL – Nova Scotia Department of Environment and Labour (previous name)
NSDNR - Nova Scotia Department of Natural Resources
SWQPP – Shellfish Water Quality Protection Program

17. Energy

* This chapter falls into both the Natural Capital and the Human Impact on the Environment domains.

For the original GPI Atlantic report on energy, please see the following: *The Energy Accounts for the Nova Scotia Genuine Progress Index* (2005) http://gpiatlantic.org/pdf/energy/energy.pdf

Headline Indicators

1. Total energy demand, by sector and fuel type
2. Per capita energy demand, Canada and provinces
3. Total primary energy production
4. Per capita primary energy production, Canada and provinces
5. Proportion of electricity generated from renewable sources
6. Primary sources of coal for electricity generation
7. Damage costs of air pollution and greenhouse gas emissions in Nova Scotia

Note to Reader: Please see Section 23.4 for additional references.

17.1. Introduction

Energy is essential to all life on earth. Whether as nourishment to sustain individual organisms or as fossil fuels to run modern societies, every activity on earth is dependent on constant, abundant, and reliable sources of energy. Any interruption to modern energy supplies can have serious consequences for the economy and society, jeopardizing current standards of living.

But the intensive use of energy, especially energy obtained from fossil fuels, is also the primary cause of a number of environmental, social, and economic concerns. Current energy production and consumption patterns have been linked to global climate change, local health effects, and regional impacts such as air and water pollution, damage to marine and other wildlife, land-use conflicts, security concerns, resource depletion, and soil contamination.

Until recently however, attention on energy matters has been focused predominantly on discovering and developing new fossil fuel based energy sources and securing existing ones, with little regard for the health and environmental impacts these create. The benefits of abundant supply were considered to outweigh the social and environmental costs of maintaining that abundance. The potential perils of global warming in particular have changed that understanding. When the full costs of energy use are now included in the equation, as in this study, the current model is seen to be unsustainable.

In GPI Atlantic's 2005 report *The Energy Accounts for the Nova Scotia Genuine Progress Index*, a sustainable energy system was defined as one that has the following components:

- Reduces demand for and dependence on conventional fossil fuel based energy supplies through changes in consumption patterns, including changes in behaviour and more efficient use of energy
- Increases reliance on renewable sources of energy
- Uses cleaner sources of conventional energy, such as natural gas, as bridging fuels, and develops ways to reduce the impacts of more polluting sources
- Ensures accessibility to adequate energy services at a reasonable cost for all sectors of the population in the most environmentally sustainable way

In short, in order for Nova Scotia to move toward sustainability in the energy sector, it must reduce its high present levels of energy consumption and make immediate investments both in improved efficiency and in renewable energy sources in order to reduce its present reliance on imported fossil fuels.[1]

This short indicator summary chapter updates both the important trends in GPI Atlantic's 2005 *Energy Accounts for the Nova Scotia Genuine Progress Index* and that report's damage cost estimates for air pollutant and greenhouse gas emissions from the energy sector. Of the 30 indicators identified in the 2005 GPI report, six key ones have been selected here as particularly indicative for the purpose of assessing whether or not Nova Scotia is making genuine progress towards sustainability in the energy sector.

17.2. Indicators of progress: energy consumption (demand)

Tracking and analyzing energy consumption levels in Nova Scotia by sector and by fuel type is a powerful way to understand the state of the energy sector. It tells us how much energy is actually being used, and provides insight into which energy users are the largest consumers and which forms of energy are the dominant sources. In order to move toward a more sustainable energy sector, as noted above, Nova Scotia must reduce its high levels of energy consumption and decrease its reliance on fossil fuels. The indicators used here to track progress in these areas are:

- Total energy demand,[2] by sector and by fuel type
- Per capita energy demand in Nova Scotia by comparison with Canada and other provinces and territories

17.2.1. Total energy demand, by sector and by fuel type

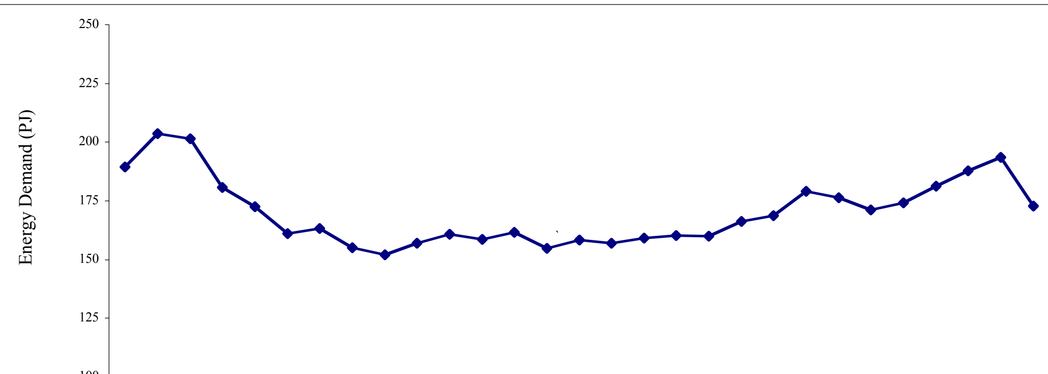
Data sources: Statistics Canada, CANSIM Tables 128-0002 and 128-0009.

Result: Nova Scotia's total energy demand grew by 25% from 1991 to 2005 and then fell by 11% between 2005 and 2006. Transportation accounts for the highest share of energy demand—34%—up from 26% in 1978.

In 2006, Nova Scotia's total energy consumption was 173 petajoules (PJ), down nearly 9% from 1978 when total energy consumption was 189 PJ, but up by 14% from its 1986 low point. As Figure 17-1 below indicates, energy demand in Nova Scotia declined rapidly in the early 1980s due to the 1970s oil crises and shortages, but increased sharply in the mid-1990s in response to the availability of cheap oil and consumer tendencies to embrace fuel-inefficient SUVs, minivans, and light trucks.

2006 marked the apparent end of a period of steep increases in energy consumption between 1996 and 2005, during which total energy use increased by 21%. Between 2001 and 2005 alone, total energy consumption in the province increased by 13%. Rising fuel prices may now be reversing this trend and initiating new efforts towards conservation and increased efficiency.

Figure 17-1. Energy use, final demand (petajoules (PJ)), Nova Scotia, 1978–2006



	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Energy Demand	189	204	201	181	173	161	163	155	152	157	161	159	162	155	158	157	159	160	160	166	169	179	176	171	174	181	188	194	173

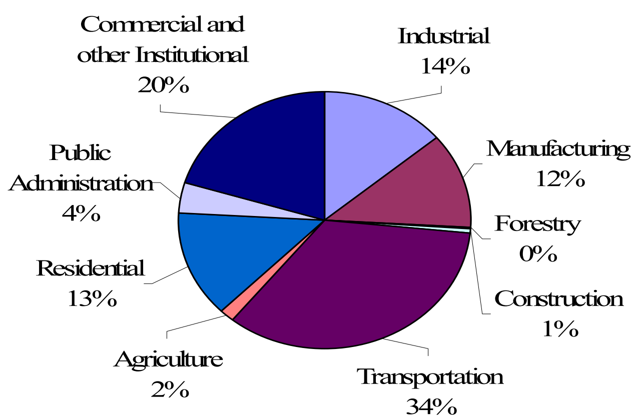
Sources: Energy use values from 2002-2006 are from CANSIM Table 128-0009 (Statistics Canada, 2008); energy use values from 1978-2001 are from CANSIM Table 128-0002 (Statistics Canada, 2005).

Figure 17-2 shows a breakdown of energy consumption in Nova Scotia for 2006, while Figure 17-3 show this breakdown for 1978 for comparative purposes. The transportation sector accounted for approximately 34% of total energy consumption in Nova Scotia in 2006 (Figure

17-2 below). The second highest energy-consuming sector in 2006 was the commercial and institutional sector at 20%, followed by the industrial, residential, and manufacturing sectors at 14%, 13%, and 12%, respectively.

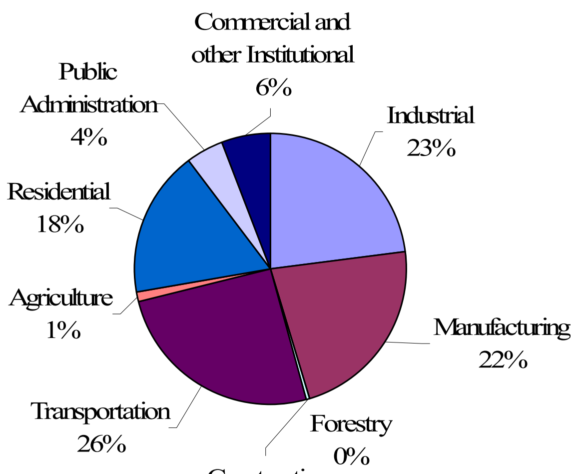
This 2006 sectoral breakdown reflects a significant shift since 1978—with total energy consumption increasing by 9% in transportation and by 185% in the commercial and institutional sector (from 14,092 TJ to 40,095 TJ[3]), and declining by 38%, 56%, and 51% in the residential, manufacturing, and industrial sectors, respectively. These sectoral changes likely reflect changes in the economic structure of the province rather than changes in energy efficiency and conservation. Thus, the decline in industrial and manufacturing energy use reflects a fundamental shift away from energy-intensive production like steel manufacturing and towards less intensive commercial businesses like call centres and other service industries.[4]

Figure 17-2. Energy use, final demand (%), by sector, Nova Scotia, 2006



Source: Derived from CANSIM Table 128-0009 (Statistics Canada, 2008).

Figure 17-3. Energy use, final demand (%), by sector, Nova Scotia, 1978



Source: Derived from CANSIM Table 128-0002 (Statistics Canada, 2005).

The use of refined petroleum products accounted for 74% of total energy consumption in Nova Scotia in 2005[5] (Table 17-1 below). Electricity was the second most important source of energy consumption in 2005, accounting for 22% of total energy use and nearly doubling in use since 1978. This trend likely reflects the increased importance of electricity to the commercial and residential sectors, and is in line with a global trend in increased electricity demand, caused in large part by a proliferation in the ownership and use of electronics and electrical equipment.[6]

This dramatic increase in electricity consumption has significant implications for Nova Scotia, given the environmental and social impacts associated with the primarily fossil fuel based electricity generation system in the province. Imported coal presently represents 80% of the fuel used to generate electricity in Nova Scotia. These impacts will be explored further in Sections 17.2.2 and 17.3 of this chapter.

Table 17-1. Energy use, final demand (terajoules (TJ)), by source and fuel type, Nova Scotia, 1978 and 2005

FUEL TYPE / SOURCE	1978		2005	
	Amount (TJ)	% of Total	Amount (TJ)	% of Total
Coal, Coke, and Coke Oven Gas	17,155	9.1%	1,254	0.6%
Natural Gas	0	0%	1,390	0.7%
Natural Gas Liquids (NGL's)	1,780	0.9%	3,824	2%
Steam	n/a	0%	1,412	0.7%
Electricity	21,772	11.5%	42,381	22%
Refined Petroleum Products	148,695	78.5%	143,307	74%
Total	**189,402**	**100%**	**193,357**	**100%**

Sources: 2005 energy use values are from CANSIM Table 128-0009 (Statistics Canada, 2008); 1978 energy use values are from CANSIM Table 128-0002 (Statistics Canada, 2005).

Note: Totals may not add up due to rounding.

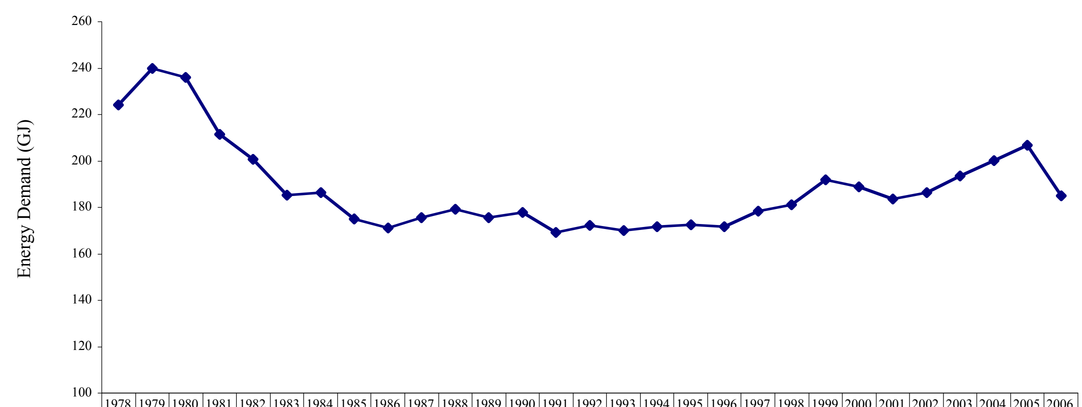
17.2.2. *Per capita energy demand in Nova Scotia and Canada*

Data sources: Statistics Canada, CANSIM Tables 128-0002, 128-0009, and 051-0001.

Result: Nova Scotia's per capita energy demand increased by 22% from 1991 to 2005 and then fell by 11% between 2005 and 2006. Among the provinces, Nova Scotia had the second lowest per capita energy demand in the country—21% below the national average.

On a per capita basis, Nova Scotians consumed an average of 185 gigajoules (GJ) of energy in 2006—down 17% from 224 GJ per person in 1978, but up 9.5% from a 1991 low point of 169 GJ per person. Again, most of the decline in per capita energy use occurred in the early 1980s following the oil crisis. Energy use per capita in the province rose sharply from 1996 to 2005 (by more than 20%) before falling off in 2006 (Figure 17-4 below).

Figure 17-4. Energy use, final demand per capita (gigajoules (GJ)), Nova Scotia, 1978–2006

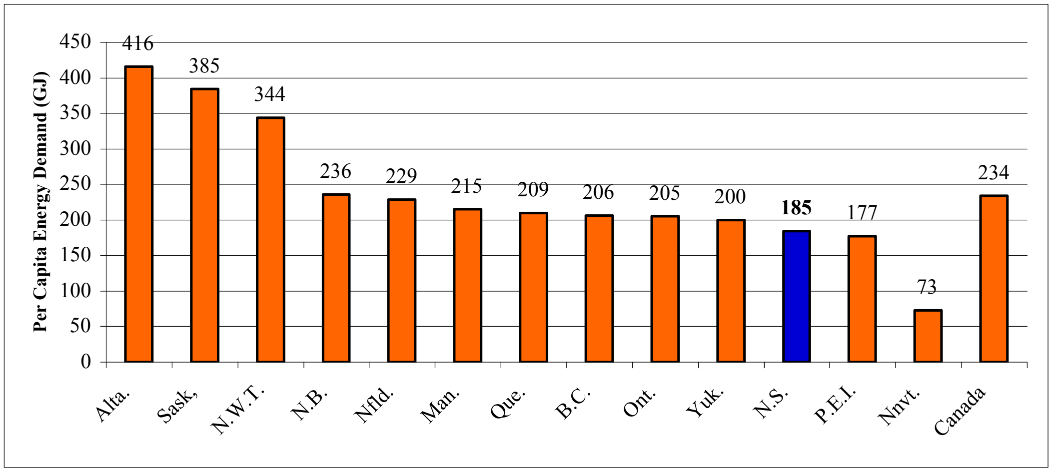


	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Energy Demand	224	240	236	211	201	185	186	175	171	176	179	176	178	169	172	170	172	173	172	178	181	192	189	184	186	193	200	207	185

Sources: Energy use values from 2002-2006 are from CANSIM Table 128-0009 (Statistics Canada, 2008) and energy use values from 1978-2001 are from CANIM Table 128-0002 (Statistics Canada, 2005). Annual population estimates are from CANSIM Table 051-0001 (Statistics Canada, 2007a).

Nova Scotia's per capita energy consumption ranked 11th among the provinces and territories—about 21% lower than the national average in 2006 (234 GJ per person) and second lowest among the Atlantic provinces (Figure 17-5 below). Oil-producing Alberta and Saskatchewan had by far the highest per capita energy demand in the country, consuming 416 GJ and 385 GJ per person, respectively, in 2006—more than twice the Nova Scotia level.

Figure 17-5. Energy use, final demand per capita (gigajoules (GJ)), Canada, provinces, and territories, 2006



Sources: Energy use values for 2006 are from CANSIM Table 128-0009 (Statistics Canada, 2008); 2006 population estimates are from CANSIM Table 051-0001 (Statistics Canada, 2007a).

17.3. Indicators of progress: energy production

At a time when energy is increasingly expensive and in short supply globally, domestic production of energy can be a source of both security and wealth (please see Chapter 3.5 of GPI Atlantic's 2005 *Energy Accounts for the Nova Scotia GPI* for a discussion of peak oil and its potential consequences). For this reason, and because a secure and affordable source of energy is essential for economic and social wellbeing, it is important for any assessment of energy sustainability to track and assess energy production as well as energy consumption.

However, different energy sources and their production methods cause varying social and environmental impacts. For example, renewable sources are inherently more sustainable than fossil fuels and nuclear energy, both because supplies should in principle last indefinitely and because renewables generally carry fewer social and environmental burdens and costs because they usually produce less harmful wastes and by-products.[7]

For these reasons, Nova Scotia must increase the share of energy produced from renewable sources and reduce its dependence on fossil fuels if it is to make genuine, long-term progress towards a sustainable energy sector. As well, because the fossil fuels used in Nova Scotia are generally imported from other countries—often from unstable parts of the world—security would be enhanced by greater reliance on domestically generated wind, solar, tidal, and geothermal power.

The indicators here used to assess Nova Scotia's progress in energy production are:

- Total primary energy production
- Per capita primary energy production in Nova Scotia, by comparison with Canada and other provinces and territories
- The proportion of electricity generated from renewable sources
- The primary sources of coal for electricity generation

Primary energy in this report refers to energy in the form of raw resources, such as wood, coal, oil, natural gas, uranium, wind, water, and sunlight. Primary energy production refers to energy produced from these sources within Nova Scotia (e.g., the production of offshore natural gas). Primary energy production does not include the use of imported fuels such as oil and coal used in electricity production.

17.3.1. Total primary energy production

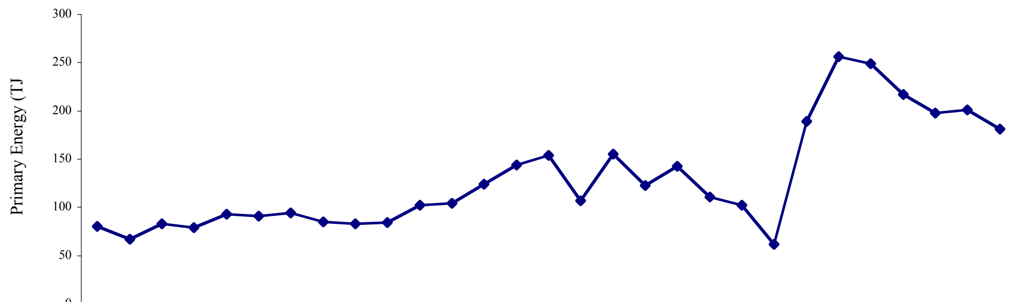
Data sources: Statistics Canada, CANSIM Table 128-0002 and 128-0009.

Result: Primary energy production in Nova Scotia increased sharply from 1999 to 2001 due to Sable Island natural gas production, but has declined by 29% since then. The province is again a net importer of energy—with the vast majority of its energy needs dependent on foreign oil and coal.

Nova Scotia produced 181 PJ of primary energy in 2006—up 125% since 1978 when primary energy production totalled just 80 PJ (Figure 17-6 below). Peak production during this time period occurred in 2001 (256 PJ), and production has been in decline ever since, with 2006 production 29% below 2001 levels. The dramatic spike in production in 1999-2001 was primarily associated with the production of natural gas at the Sable Island Offshore Energy Project, which briefly turned Nova Scotia into a net exporter of energy. Since that time, Sable Island production levels have declined, and Nova Scotia is once again a net importer of energy.

Even with the province's substantial offshore natural gas production, the vast majority of energy actually used in Nova Scotia comes from non-Canadian imported fuels (coal and oil). Most of the provincially produced natural gas is exported to New Brunswick and the eastern United States.[8] For example, in 2005, Nova Scotia produced 157 PJ of natural gas energy, but 148 PJ (or more than 94%) of this left the province in inter-regional transfers.[9]

Figure 17-6. Primary energy production (petajoules ((PJ)), Nova Scotia, 1978–2006



	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Series1	80	67	83	79	93	91	94	85	83	84	102	104	124	144	154	107	155	123	143	111	102	62	189	256	249	217	198	201	181

Sources: Primary energy production values for 2002-2006 are from CANSIM Table 128-0009 (Statistics Canada, 2008); primary energy production values for 1978-2001 are from CANSIM Table 128-0002 (Statistics Canada, 2005).

17.3.2. Per capita primary energy production in Nova Scotia and Canada

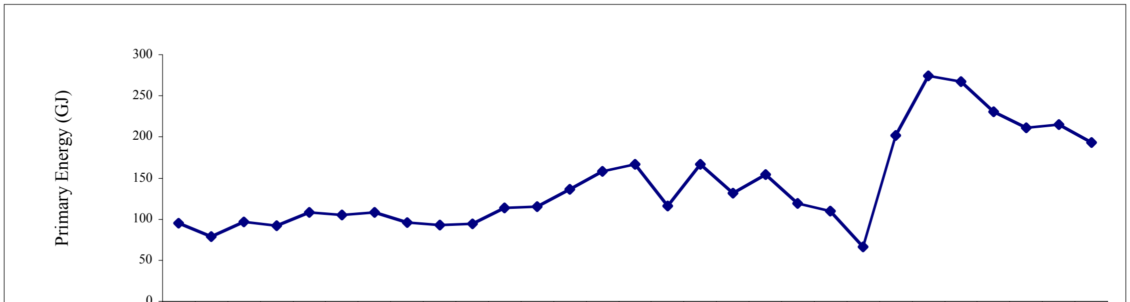
Data sources: Statistics Canada, CANSIM Tables 128-0002, 128-0009, and 051-0001.

Result: Per capita primary energy production in Nova Scotia increased sharply from 1999 to 2001 due to Sable Island natural gas production, but has declined by 28% since then. In 2006, Nova Scotia ranked fifth among the provinces in primary energy production—62% below the national average.

On a per capita basis, Nova Scotia produced approximately 193 GJ of energy per person in 2006—more than double the 95 GJ per person produced in 1978 (Figure 17-7 below). As noted above, the sharp spike in production between 1999 and 2001 was due to the production of natural gas at Sable Island.

Nova Scotia's per capita energy production ranked seventh among Canada's provinces and territories—about 62% lower than the national average of 514 GJ per person—and second highest among the Atlantic provinces (Figure 17-8 below). Not surprisingly, oil-producing Alberta had by far the highest per capita level of energy production in Canada in 2006, at 3,224 GJ per person, followed by Newfoundland and Labrador at 1,677 GJ per capita, and Saskatchewan at 1,516 GJ per capita.

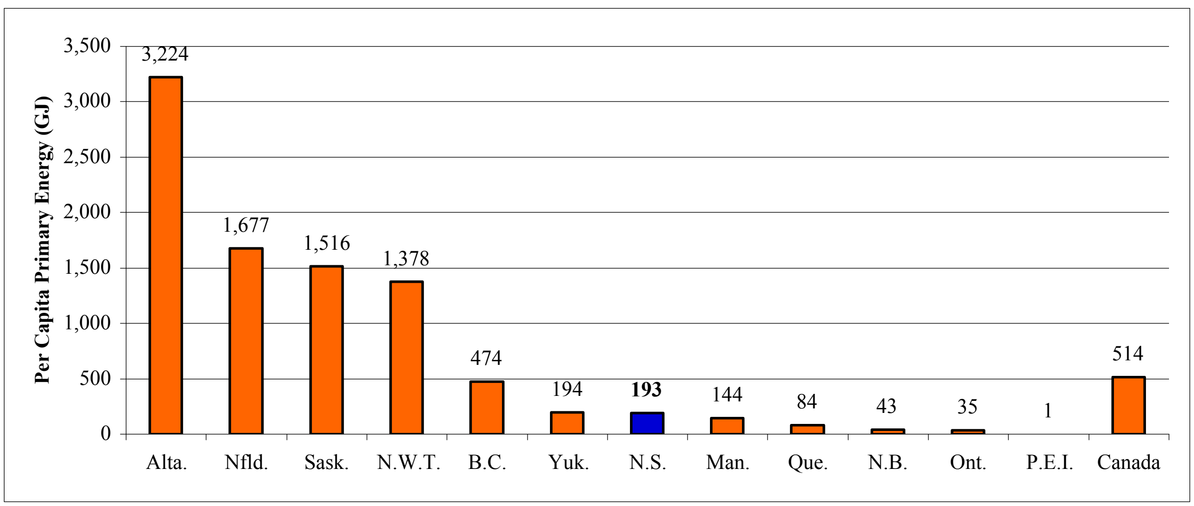
Figure 17-7. Primary energy production per capita (gigajoules (GJ)), Nova Scotia, 1978–2006



	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
GJ per cap	95	79	97	92	108	105	108	96	93	94	114	115	136	158	167	116	167	132	154	119	110	66	202	274	267	231	211	215	193

Sources: Primary energy production values for 2002-2006 are from CANSIM Table 128-0009 (Statistics Canada, 2008); primary energy production values for 1978-2001 are from CANSIM Table 128-0002 (Statistics Canada, 2005). Annual population estimates are from CANSIM Table 051-0001 (Statistics Canada, 2007a).

Figure 17-8. Primary energy production per capita (gigajoules (GJ)), Canada, provinces, and territories, 2006



Sources: Primary energy production values for 2006 are from CANSIM Table 128-0009 (Statistics Canada, 2008) and 2006 population estimates are from CANSIM Table 051-0001 (Statistics Canada, 2007a).

17.3.3. Proportion of electricity generated from renewable sources

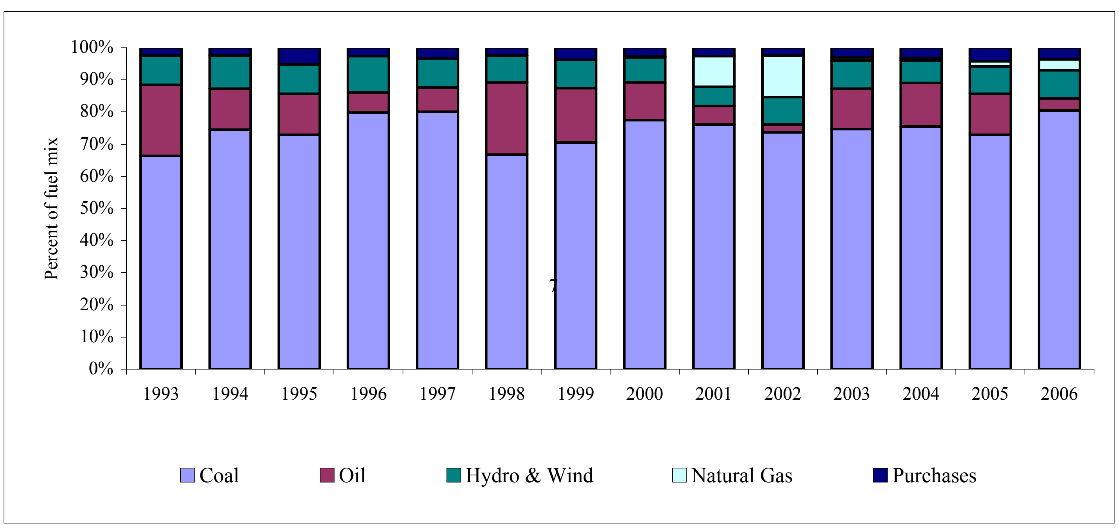
Data sources: Emera, Annual Financial Reports

Result: In 2006, 80.4% of Nova Scotia's electricity was from coal—the highest share since 1993. Renewables accounted for just 8.8%—relatively unchanged since 1993 and mostly from older, small-scale hydro projects. Wind energy production has not yet significantly changed the mix.

Electricity accounted for 22% of final energy demand in Nova Scotia in 2006 (Table 17-1 above). Because the environmental, economic, and social impacts of electricity production may affect the wellbeing of Nova Scotians in various ways, it is, therefore, important to consider how electricity is produced in the province. Nova Scotia Power Inc. (NSPI) is the primary electricity supplier in Nova Scotia, providing over 95% of the province's electricity generation, transmission, and distribution.[10]

Figure 17-9 below shows the fuel mix used to generate electricity at NSPI's power generation plants located throughout the province. Between 1993 and 2006, coal has been the primary fuel used to generate electricity, accounting for at least 66% of the fuel mix in any given year during that period. In 2006, 80.4% of the electricity generated by NSPI was from coal, representing coal's highest share of the fuel mix since 1993.

Figure 17-9. Power generation fuel mix for Nova Scotia Power, 1993–2006



Sources: Emera Annual Reports, 2006, 2005, 2004, 2003, 2002, 2001, 2000; NSPI Annual Reports, 2000, 1999.

Oil has generally been the second most important fuel in the mix since 1993, with natural gas briefly taking its place in 2001 and 2002. However, in 2006, the use of oil declined significantly, due largely to price increases, and accounted for only 3.8% of the fuel mix. Unfortunately, this decline in oil use was generally offset by an increase in coal use, rather than by any substantial increase in renewable sources.

In 2006, renewable sources such as hydro and wind accounted for only 8.8% of the fuel mix, an amount which is actually slightly lower than the share of renewables in 1993 (9.2%). The renewable share of electricity production in Nova Scotia remains almost entirely attributable to older small-scale hydropower projects, although NSPI is attempting to increase the share of electricity produced with wind power.

From a sustainability perspective, it is a major concern that the proportion of electricity generated from renewables has actually declined slightly rather than increased over the last 13 years. In 2003, the provincial government set a target to increase the proportion of total electricity generated from renewable sources by five percentage points by 2010.[11] Since that time, however, the proportion has remained steady at 8.8%. Clearly, more urgent efforts and more substantial investments are required to increase the use of renewable electricity generation technologies.

The province's Environmental Goals and Sustainable Prosperity Act, passed in 2007, commits the province to obtaining 18.5% of its total electricity needs from renewable energy sources by 2013.[12] This will require an increase of approximately 10 percentage points beyond current production levels in the share of the fuel mix occupied by renewables.

NSPI's continued reliance on fossil fuels—particularly coal—for electricity generation has significant environmental and health implications. The use of coal is largely responsible for Nova Scotia's elevated levels of mercury (Hg) and sulphur oxide (SO_X) emissions.[13] Mercury is considered toxic under the Canadian Environmental Protection Act (CEPA), with no safe level of exposure. Toxic effects are greatest on the central nervous system, with even low-level chronic exposure linked to neurological, reproductive, behavioural, and learning problems. Sulphur oxides may cause breathing difficulties among asthmatics and those with lung disease, and are a major contributor to acid rain and smog.

In 2006, per capita mercury emissions in Nova Scotia were approximately 0.19 g per person, making Nova Scotia the fifth highest emitter of mercury per capita in the country—0.04 g above the national average of 0.15 g per capita.[14] In 2005, mercury emissions from NSPI electricity generation accounted for approximately 92% of Nova Scotia's total mercury emissions.[15]

In 2006, Nova Scotia had the highest per capita emissions of sulphur oxides in Canada at 111 kg per person—nearly seven times higher than the national average of 16.1 kg per person.[16] In 2005, sulphur oxide emissions from NSPI generating plants accounted for 82% of Nova Scotia's total sulphur oxide emissions.[17] A discussion of the economic impacts of the damages resulting from mercury and sulphur oxide emissions is provided in Section 17.4.1 of this chapter. Please also see Chapter 15 above for more about air pollution in Nova Scotia.

Despite the province's small population, NSPI is Canada's fourth worst air polluter. Out of 29 coal-fired plants in the country, NSPI's Trenton, Lingan, and Point Tupper plants are ranked as three of the country's four dirtiest in acid gas emissions. This need not be so. NSPI's Point Aconi plan uses a clean coal technology that has reduced sulphur oxide and nitrogen oxide (NO_X) emissions by up to 90% and 75%, respectively, compared to its older, less efficient, and more polluting plants.

In 2005, NSPI took a positive step in this regard by installing pollution control equipment at its Tuft's Cove plant in Dartmouth, designed to reduce the amount of particulate matter being released from the stacks.[18]

17.3.4. Primary sources of coal for electricity generation

Data sources: Emera, Annual Financial Reports; Hughes, Energy Security in Nova Scotia; GPIAtlantic, Energy Accounts for the Nova Scotia Genuine Progress Index

Result: Coal—accounting for over 80% of Nova Scotia's electricity fuel mix—is almost entirely imported from foreign countries, where coal production has produced some serious social and environmental problems.

As indicated above, coal is the primary fuel used to generate electricity in Nova Scotia, and nearly all of this coal is imported from overseas. In 2005, GPI Atlantic reported that Nova Scotia Power Inc. (NSPI) imports steam coal from China, and that up to 17% of NSPI's coal supply comes from Columbia.[19] While specific amounts and sources of imported coal are generally kept confidential by NSPI, there is no existing public information to suggest that the sources of coal imports have changed. In 2007, a study on energy security produced by the Canadian Centre for Policy Alternatives (CCPA) reported that most of the coal used by NSPI to generate electricity in Nova Scotia is imported from Columbia, Venezuela, and the United States.[20]

Nova Scotia's continued reliance on imported coal to generate electricity raises a number of concerns in relation to the long-term economic viability of the energy sector, energy security, social and environmental issues in the coal-supplying countries, environmental and health impacts at home, and other issues.

According to the CCPA, world coal prices have doubled since 2002 alone, and NSPI costs for coal rose from $202.9 million in 2001 to $260.9 million in 2005.[21] The continued high demand for coal globally, and increasing fears about the scarcity of fossil fuel reserves, could lead to further increases in these costs, which, in turn, could lead to higher energy costs for Nova Scotia home owners.

Social and political tensions in coal-supplying countries could also lead to reduced availability of imports and interruptions in supply. For instance, increasing political and economic tensions between Venezuela and the United States could lead to a reduction in import availability of coal for Nova Scotia. In these and other ways, Nova Scotia's continued dependence on energy imports from unstable regions can undermine energy security at home. By contrast, Prince Edward Island has commited to produce 100% of its electricity from wind by 2015—thereby not only creating multiple environmental benefits but also substantially enhancing its energy security through reliance on a wholly domestic renewable source of electric power with limitless supply.

The use of coal from other countries also links Nova Scotia with serious social and environmental problems associated with coal mining in these countries. For example, China's coal mining industry has a disproportionately high number of fatal accidents,[22] while coal coming from some suppliers in Columbia has been referred to as "blood coal" due to the very poor treatment of workers in some coal fields.[23] While these social costs are not borne directly by Nova Scotians, they are certainly a part of our global energy footprint, and they need to be taken into account when assessing the full costs of energy production. By purchasing coal from these sources at the lowest available market prices without making its purchases contingent on adherence to accepted labour and environmental standards, Nova Scotia is indirectly contributing to the continued negative social impacts suffered by workers in these countries, as well as the environmental impacts of coal mining.

17.4. Assessing the full cost of energy in Nova Scotia

Data sources: GPI Atlantic Energy Accounts (2005), Air Quality Accounts (2004), and Greenhouse Gas Accounts (2001)

Result: Damage costs attributable to air pollutant and greenhouse gas emissions from Nova Scotia's stationary energy sources (power plants and refineries) in 2005 are estimated at more than $380 million or $400 per Nova Scotian.

The extraction, production, transportation, marketing, and use of energy all have effects on people's health, the environment, and society. However, few of these effects are reflected in the market price of energy. For example, air pollution from the burning of fossil fuels has measurable impacts on human health, thereby increasing medical expenditures and causing productivity losses to the economy. Greenhouse gas (GHG) emissions from burning coal and oil are virtually certain to be contributing to climate change, and will continue to do so, which will have costly and even deadly impacts throughout the world for generations to come.

In an effort to provide a more complete assessment of the true costs of Nova Scotia's energy sector, GPI Atlantic, in its 2005 *Energy Accounts for the Nova Scotia Genuine Progress Index*, translated some of these externalities into damage cost values that more accurately reflect the economic burdens of our energy choices. While the methodologies of this type of "full-cost accounting" approach are still under development, the initial estimates provided in the 2005 GPI report are far more accurate than the conventional practice of not assigning any value to vital non-market goods and services, which wrongly implies that they have zero monetary worth.

In this update of key trends from the 2005 GPI Atlantic report, these damage costs have also been updated. The 2005 GPI report provided damage cost estimates for air pollution and GHG emissions for the year 2000, and this section updates those costs to the year 2005 based on 2005 energy-related emissions.

There is no pretence that the following estimates provide a complete picture of the true costs of energy use. Aside from air pollution and climate change damage costs, there are clearly many other economic consequences and implications of energy production and consumption that are not fully acknowledged in conventional accounting practices, including affordability, reliability, energy security, subsidies, resource consumption and depletion, employment, land use, and land and water contamination. Due to methodological and data availability issues, dollar values have not yet been assigned to these and other impacts in this analysis. However, a qualitative discussion of these additional costs is provided in the 2005 GPI report.

17.4.1. Damage costs of air pollution from stationary energy-related sources

This section estimates the damage costs associated with air pollutant releases from Nova Scotia's energy sector. Damage cost estimates for air pollution include consideration of increased medical expenses and productivity losses due to the health consequences of pollution exposure, and costs associated with general environmental degradation (e.g., reduced crop yields, forest defoliation, or acidification of lakes resulting from acid rain). Damage costs per tonne were derived from an extensive literature review in the 2004 GPI Atlantic report *The Ambient Air Quality Accounts for the Nova Scotia Genuine Progress Index* (see Section 15.4 above), and were then converted to 2005 Canadian dollars and applied to energy-related pollutant emissions (see Tables 17-2 and 17-3 below).

Both low and high estimates have been provided in order to represent the often significant variability of the cost estimates in the literature. The substantial gap between the high and low figures reflects the different assumptions contained in the different studies examined in the literature review on cost estimates. Specific details on this literature review and on the assumptions and methodologies employed to derive these damage cost values can be found in the GPI Atlantic 2004 air quality and 2005 energy reports.

Table 17-2 below provides 2005 stationary energy-related air pollutant emissions. Note that these emissions exclude mobile emissions from the transportation sector, and are confined to emissions from NSPI's five main power plants in Nova Scotia plus the Irving Imperial Oil refinery in Halifax and the Brooklyn Energy Centre. Damage costs for air pollution from the transportation sector are separately discussed in Chapter 22 of this indicator report. Damage costs for stationary energy-related air pollutant emissions were calculated by multiplying costs per tonne by the level of emissions in 2005. As indicated in Table 17-3 below, energy-related air pollutant emissions currently cause between $280 million and $2 billion a year in damages to health, society, and the environment.

Table 17-2. Tonnes of stationary energy-related air pollutant emissions, Nova Scotia, 2005

POLLUTANT	EMISSIONS (TONNES)
CO (carbon monoxide)	51,022
TPM (total particulate matter)	10,473
SO_X (sulphur oxides)	110,522
NO_X (nitrogen oxides)	38,324
VOCs (volatile organic compounds)	12,063
Hg (mercury)*	0.114

Source: Environment Canada, 2007a, 2007b.

Note: *Mercury emissions from stationary energy-related sources include emissions from NSPI power plants (0.105 tonnes), Irving Imperial Oil refinery (0.0022 tonnes), and Brooklyn Energy Centre (0.0067 tonnes).

Table 17-3. Nova Scotia stationary energy-related air pollutant damage cost estimates (C$2005), 2005

POLLUTANT	LOW / TONNE	DAMAGE COSTS	HIGH / TONNE	DAMAGE COSTS
CO	$2.23	$113,779	$6.68	$340,827
TPM	$2,359	$24,705,807	$5,764	$60,366,372
SO_X	$1,536	$169,761,792	$11,684	$1,291,339,048
NO_X	$1,569	$60,130,356	$13,853	$530,902,372
VOCs	$2,225	$26,840,175	$9,169	$110,605,647
Hg	$9,102,493	$1,037,684	$12,820,201	$1,461,503
Total		**$282,589,593**		**$1,995,015,769**

Source: High and low damage cost estimates per tonne from GPI Atlantic. 2005. *The Energy Accounts for the Nova Scotia Genuine Progress Index: Update 3, November 2005*. Available from http://www.gpiatlantic.org/pdf/energy/energy.pdf. Accessed January 25, 2008.

Note: High and low damage costs were adjusted to C$2005.

17.4.2. Damage costs of greenhouse gas emissions from stationary energy-related sources

Assessing the damage costs associated with greenhouse gas (GHG) emissions is a very complex and challenging aspect of full-cost accounting. Though produced locally, Nova Scotia's GHG emissions have global impacts. In addition, GHG emissions released today will have effects that extend well into the future. Thus, in order to estimate the damage costs of releasing GHG emissions, the future impacts of climate change on ecological and terrestrial systems; human society; health and disease; agriculture; coastlines; and global weather systems, including the frequency and intensity of droughts, floods, storms and hurricane activity, must all be modelled. As well the particular and different vulnerabilities of developing and developed nations must be assessed, along with the potential for and costs of human adaptation to climate change. These considerations all involve assumptions and alternative scenarios that have a major impact on estimating damage costs attributable to GHG emissions.

In GPI Atlantic's 2001 report *Nova Scotia Greenhouse Gas Accounts for the Genuine Progress Index*, low and high damage cost estimates per tonne of CO_2 were derived from an extensive literature search. Since that time, GPI Atlantic has built on the results of that report and revised these per tonne cost estimates in order to reflect the current state of knowledge in the more recent literature on the economics of climate change. These new estimates are based primarily on the work of renowned climate change economist, Dr. Richard Tol, who himself undertook an extensive review of the literature in the field.[24]

As with the air pollution cost estimates above, low and high damage cost estimates have been provided here to reflect the often significant variability of the greenhouse gas damage cost estimates in the literature (see Table 17-4 below). The substantial gap between the high and low figures reflects different assumptions contained in the studies examined in the literature review. For example, higher end estimates may include the costs of shocks, catastrophic damages, and massive produced and natural capital infrastructure losses, such as occurred in New Orleans during Hurricane Katrina. A complete discussion of the derivation of these damage cost estimates, and of some of the assumptions they include, can be found in GPIAtlantic's 2005 energy report.

As seen in Table 17-4 below, Nova Scotia's energy-related GHG emissions from stationary sources in 2005 can be estimated to produce between $100 million and $600 million in climate change damage costs, depending on whether low or high cost estimates from the literature are used. These cost estimates again exclude GHG emissions from transportation energy use, which are discussed in Chapter 22 of this summary indicator report.

Table 17-4. Nova Scotia stationary energy-related GHG damage cost estimates ($2005), 2005

	LOW	HIGH
Cost estimates (per tonne)	$6.98	$40.67
Emissions (tonnes CO_2 eq.)	14,600,000	14,600,000
Total	**$101,908,000**	**$593,782,000**

Sources: Emissions are from Environment Canada. 2007. National Inventory Report: Greenhouse Gas Sources and Sinks in Canada 1990–2005. Available from http://www.ec.gc.ca/pdb/ghg/inventory_report/2005_report/2005_report_e.pdf. Accessed December 12, 2007; high and low damage cost estimates are from GPI Atlantic.2005. *The Energy Accounts for the Nova Scotia Genuine Progress Index: Update 3, November 2005*. Available from http://www.gpiatlantic.org/pdf/energy/energy.pdf. Accessed January 25, 2008.

Note: High and low damage cost estimates were adjusted to C$2005.

Table 17-5 below shows the aggregate estimated damage costs associated with air pollutant and GHG emissions from Nova Scotia's stationary energy sources (power plants and refineries) in 2005. As indicated, the damages resulting from these 2005 emissions could result in costs ranging from $380 million to $2.6 billion. On a per capita basis, the damage costs associated with the province's stationary energy-related emissions range from $400 to more than $2,700 per Nova Scotian each year. Those costs are currently invisible in conventional accounting mechanisms, and indicate that Nova Scotia does not presently pay the true price for unsustainable energy use.

Table 17-5. Aggregated air pollution and greenhouse gas damage cost estimates attributable to Nova Scotia's stationary energy sector, 2005 (C$2005)

	Low	High
Air Pollutant Damage Costs	$282,589,593	$1,995,015,769
GHG Damage Costs	$101,908,000	$593,782,000
Total	**$384,497,593**	**$2,588,797,769**
Per Capita	**$410.79**	**$2,765.84**

Note to Reader: Please see Section 23.4 for additional references.

HUMAN IMPACT ON THE ENVIRONMENT

18. Energy Use

For the original GPI Atlantic report on energy use, please see the following:

The Energy Accounts for the Nova Scotia Genuine Progress Index (2005)
http://gpiatlantic.org/pdf/energy/energy.pdf

Headline Indicators

1. Total energy demand, by sector and fuel type
2. Per capita energy demand, Canada and provinces
3. Total primary energy production
4. Per capita primary energy production, Canada and provinces
5. Proportion of electricity generated from renewable sources
6. Primary sources of coal for electricity generation

Note: For this chapter, please see the previous chapter, “Energy,” which falls into both the Natural Capital and the Human Impact on the Environment domains.

19. Solid Waste

For the original GPI Atlantic report on solid waste management, please see the following:

The Nova Scotia GPI Solid Waste Resource Accounts (2004)
http://gpiatlantic.org/pdf/solidwaste/solidwaste.pdf

Headline Indicators

1. Solid waste disposed per capita
2. Diversion rate
3. Residential recycling and composting rates
4. Disposal of hazardous and toxic wastes
5. Stewardship agreements with producers

Note to Readers

This chapter reports the most recently available data at time of writing and publication. In December 2008, the Nova Scotia Department of Environment will be releasing new data on disposal and diversion rates and, if time permits, on the overall gross and net costs of waste-resource management in municipalities.

19.1. Introduction

In 1989, the Canadian Council of Ministers of the Environment (CCME), comprising all Canada's provincial, territorial, and federal environment ministers, set a target to halve the amount of solid waste being sent to landfills and incinerators by the year 2000. That same year (1989), Nova Scotia sent 641,375 tonnes of waste—or 726 kg per person—to landfills and incinerators. Nova Scotia, like other jurisdictions, was faced with the challenge of designing and implementing a system that would divert half that solid waste from landfills each year. In 2000, for a six-month period, Nova Scotians succeeded in throwing away half as much waste as they did in 1989—becoming the first and only province in Canada to achieve the 2000 CCME target, and indeed, the first province or state in all North America to divert half its waste from landfills.[1] Since then, Nova Scotians have achieved a diversion rate of between 34% and 46% (see Section 19.3 below).

In 1995—following extensive citizen and expert consultations—the Nova Scotia Department of Environment[2] developed, and in 1996 implemented, a new Solid Waste Resource Management

Strategy—a system that involves recycling, composting, and improved ("second generation") landfills. In 2004, GPI Atlantic reported in its *Nova Scotia GPI Solid Waste Resource Accounts* that, from a full-cost accounting perspective, despite the increased operating and amortized capital costs of the new system in 2000/2001, the new solid waste resource system in the fiscal year 2000/2001 provided a net savings of between $31.2 million and $167.7 million ($2000) when compared to the old system in place in fiscal year 1996/1997.[3] This translates into a savings of $33 to $178 for each Nova Scotian.[4] The new system had more than paid for itself from a full cost–benefit perspective, while producing new jobs and substantial environmental benefits.[5]

In 2004, GPI Atlantic reported that—based on diversion rates (diversion of waste from landfills) and other waste management data—Nova Scotia was a leader both nationally and internationally in waste diversion. Internationally, Nova Scotia had achieved a waste diversion rate that was among the highest in the world, compared to other OECD countries. In addition, GPI Atlantic reported that both recycling and composting—the two major ways in which the province has managed to achieve diversion gains—have become much more accessible and comprehensive since the inception of the Solid Waste Resource Management Strategy.[6] Updates for each of these indicators are provided below.

It should be noted that, based on 1999 OECD estimates, OECD countries represent approximately 18% of the world's population but are responsible for 80% of total global waste generation. Thus, because they are clearly responsible for most of the environmental consequences of excessive waste generation, the OECD countries carry the major burden of responsibility to reduce global waste output.[7]

According to the most recently available OECD data (2008), however, municipal waste generated in the OECD countries has increased since 1980 and exceeded 650 million tonnes in 2006—or 560 kg per capita.[8]

In April 2007, the Nova Scotia government passed the Environmental Goals and Sustainable Prosperity Act—legislation that commits the province to 21 goals, including reducing the amount of waste sent to landfills by a further 37% by 2015. This means that, in order to meet these goals, the 2006/2007 disposal rate of 477 kg per person will have to be reduced to 300 kg per person per year—a further reduction or diversion of 177 kg of waste per Nova Scotian.[9] According to Bob Kenney, solid waste resource analyst with the Department of Environment, the strategy renewal is a "significant step" and will "engage stakeholders to help the Nova ScotiaDepartment of Environment to develop policies" to reach the goal of 300 kg per person per year.[10]

19.2. Solid waste disposed per capita

Data sources: Statistics Canada Waste Management Industry Survey; Nova Scotia Department of Environment.

Result: Since 2001, Nova Scotians have been producing and disposing more garbage per capita. Since 2006, there has been a slight reversal of this upward trend.

The Nova Scotia Department of Environment defines *solid waste* as:

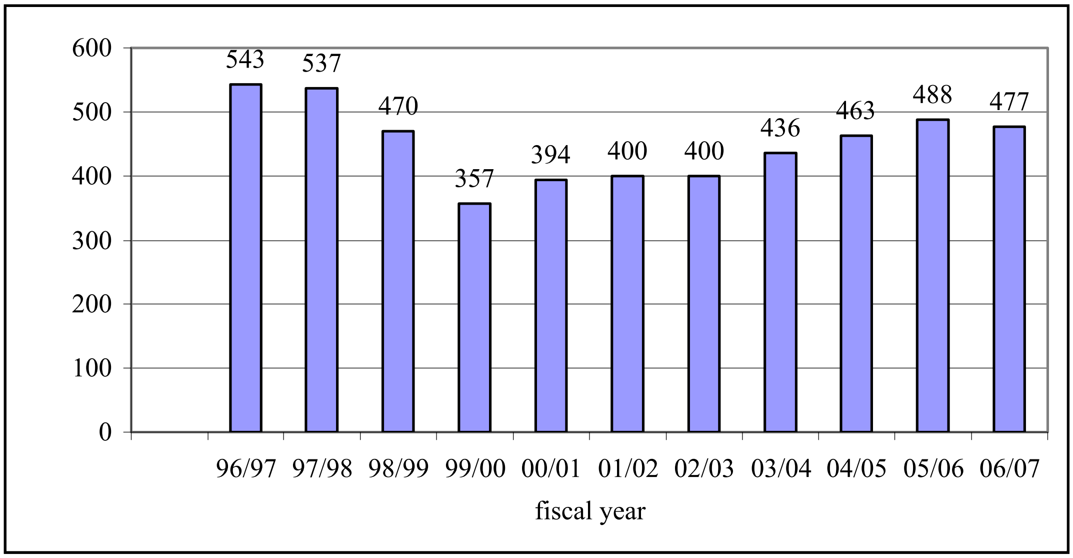
> any material, product, or by-product for which the generator has no further use and which is discarded for management at waste disposal facilities. This definition excludes wastes that are associated with primary resource extraction or harvesting, conventional air pollutants and liquid effluents that may be discharged from processing or manufacturing sites and soil as a result of contaminated sites clean-up programs.[11]

Since 2001, Nova Scotians have been generating and disposing more garbage per capita—and doing so at a faster rate than they are diverting it. This upward trend, which began in fiscal year 1999/2000 reversed somewhat in the 2006/2007 fiscal year, when the per capita annual disposal rate dropped marginally from 488 kg in 2005/2006 to 477 kg in 2006/2007.[12] The upward trend in waste disposal is a disappointing turn of events for the province given its notable earlier achievements: thus, between 1996/1997 and 1999/2000, waste disposal per capita in Nova Scotia decreased by a remarkable 34%—from 543 kg to 357 kg per person—by far the sharpest decline in the country, but it then began to creep steadily back upwards (see Figure 19-1 below).[13]

In an effort to encourage residents to comply with the recycling and composting program, 30 of Nova Scotia's 55 municipalities require residents to use clear bags for their garbage. This move has resulted in a dramatic increase in recycling and composting rates in these municipalities—and a corresponding decline in the amount of waste going to landfill.[14] For example, according to preliminary data from eight of the municipalities that require clear bags, the Nova Scotia Department of Environment reported that the amount of residential waste disposed decreased by 40% between 2004/2005 and 2006/2007, while the quantities of materials recycled and organics composted increased by 35% and 38%, respectively, in these municipalities.[15]

While it is not clear to what extent these exemplary rates of diversion and lower rates of disposal are attributable to the clear bag program in effect in these particular municipalities, the comparative municipal data available may argue for mandatory adoption of the clear bag program in all municipalities as a practical way to improve diversion rates and lower the disposal rates that have been creeping steadily upwards across the province since 1999/2000. Prince Edward Island's mandatory province-wide black cart program may have helped lower that province's waste disposal rate to the lowest in the country.[16]

Figure 19-1. Per capita solid waste disposal (kg per capita per year), Nova Scotia, 1996/1997–2006/2007



Source: Kenney, Bob. Solid Waste Resource Analyst. Nova Scotia Department of Environment. Personal communication, September 2, 2008.

Note: This includes waste disposed in Nova Scotia's municipal solid waste landfills and construction and demolition (C&D) debris landfills.

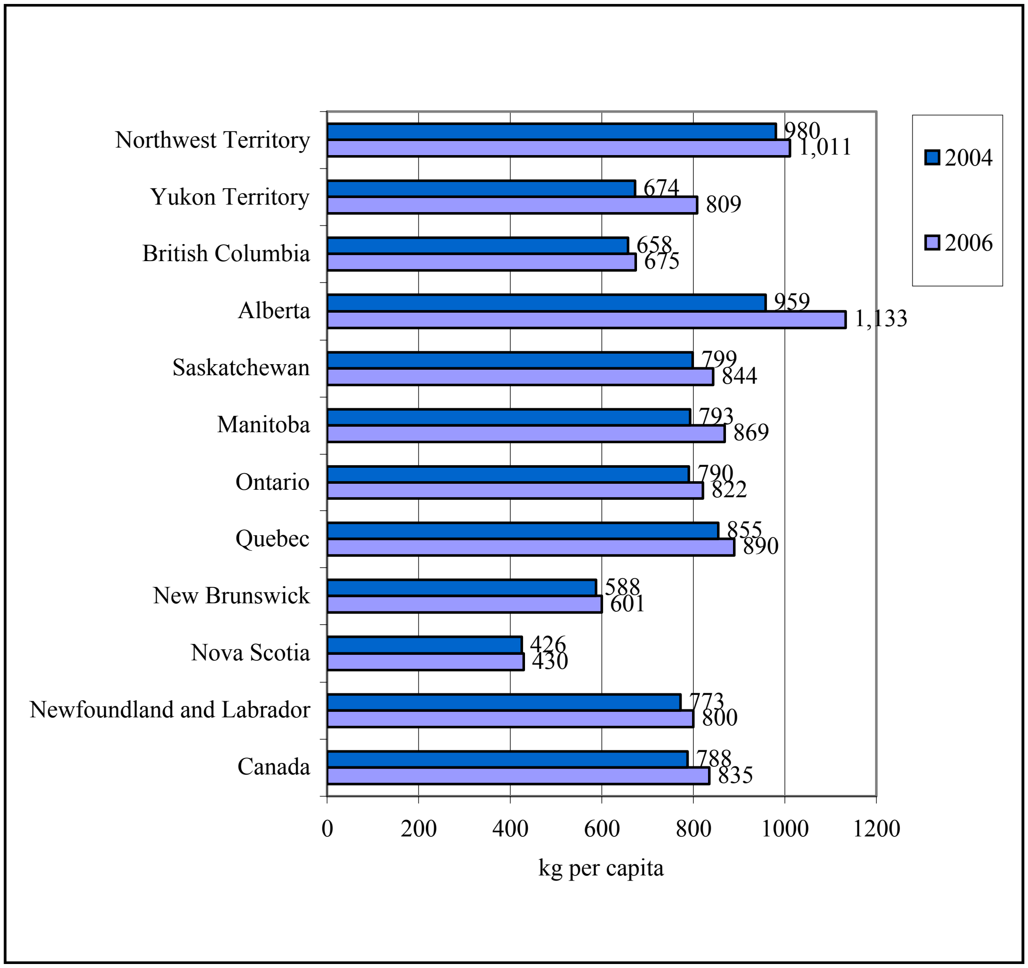
The increase in solid waste disposed per Nova Scotian between 1999 and 2006 could be due in part to higher rates of economic growth and consumption and, therefore, greater waste generation. In 2004, GPI Atlantic found that expenditure-based GDP per capita in Nova Scotia grew steadily between 1996 and 2002, from $25,369 to $32,146 ($2006). Since consumer spending constitutes the largest portion of GDP, this growth signifies increased consumption, which in turn may lead to increased waste generation.[17] An update of this analysis indicates that, between 2003 and 2006, expenditure-based GDP per capita increased further from $32,927 to $34,243 ($2006). In total, this overall increase points to what may amount to a nearly 35% growth in per capita spending on goods and services in a 10-year period.[18]

According to the Nova Scotia Department of Environment, the increase in solid waste disposal is attributable to a number of factors: "Economic growth in the province, changes in consumption patterns, and new products and product designs are all factors contributing to this increase." The department also notes, "improvements in data collection methodologies are also allowing more precise measures of materials not previously captured."[19]

As Figure 19-2 below illustrates, Nova Scotia had by far the lowest amount of waste disposed per capita among the provinces and territories in both 2004 and 2006—about half the national average (though comparable data for Prince Edward Island and Nunavut were unavailable).[20] However, since 2004, there has been an increase in the amount of solid waste disposed per capita in every Canadian province and territory.[21] Alberta, which produced the most solid waste per person in 2006, had the most dramatic absolute increase in that two-year period, from 959 kg to

1,133 kg—an increase of 18%. Nova Scotia had the smallest increase from 426 kg to 430 kg per capita—an increase of just 1%. There was a 6% increase in Canada overall in that time period.

Figure 19-2. Per capita solid waste disposal (kg) for Canada and provinces, 2004 and 2006



Source: 2004 data derived from a survey administered by RECYC-QUEBEC. 2006 data from Statistics Canada's 2006 Waste Management Industry Survey. Both years of data reported by Statistics Canada. Waste Management Industry Survey: Business and Government Sectors, 2006. Environment Accounts and Statistics Division. Table 1-1. Available from http://www.statcan.ca/english/freepub/16F0023XIE/16F0023XIE2006001.pdf. Accessed August 6, 2008.

Notes:

- Data for Prince Edward Island and Nunavut were unavailable.
- Total waste disposed is the amount of non-hazardous waste disposed of in public and private waste disposal facilities. This includes waste that is exported out of the source province or out of the country for disposal in other jurisdictions (as, for example, in the shipment of some Toronto waste to Michigan), but does not include waste that is disposed in hazardous waste disposal facilities.
- Per capita waste disposal statistics for Nova Scotia from Statistics Canada in Figure 19-2 are not entirely comparable to those provided by the Nova Scotia Department of Environment and reported in Figure 19-1 above due to different definitions and data collection methodologies.

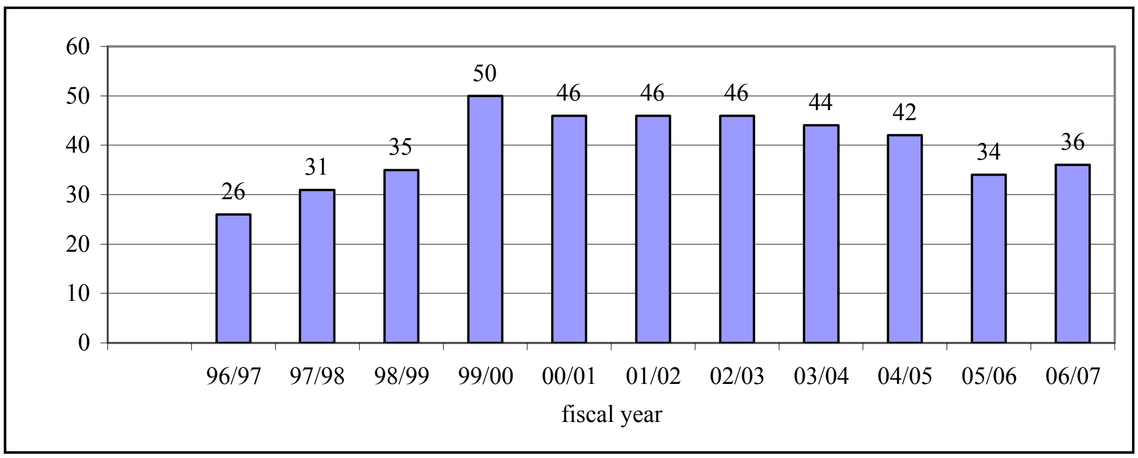
19.3. Diversion rate

Data sources: Statistics Canada Waste Management Industry Survey; Nova Scotia Department of Environment

Result: In 2006/2007, the Nova Scotia waste diversion rate (36%) was well below the 50% peak achieved in 1999/2000, but remained highest among the provinces.

The diversion rate[22] is based on the percentage of total waste generated that is recycled and composted—or diverted from landfills—compared to the amount of waste sent to landfills in 1989. As previously noted, for a six-month period in 2000, Nova Scotians achieved the 50% waste diversion target set in 1989 by the Canadian Council of Ministers of the Environment (CCME) and succeeded in throwing away half as much waste as they did in 1989. This was a dramatic improvement over the 10% diversion rate of the mid-1990s prior to implementation of the province's Solid Waste Resource Management Strategy.[23] Since then, however, Nova Scotia's diversion rate has been decreasing, dropping to 34% in 2005/2006 and increasing to 36% in 2006/2007 (Figure 19-3 below).[24]

Figure 19-3. Diversion rate of solid waste (%), Nova Scotia, 1996/1997 to 2006/2007



Source: Kenney, Bob. Solid Waste Resource Analyst. Nova Scotia Department of Environment. Personal communication, September 2, 2008.

According to the Nova Scotia Department of Environment, the decline in waste diversion seen in Figure 19-3 above is due primarily to an increase in the amount of waste being disposed, which according to GPI analysis is, in turn, due to rising GDP and consumption (see Section 19.2 above). In addition, early gains in waste diversion are likely to be larger than later gains, as materials become increasingly difficult to recycle.[25] For example, it may be easier to increase diversion from 0% to 30% through composting and through recycling of basic materials, like newsprint, glass, aluminium, and tires, than to increase diversion from 50% to 60% as recycling options diminish.

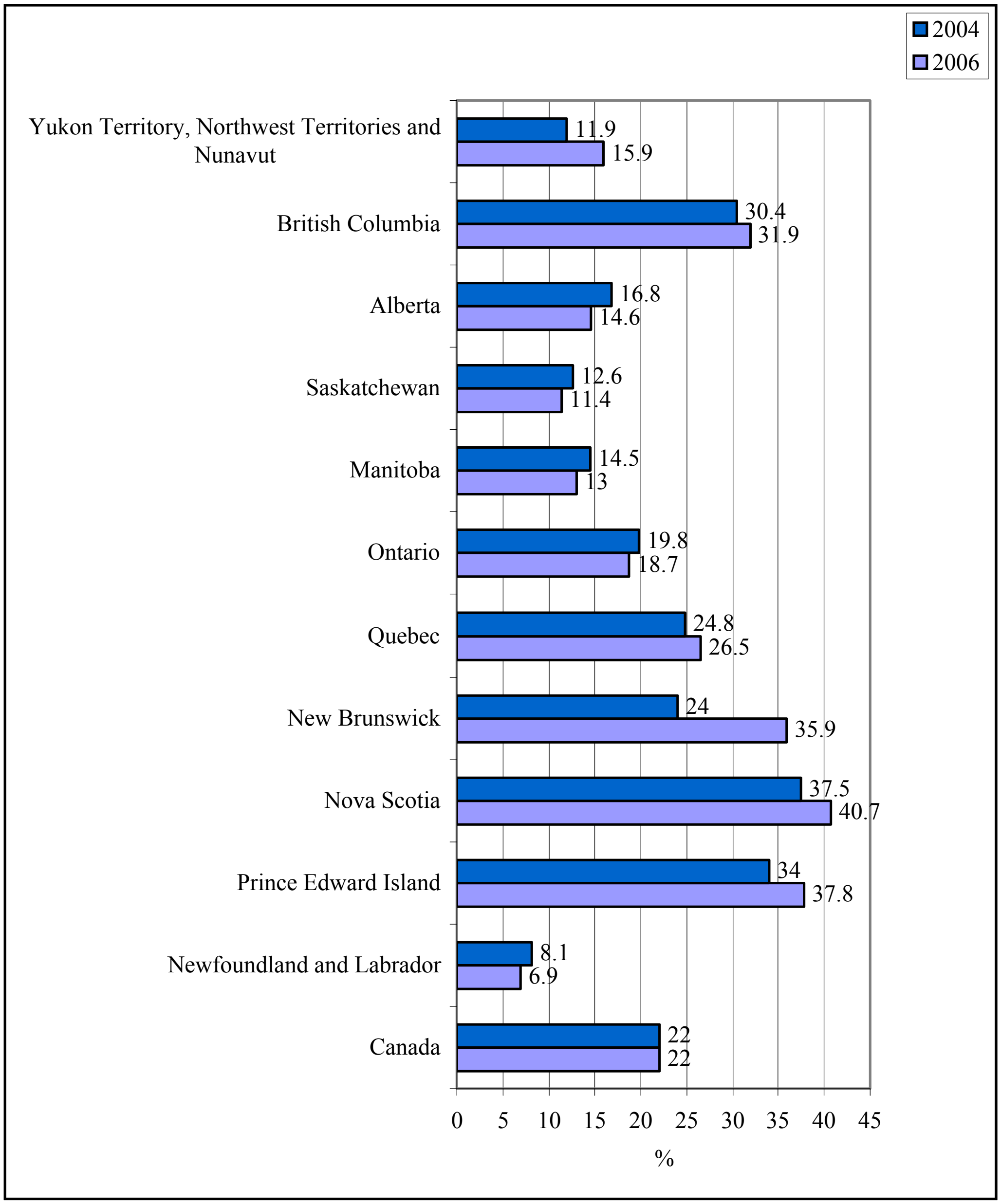
In assessing comparative diversion rates, it is also important to distinguish relative from absolute gains in and levels of diversion, since the 1989 base year used for assessing diversion rates determines subsequent diversion rates. For example, it was noted in GPI Atlantic's 2004 solid waste report that, on a *relative* basis, Halifax Regional Municipality (HRM) had the highest diversion rate in the province in 2001 in relation to 1989 levels. However, the Annapolis Valley actually disposed of less waste per capita on an *absolute* basis in 2001.

In fact, many regions at that time argued that HRM's apparent success in achieving such a high diversion rate over 1989 levels is partly due to its high level of waste disposal in 1989. For example, to meet its 50% diversion target over 1989 levels, HRM was required to reduce waste disposal per capita to 0.42 tonnes per capita. In contrast, the western region (Annapolis Valley), which had the lowest waste disposal level in 1989, had to reduce waste disposal to 0.28 tonnes per capita to attain 50% waste diversion. In other words, the use of 1989 benchmarks to assess comparative diversion rates may create a skewed picture of actual levels of current success, as each region's benchmark is different.[26]

In addition, accurate comparison of diversion rates is rendered even more challenging by differences in the materials diverted. According to Bob Kenney, Solid Waste Resource Analyst at the Nova Scotia Department of Environment, diversion rates in other jurisdictions can include scrap metal from established industries, biosolids not composted in composting systems and / or never landfilled, leaf and yard waste from parks and recreation departments, and organic materials from industrial sources that have never been disposed in municipal solid waste landfills (e.g., pulp and paper waste)—all of which can significantly inflate diversion rates. "In addition," Kenney notes, "wealthy communities can show higher diversion rates simply because they consume more."[27]

For all these reasons, Kenney recommends that the disposal rates be used over diversion rates to assess progress in solid waste resource management, because they are "a good leveller." He further recommends that if diversion rates are reported, as they are in Figure 19-4 below, they should be accompanied by an explanation of these challenges and caveats. Kenney notes that, even though disposal rates are by no means a perfect measure, Statistics Canada, Nova Scotia, and Alberta believe that they are the most appropriate means of measuring performance and resource efficiency in solid waste resource management.[28]

Figure 19-4. Waste diversion rate by province and territory, Canada, 2004 and 2006



Source: 2004 data derived from a survey administered by RECYC-QUEBEC. 2006 data from Statistics Canada's 2006 Waste Management Industry Survey. Both years of data reported by Statistics Canada. Waste Management Industry Survey: Business and Government Sectors, 2006. Environment Accounts and Statistics Division. Table 2. Available from http://www.statcan.ca/english/freepub/16F0023XIE/16F0023XIE2006001.pdf. Accessed August 6, 2008.

Note: Per capita waste disposal statistics for Nova Scotia from Statistics Canada in Figure 19-4 are not completely comparable to those provided by the Nova Scotia Department of Environment and reported in Figure 19-3 above due to different definitions and data collection methodologies.[29]

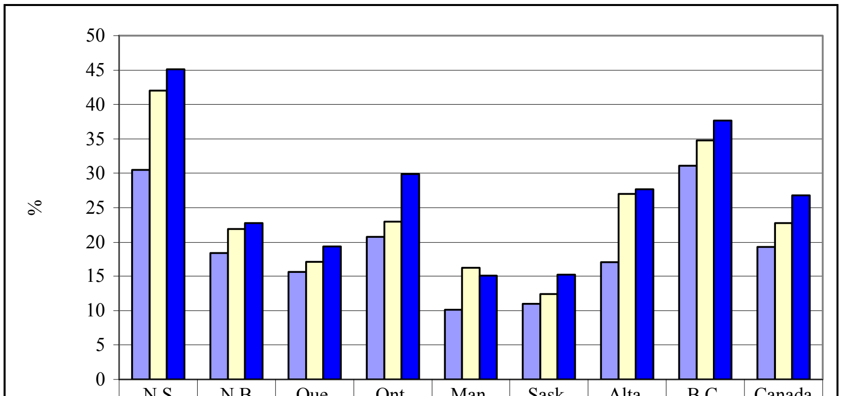
19.4. Residential recycling and composting rates

Data source: Statistics Canada, Environment Accounts and Statistics Division, Households and the Environment Survey.

Result: Residential recycling and composting rates in Nova Scotia have increased since 2001, and Nova Scotia continues to boast the highest rates among those provinces reporting.

The residential recycling rate refers to the amount of residential waste recycled and composted as a proportion of waste generated.[30] In 2004, Nova Scotians recycled 157 kg of residential waste per capita—almost double the 80 kg per capita recycled in 2000. Canadians recycled 112 kg per capita in 2004 and 71 kg per capita in 2000. The recycling rate in Nova Scotia rose from 30.5% in 2000 to 45.1% in 2004—the highest rate reported in the country—compared to the Canadian rate of 19.3% in 2000 and 26.8% in 2004 (Figure 19-5 below).

Figure 19-5. Residential recycling rate, Canada and provinces, 2000-2004



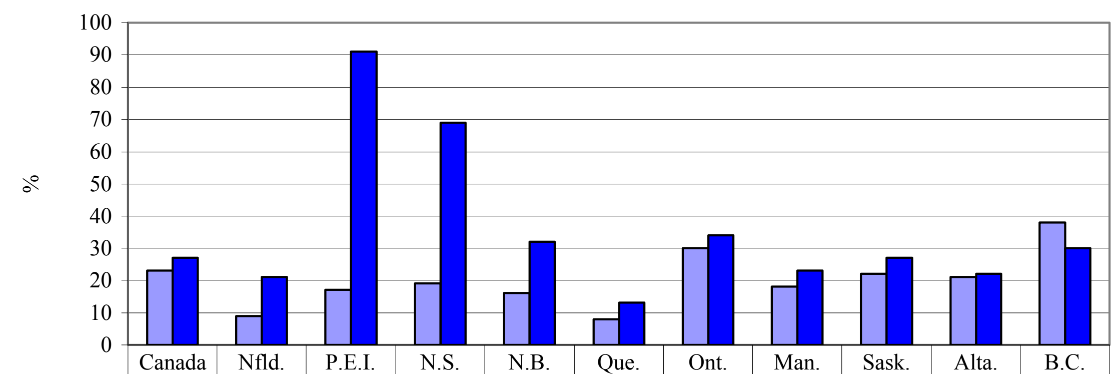
	N.S	N.B	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Canada
2000	30.5	18.4	15.6	20.8	10.1	11	17	31.1	19.3
2002	42	21.9	17.1	23	16.2	12.4	27	34.8	22.8
2004	45.1	22.8	19.4	29.9	15.1	15.2	27.7	37.7	26.8

Source: Statistics Canada. 2007. Envirostats. Volume 1, no. 1. Catalogue no. 16002-XIE. Available from http://www.statcan.ca/english/freepub/16-002-XIE/2007001/article/10174-en.htm. Accessed August 18, 2008.

Note: Data were unavailable for Prince Edward Island and Newfoundland and Labrador. The Prince Edward Island rate is thought to be as high as or higher than Nova Scotia's, but the province does not report its rates for "competitiveness" reasons, due to the fact that only one company handles all the waste in PEI.

In 1998, the Nova Scotia Department of Environment banned compostable organic material from landfills—and remains the only jurisdiction in North America to have done so. Doing so reduces greenhouse gas (GHG) emissions resulting from methane gas and protects surface and groundwater from leachate contamination.[31] The ban is also key to the province's high rates of composting and waste diversion. In 2006, 69% of Nova Scotia residents composted, well over double the 27% Canadian average, and surpassed only by the 91% rate in Prince Edward Island (Figure 19-6 below).[32]

Figure 19-6. Percent of residents that compost, Canada and provinces, 1994 and 2006



	Canada	Nfld.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
1994	23	9	17	19	16	8	30	18	22	21	38
2006	27	21	91	69	32	13	34	23	27	22	30

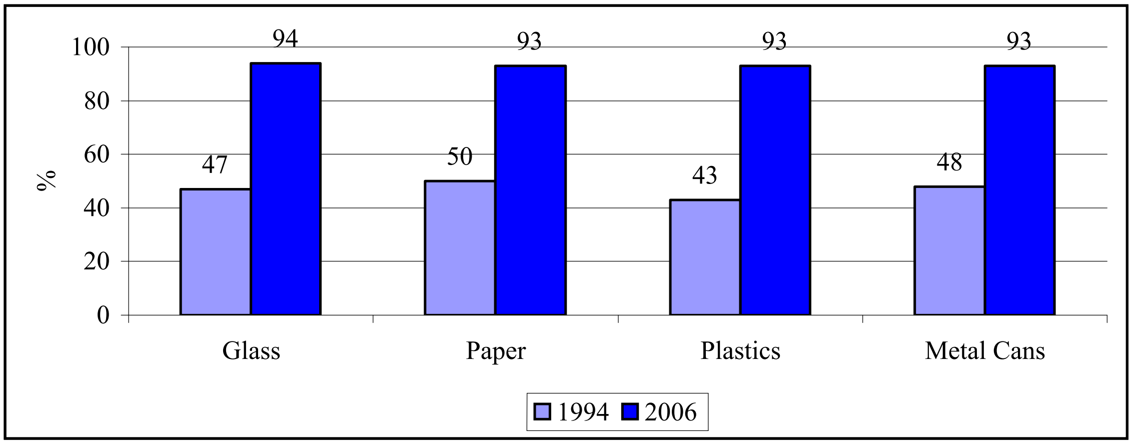
Source: Statistics Canada. 2007. Envirostats. Volume 1, no. 1. Catalogue no. 16002-XIE. Available from http://www.statcan.ca/english/freepub/16-002-XIE/2007001/article/10174-en.htm. Accessed August 18, 2008.

The composting rates in Figure 19-6 above refer only to backyard and curbside pickup of organics and do not include those residents who compost in their own backyards—for which participation rates and quantities processed are unknown. However, all Nova Scotia municipalities also promote backyard composting, particularly for leaf and yard waste. Indeed, from a GPI full-cost account perspective, backyard composting is preferable to curbside collection of compost, due both to direct savings in avoided curbside collection costs and indirect benefits including decreased transportation and energy costs, reduced transport-related GHG emissions and road maintenance costs, and the substitution of nutrient-rich compost for fossil fuel-based garden fertilizers that are a cause of water pollution.

The most extensive backyard composting study in Nova Scotia took place in Bedford in 1995 and found that backyard composting education and promotion were cost-effective and led to a significant decrease in the amount of organic materials entering the municipal organics pick-up stream.[33]

Access to curbside recycling has increased significantly since 1987, when no Nova Scotians had access to a curbside recycling program.[34] Figure 19-7 below illustrates how household access to glass, paper, plastics, and metal-can recycling has improved sharply in Nova Scotia since 1994—virtually doubling.

Figure 19-7. Percent of households that had access to glass, paper, plastics, and metal-can recycling programs, Nova Scotia, 1994 and 2006

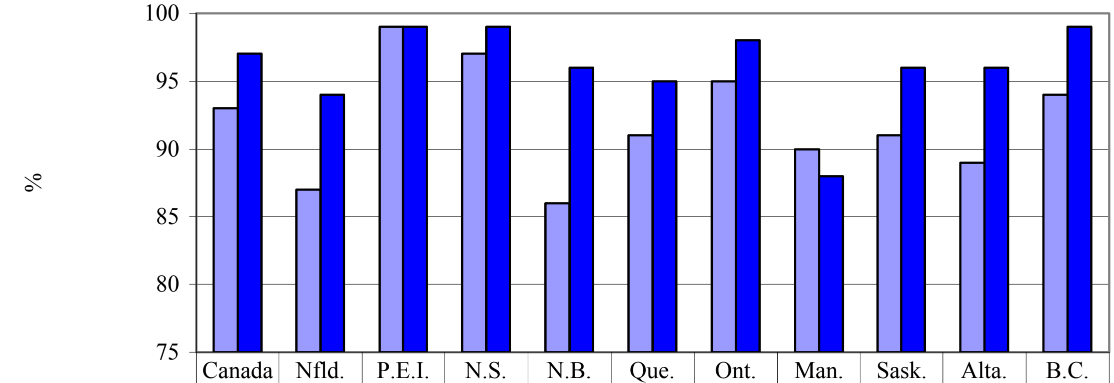


Source: Statistics Canada. 2007. Envirostats. Volume 1, no. 1. Catalogue no. 16002-XIE. Available from http://www.statcan.ca/english/freepub/16-002-XIE/2007001/article/10174-en.htm. Accessed August 18, 2008.

Figure 19-8 below indicates comparative recycling access and use rates in Canada and the provinces. In 2006, 97% of Nova Scotia households had access to a recycling program, and nearly 100% of those with access used the program.[35] In addition, in 2006, 90% of Nova Scotia residents had access to the curbside collection of organic materials, including food waste.[36]

It should be noted that simple access to recycling and composting—while vitally important as a *condition* for effective recycling—does not say much by itself about whether a program is working or not, or what and how much is actually being recycled. Thus, access measures should always be accompanied by actual recycling and composting rate information, as we have attempted to do in this chapter.

Figure 19-8. Percent of residents that had access to and used recycling programs, Canada and provinces, 2006



	Canada	Nfld.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Access (%)	93	87	99	97	86	91	95	90	91	89	94
Used (%)	97	94	99	99	96	95	98	88	96	96	99

Source: Statistics Canada. 2007. Envirostats. Volume 1, no. 1. Catalogue no. 16002-XIE. Available from http://www.statcan.ca/english/freepub/16-002-XIE/2007001/article/10174-en.htm. Accessed August 18, 2008.

Note: The second column represents the percentage of those with access who used the services.

19.5. Hazardous and toxic wastes

Data source: Nova Scotia Department of Environment.

Result: Due to lack of a tracking system—thus, the absence of any raw data—it is not possible to evaluate progress on the disposal of household hazardous waste.

Household hazardous waste (HHW) is any waste material generated in homes that poses a risk to health, safety, or the environment. It includes flammable or combustible products such paint and solvents; reactive products such as pool chemicals; corrosive products such as cleaners; toxic products such as pesticides; products with heavy metals in them; and pharmaceuticals.[37]

While HHW represents a small portion of the waste stream in absolute terms,[38] it poses a serious potential threat both to human health and to the health of the environment. In 2004, GPI Atlantic reported that, at that time, a tracking system had not yet been put in place, and therefore, there were no available data in 2004 to evaluate progress on HHW disposal. It was a strong recommendation of the 2004 GPI solid waste report that such a tracking system be instituted without delay.

According to Bob Kenney, the Nova Scotia Department of Environment's Solid Waste Resource Analyst, the department has since asked municipalities to report voluntarily on quantities of HHW collected and managed through its solid waste data collection system. Kenney notes: "The Department has identified HHW as a waste resource management priority and will be exploring HHW management strategies in 2008/2009. A more robust system of tracking HHW disposal will be considered as part of this plan."[39]

According to Alanna McPhee of the Resource Recovery Fund Board (RRFB), the RRFB provides funding of up to $16,000 a year to each of the seven waste management regions in the province to assist them in disposing of HHW. Throughout the year, municipalities within each region receive HHW from residents at either permanent or mobile facilities. At the end of each fiscal year, regions compile reports outlining their total costs for HHW, including a breakdown of the types of waste they handled. The RRFB then pays them based on a schedule of fees.[40]

One area in which there has been definite improvement in terms of HHW management is in the disposal of metals like lead, mercury, and cadmium that are used in the circuitry of computers and televisions. These metals can be an environmental hazard in landfills and—if they decompose over a long period of time—can leak into groundwater and contaminate water supplies. As of February 1, 2008, new provincial regulations banned four categories of electronic products from landfill disposal: televisions, computers, monitors, and printers. As of February 1, 2009, telecommunications and audio–video equipment such as computer scanners, telephones and fax machines, and cell phones and other wireless devices, will also be banned from landfill disposal.[41]

It is estimated that more than 4,500 tonnes of electronic product waste are generated in Nova Scotia annually. The new regulations will divert much of this waste from landfills through creation of a new province-wide electronic waste collection and recycling program that will recycle the waste into new products. Industry, through the Atlantic Canada Electronics Stewardship (ACES) agreement, is responsible for the development and implementation of the program, which will be administered by the RRFB.[42]

In 1995, the Solid Waste Resource Management Strategy predicted that stewardship programs for waste paint and used oil alone would result in a 60% to 70% diversion of HHW entering the municipal solid waste stream.[43] Since the province now has such stewardship programs in place for both waste paint and used oil, it is possible to surmise—even in the absence of a tracking system—that there is currently HHW diversion at least of this magnitude.

GPI Atlantic again recommends that a full-fledged tracking system be put in place to monitor HHW management regularly and consistently, and that all remaining industries producing HHW products that have not yet done so sign stewardship agreements either to eliminate toxic materials from their products or to ensure that they are safely and properly collected and recycled or disposed.

19.6. Stewardship agreements with producers

Data source: Nova Scotia Department of Environment.

Result: There has been one new stewardship agreement (for electronic waste) put in place since the last GPI solid waste study (2004).

The goal of product stewardship programs is to shift the financial or physical burden or responsibility for dealing with product waste from the municipal taxpayers to the producer of the product. Stewardship agreements should reflect the full cost of managing the materials. Needless to say, higher industry contributions to the costs of managing the wastes they produce will be passed on to consumers in the form of higher prices, thereby, in turn, encouraging more environmentally benign consumption choices and product designs that require less costly waste management, and ultimately less waste.

Certain items that are banned from landfill disposal, such as beverage containers, waste paint, used tires, and electronic products, are already managed through existing stewardship programs administered by the Resource Recovery Fund Board (RRFB). In 1995, the RRFB was charged, among other responsibilities, with the mandate to develop and implement industry stewardship programs. While there has been modest success in this area, its full potential has yet to be realized.

Since the Solid Waste Resource Management Strategy was released in the mid-1990s, voluntary product stewardship agreements have been formed with several industries to manage product waste like dairy packaging, newsprint, residential syringes, and telephone directories. According to the Nova Scotia Department of Environment, these industries contribute to the management of their product wastes through either direct funding or in-kind support. For example, as reported by GPI Atlantic in 2004, the Atlantic Dairy Council has an agreement with the province to pay municipalities the full cost of collecting, processing, and recycling milk packaging. The agreement, in place since 2000, also requires milk packaging companies to provide advertising for curbside recycling programs on milk cartons.

The Sharps Stewardship Agreement between the Nova Scotia Department of Environment, the Pharmacy Association of Nova Scotia, and the Canadian Diabetes Association, provides for the safe management of residentially generated syringes, lancets, and pen needles. Members of the Pharmacy Association of Nova Scotia provide containers in which residents may safely dispose of the sharps, and will accept these filled containers for recycling. In addition to milk cartons and sharps, it was reported in 2004 that stewardship programs also existed for beverage containers, tire recycling, paint, pharmaceuticals, used oil, and batteries.

In 2007, the province introduced regulations requiring “brand owner” to set up a collection, transportation, reuse, and recycling program for certain electronic products. RRFB was hired by the Atlantic Canadian Electronics Stewardship (ACES) to oversee the program's implementation. The two-phased program was launched in February 2008. According to the DOE, "Nova Scotians generate an estimated 4,500 tonnes of electronic waste every year—the equivalent of about 9,800 moose."[44]

As previously noted, in April 2007, the Nova Scotia government passed the Environmental Goals and Sustainable Prosperity Act—legislation that commits the province to 21 goals, including reducing the amount of waste sent to landfills by a further 37% by 2015. This means that, in order to meet these goals, the 2006/2007 disposal rate of 477 kg per person will have to be reduced to 300 kg per person per year—a further reduction or diversion of 177 kg of waste per Nova Scotian. According to the act, in order to achieve this goal, new programs and new stewardship regulations need to be developed, which shift the responsibility for managing end of life products from the taxpayer to the consumer and / or the producer of that product.[45]

To this end, in 2008, the DOE and the municipalities created the Nova Scotia Product Stewardship Working Group (NSPSWG) to address the issue of packaging. The committee developed a list of 59 "end of life" items with stewardship potential. Subsequently, the NSPSWG created a shortlist or "top 20 list" of products to get out of the waste system. These are:[46]

1. Herbicides, fungicides, and pesticides and containers
2. Asphalt shingles
3. Creosote wood, pressure-treated wood
4. Items containing mercury (fluorescent lighting, thermometers, barometers, thermostats, irons, button batteries)
5. Carpet and underlay
6. Disposable diapers[47]
7. Pressurized gas containers
8. Disposable cups
9. Flammables and containers
10. Plastic shopping bags
11. Mattresses
12. Plastic containers numbered 3 to 7 (non-beverage)
13. Rechargeable batteries
14. Clothing and footwear
15. Tires not included in current program
16. Empty HHW containers
17. Other plastic packaging
18. Non-rechargeable batteries
19. Upholstered furniture
20. Vinyl siding and plastic shingles (PVC)

20. Ecological Footprint

For the original GPI Atlantic reports on the Ecological Footprint, please see the following:

The Nova Scotia Ecological Footprint (2001)
http://gpiatlantic.org/pdf/ecofoot/ns-ecofoot.pdf

The Prince Edward Island Ecological Footprint (2003)
http://gpiatlantic.org/pdf/ecofoot/pei-ecofoot.pdf

Headline Indicators

1. Ecological Footprint for Canada

20.1. What is an Ecological Footprint?

A "sustainable" society ensures the social, environmental, and economic wellbeing of all people without compromising the wellbeing of future generations. A tool known as Ecological Footprint analysis, developed by researchers at the University of British Columbia, enables us to assess progress toward sustainability by measuring the impact of human activities on the environment according to how much land it takes to produce the resources necessary to sustain those activities and to absorb the wastes produced by those activities.

In 2001, GPI Atlantic produced *The Nova Scotia Ecological Footprint*, the first provincial Footprint analysis attempted in Canada. It assessed how much biologically productive area Nova Scotians needed and utilized to maintain their current lifestyles. The results provided a crude but graphic benchmark of how unsustainable current Nova Scotian lifestyles are, and identified the challenges Nova Scotians faced to reduce their Ecological Footprint and their impact on the environment.

Unlike measures of progress based on the GDP and related economic growth statistics in which more production and consumption are always assumed to be better, a smaller Ecological Footprint indicates progress towards sustainability and thus is considered a sign of progress in the Genuine Progress Index (GPI). In other words, the smaller an individual's, household's, or society's Ecological Footprint, the less they are depleting the earth's limited resources and degrading the natural environment, and the healthier the natural legacy and wealth we leave to our children.

The Ecological Footprint concept is based on the simple maxim that all human activities depend on nature, which is the basis of all life support functions. Nature provides the air we breathe, our food and water, the energy we need for heat, light, transportation and to operate our machines, and the materials we use to build our houses and to make our clothes, computers, cars, paper products, and every other object that cycles through the economy. Nature also acts as the dump for our waste products. The carbon dioxide, acid gases, and particulate matter that our cars emit; the phosphates from our detergents and fertilizers; the synthetic chemicals found in plastics, paints, and other artificial products; and the garbage we put out on the curb each week all end up in our environment.

Human beings have an impact on the earth simply because they consume nature's products and services. Our personal Ecological Footprint, therefore, corresponds to the amount and type of nature's resources an individual uses or occupies in order to live. This need not be of concern as long as the human load remains within the "carrying capacity" of nature. "Carrying capacity" refers to the ability of the natural world to support human activity, absorb waste, and renew itself without depleting natural resource stocks. The sustainability challenge, in short, is to attain a high quality of life for all while ensuring that resource consumption and waste generation remain within the carrying capacity of nature.

But are Canadians and Nova Scotians currently living in such a way? Ecological Footprint analysis was designed to answer this question by determining the extent of human impact on nature and whether this impact can be sustained into the future. It shows how much productive land and water a given population requires to produce the resources it consumes and to absorb the wastes it creates. The Ecological Footprint therefore becomes a benchmark for measuring the "bottom line" of sustainability—human activity in relation to nature's carrying capacity. A Footprint that corresponds with the capacity of nature to renew itself, to continue providing a flow of goods and services into the future, and to assimilate wastes without overloading the environment is an essential precondition for securing the wellbeing of present and future generations.

One particular power of Ecological Footprint analysis is that it explicitly links environmental sustainability and social justice, not as a matter of ethics, advocacy, or ideology, but as a simple matter of empirical description. If wealthy nations and wealthy individuals consume more resources and produce more waste and greenhouse gas emissions than less affluent nations and individuals, then their impact on the environment is also proportionately greater. In a world of limited resources and limited waste assimilation capacity, excess consumption by the rich literally requires that others live in poverty if we are not, in aggregate, to exceed the earth's physical carrying capacity. Conversely, improved living standards and a reduction in poverty for those currently suffering deprivation and living in straitened circumstances also require that excess consumption be curbed if nature's aggregate carrying capacity is not to be exceeded. In sum, Ecological Footprint analysis cuts through the illusion that we can improve the living standards of the poor without also examining closely the consumption patterns of the rich, and it thus inevitably supports greater equity among the earth's inhabitants.

Most measures of sustainable development subtly place responsibility for greater sustainability on producers. While essential to assess the "supply" side of the sustainability equation, natural resource accounts for forests, fisheries, soils, and agriculture, for example, inevitably focus on whether current harvesting practices are sustainable, thus subtly placing the onus of responsibility for sustainability on those who carry out those activities—the loggers, fishermen, and farmers. Ecological Footprint analysis, by contrast, assesses the “demand” side of the sustainability equation, and thus, shifts responsibility to consumers by assessing the impact of consumption patterns on the natural world. The Ecological Footprint perspective therefore cuts through the tendency to blame farmers, loggers, fishermen, and businesses alone for the depletion and degradation of natural resource stocks, and places greater responsibility on the demand that consumers generate, which producers aim to fulfill. The critical importance of this component of the GPI, therefore, is that it clarifies that the sustainability challenge is the shared collective responsibility of all Nova Scotians and Canadians.

Ecological Footprint calculations are based on two simple facts and measurable / quantifiable realities: first, most of the resources consumed by a population, and the wastes that are generated by that population, can be accounted for. Second, this resource consumption and waste generation can be converted into the biologically productive area necessary to sustain these functions. The Ecological Footprint of any defined population (a single person, household, province, or country) is the biologically productive area required to:

- produce the food, wood, energy and other resources that humans consume
- provide room for infrastructure such as buildings and roads
- absorb the wastes, carbon dioxide, and other pollutants that result from human activity

To provide results in comparable units of measure, all components of the earth’s productive area are adjusted for their biological productivities. This means that land with higher than average productivity appears larger in Footprint accounts in terms of the level of human activity it can support than resource-poor land. Since the resources we consume come from all corners of the planet and the wastes we generate, like greenhouse gas emissions, affect distant places, Ecological Footprint analysis considers the sum of all our ecological impacts no matter where they occur on the planet. For example, if Nova Scotians eat bananas from Guatemala and use wood from the Amazon rain forest, the land area required to produce these commodities consumed in Nova Scotia—regardless of where they are produced—is counted as part of the Nova Scotia Footprint.[1]

It is important to note that current Ecological Footprint estimates err on the conservative side. Low-end figures have been consistently used whenever available data indicate a likely range of estimates; areas set aside for the protection and treatment of water resources are not included in Ecological Footprint estimates, and areas required for the absorption of wastes, pollutants, and toxic materials other than carbon dioxide have been omitted due to methodological and data limitations. In addition, the Footprint analysis takes no account of the probability that chemical pesticide and fertilizer use, soil compaction, clearcutting, and other unsustainable harvesting practices will reduce future soil productivity. These assumptions render current Footprint analyses highly conservative.

However, possibly the most conservative assumption in current Footprint calculations is that they provide no allocation of biocapacity to other species, but rather assume that all the earth’s biocapacity is available for a single species alone. Since we share the planet with over ten million other species, it is clearly not possible to use the entire bioproductive ecological space of the planet solely for human consumption. Indeed, it is doubtful that the human species itself could survive if it used all productive resources for its own needs at the expense of all other species.

For this reason, and to conserve biological diversity on the planet, the United Nations Commission on Environment and Development recommended in the 1987 Brundtland Report that protected areas worldwide be at least tripled in order to conserve the earth's ecosystems adequately.[2] In accord with this Brundtland Commission target, the World Wildlife Fund (WWF) Canada subsequently launched the Endangered Spaces Campaign to preserve Canada's representative ecosystems through the protection of at least 12% of the country's landmass. The WWF goal of preserving all Canada's designated landscape and habitat types in a comprehensive network of protected areas was endorsed in the Tri-Council Statement of Commitment to Complete Canada's Networks of Protected Areas, which was signed by all federal, provincial, and territorial governments in 1992.[3]

Significant progress has been made towards these targets in the last decade, with over 17.1 million square kilometres of land now protected globally, covering approximately 11.5 percent of the terrestrial earth. [4] While Canada still falls short of the WWF goal, Canada now protects about 8% of its land compared to 3% in 1989, and Nova Scotia has recently increased the proportion of its total landmass under protection from 8.1% in 2001 to 8.5% in 2007.[5] However, the province still adheres to the 12% target, with the 2007 Environmental Goals and Sustainable Prosperity Act specifically stating in Section 4 (2) that "twelve per cent of the total land mass of the province will be legally protected by the year 2015."[6]

This protected areas set-aside has major implications for Footprint calculations. If we set aside 12% of ecologically productive land for biodiversity preservation, the globally available supply of bioproductive area or biocapacity would shrink from the 2.1 global hectares (gha) per person currently assumed to be available.[7] While this protected land functions as a more effective carbon sink than if it were developed, it is unavailable for human resource consumption. And yet, current Footprint calculations by the Global Footprint Network contain no such consumption-related exclusions, rendering Footprint estimates even more conservative than indicated by the caveats listed above.

However, even such a 12% exclusion from human resource consumption might be regarded as minimalist and overly conservative in light of dramatically high ongoing rates of species extinction. Many conservation biologists recommend a minimum essential set-aside of 30% for biodiversity preservation, and have argued that the 12% set-aside based on the Brundtland Commission report, actually minimizes the ecological scarcity documented by scientists, is simply what is currently deemed *politically* feasible based on international agreements, and is "not scientifically defensible."[8] The actual biodiversity preservation required for the longer term self-preservation of the human species and to slow the current extreme rate of species extinction will likely require considerably greater land protection.

For example, Kenton Miller and Jeff McNeely—two senior International Union for Conservation of Nature (IUCN) scientists whose opinions were cited as the source for the recommendation to triple existing protected areas in the Brundtland Report—have acknowledged that these targets were chosen because they represented a dramatic increase in the minimal protected area coverage existing at that time, and that higher targets would have been politically unacceptable and be dismissed as being "unrealistic." At the same time, a specific target was required at the time to avoid criticism of being too vague and general. In short, the 12% target was determined largely for political rather than biological reasons, and is regarded by conservation biologists as inadequate to represent and preserve ecosystems and maintain viable populations of species.[9,10]

The reason this issue is so highly relevant to Footprint calculations is that failure to protect and set aside adequate bioproductive land and water that is off limits to human consumption will ultimately reduce global bioproductive capacity by rendering each available hectare less productive. The most dramatic example of this reality is in the oceans, where, as reported in the scientific journal *Nature*, big fish stocks (like tuna, swordfish, marlin, cod, halibut, and flounder) have fallen by 90% since 1950 due to industrialized fishing.[11] In Footprint language, each global hectare of ocean is considerably less productive than it was half a century ago.

Incorporating a set-aside into Footprint calculations is complex, particularly because the carbon absorption capacity of land and water is not diminished by its protection from human development and use. On the contrary, that function is likely to be enhanced by its protection. Thus, it would be necessary in any Footprint adjustment for biodiversity protection to balance the reduction in bioproductive availability for human consumption purposes against the potentially enhanced capacity of that productive area to absorb and store human wastes like greenhouse gas emissions.

When GPI Atlantic in 1999 embarked on the task of estimating Nova Scotia's Ecological Footprint, the Global Footprint Network—with its mandate to ensure the highest standards in Footprint calculations and reporting—did not yet exist. The idea and potential feasibility of assessing humankind's Ecological Footprint was first conceived in 1990 by Mathis Wackernagel and William Rees at The University of British Columbia, but it was only in 2003 that Wackernagel created the Global Footprint Network (GFN) to establish a consistent, rigorous, and comparable methodology for calculating Footprints, and a straightforward and non-misleading manner for reporting results.

GFN now produces annual National Accounts that ensure that the Footprints of different nations are calculated, presented, and reported comparably, and in June 2006, GFN launched the first *Ecological Footprint Standards*, which govern the way in which Footprints are now calculated.[12] As a member and partner in GFN, and in recognition of the vital importance of this key indicator to assess sustainability, GPI Atlantic is fully committed to this ongoing effort to deepen and further strengthen Footprint estimations and analysis.

Given the development of these new and more rigorous methodologies, GPI Atlantic is not presently able to update its 2001 *Nova Scotia Ecological Footprint* report, which did not have the benefit at the time of this more recent, advanced, and now standardized methodology, but relied instead on older and less robust methodologies that were then in the process of development but have since been superseded by more rigorous methods.

Every two years, the World Wildlife Fund (WWF), in collaboration with GFN and the Zoological Society of London, publishes the *Living Planet Report*, which provides a breakdown of data and Footprint components for 200 nations, including Canada. The 2008 edition of the *Living Planet Report* provides 2005 data. As well, GFN kindly made available to GPI Atlantic (as a partner and member organization) the full set of National Footprint Accounts for Canada, with all their component breakdowns. However, despite the ongoing sub-national and provincial Footprint work that is in process, there are no provincial Footprint data currently available for our uses here.

According to GFN:

> National Footprint analyses are the most accurate of all Ecological Footprint assessments because complete trade statistics are available at the national level, and because national analysis does not require data on consumer behaviour or final use of resources within the country; all that is required is data on aggregate final demand.[13]

Therefore, in this update, GPI Atlantic reports the 2005 Canadian Footprint data by component, based on the *Living Planet Report* and GFN National Accounts. Using these national data as a temporary placeholder in the Nova Scotia GPI until reliable and rigorous province-specific estimates can be developed for Nova Scotia, this chapter will then explore some of factors specific to Nova Scotia that are likely to influence the magnitude of its Ecological Footprint by comparison with the national statistics presented here.

The most important sub-national Canadian Footprint work currently under way is that being conducted by the City of Calgary in collaboration with GFN (see Figure 20-5 below). GPI Atlantic remains in close touch with this work and its architects in the hope that the Calgary initiative will lead to the development of comparable provincial and sub-provincial Footprint estimates that reveal how particular lifestyles, behaviours, consumption patterns, and types of energy use both in Nova Scotia and in other parts of Canada differentially impact the environment.

20.2. Canada's Ecological Footprint

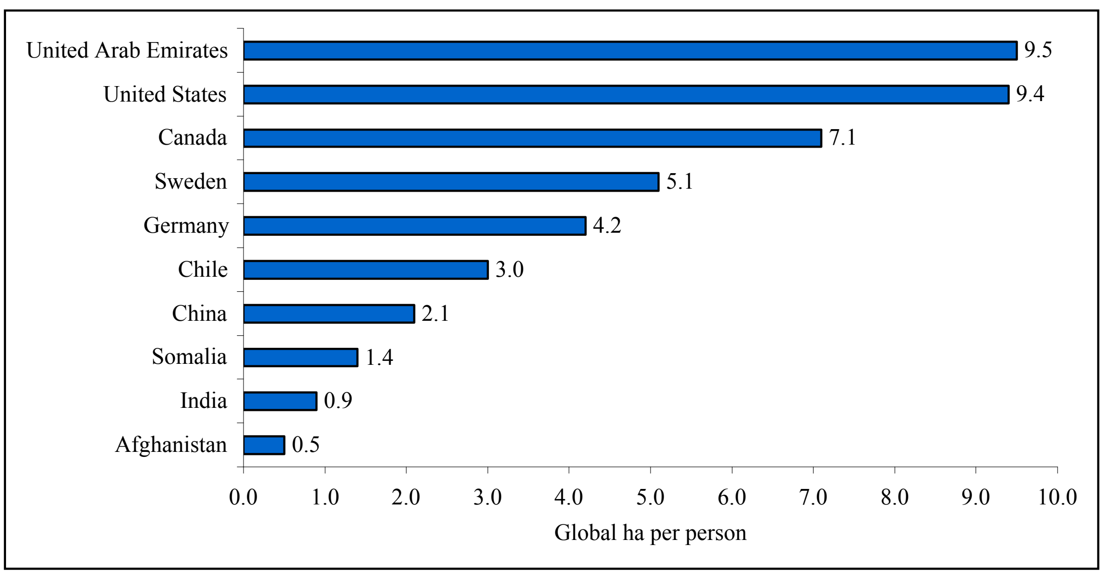
According to the 2008 *Living Planet Report*, the global Ecological Footprint in 2005 was 17.5 billion gha, or 2.7 gha per person on the planet. However, in 2005, the total supply of biologically productive area—also referred to as "biocapacity"—was only 13.6 billion gha, or 2.1 gha per person. However, if some of this biological productivity is allocated for use and consumption by wild species in the form of protected areas not available for human harvesting or other uses, the biocapacity will be considerably less than 2.1 global hectares per person. This is an important consideration because, according to WWF, "[t]he value of biodiversity to human well-being, while not readily quantifiable in monetary terms, could be the difference between a planet that can support its human population and one which cannot."[14]

Even with no set-aside for other species, the gap between the 17.5 billion gha consumed and the 13.6 billion gha available is a measure of humanity's annual ecological "deficit," or "overshoot," of the earth's carrying capacity. According to the WWF report, humanity's Footprint first began surpassing the earth's biocapacity in the 1980s, and the magnitude of this overshoot has been increasing annually, with demand exceeding supply by roughly 30% in 2005. This means that it takes the earth approximately a year and four months to produce the resources humans use in one year. The WWF report observes, "The resulting deforestation, water shortages, declining biodiversity and climate change [resulting from this overshoot] are putting the well-being and development of all nations at increasing risk."[15]

As Figure 20-1 below indicates, Canada had an Ecological Footprint in 2005 of 7.1 gha per capita—25% smaller on a per capita basis than the Footprints of the United States and the United Arab Emirates (which has the world's largest per capita Footprint), but much larger than the Footprints of any European country, let alone that of countries in Asia, Africa, and Latin America. Thus, the average Canadian had an Ecological Footprint or impact on the environment that was 69% larger than that of the average German and nearly eight times larger than that of the average Indian.

As noted above, the total global supply of productive area or biocapacity was 2.1 gha per capita in 2005. This means that, if everyone in the world lived and consumed like Canadians do, we would need 3.4 planets to support that lifestyle.

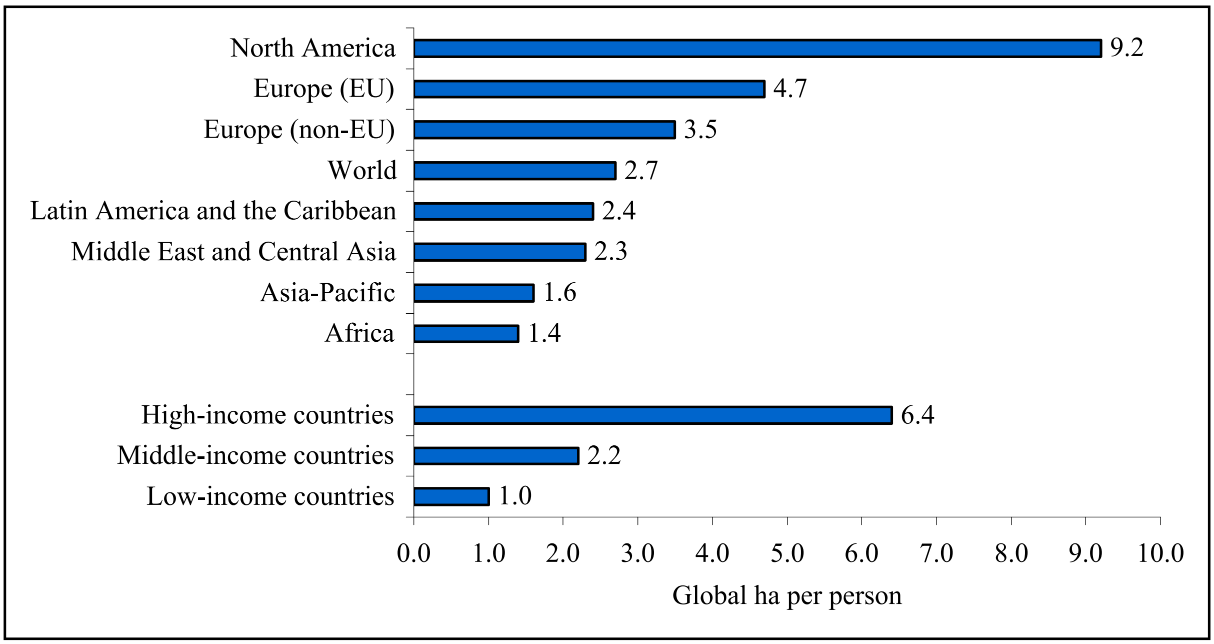
Figure 20-1. Ecological Footprint per person (gha), selected countries, 2005



Source: World Wildlife Fund, Zoological Society of London, and Global Footprint Network. 2008. Living Planet Report, Table 1. Available from http://www.panda.org/news_facts/publications/living_planet_report/index.cfm. Accessed December 2008.

Figures 20-1 above and 20-2 below illustrate that not all Footprints are the same size. The average African Ecological Footprint is 1.4 gha per person, while the average North American Footprint is 9.2 gha per person—about twice as large as that of the European Union. The average Ecological Footprint of the world's highest income countries (6.4) is almost three times larger than the average Footprint of the middle-income countries and over six times larger than the average Footprint of the low-income countries (Figure 20-2).

Figure 20-2. Ecological Footprint by region and income (gha), 2005



Source: World Wildlife Fund, Zoological Society of London, and Global Footprint Network. 2008. Living Planet Report, Table 1. Available from http://www.panda.org/news_facts/publications/living_planet_report/index.cfm. Accessed December 2008.

It is clear from Figure 20-2 above that the high-income countries listed in the *Living Planet Report* consumed a disproportionate quantity of the earth's resources and produced a disproportionate amount of its waste.

According to the United Nations, the world's richest countries, with 20% of global population, account for 86% of total private consumption, whereas the poorest 20% of the world's people account for just 1.3% of consumption. Moreover, 2% of the world's population living in countries with the highest per capita fossil-fuel carbon dioxide emissions contribute 63% of the total global emissions, while the 20% in the lowest emission countries contribute just 2% of the total.[16] Similarly, the richest one-fifth of humankind consume 84% of all paper and own 87% of all cars, while the poorest one-fifth account for just 1% of each.[17]

Similarly, within Canada, those with the highest incomes tend to have the largest Ecological Footprint. According to a recent study by the Canadian Centre for Policy Alternatives (CCPA) using 2002 data, the richest 10% of Canadian households have a Footprint of 12.4 gha per person—66% higher than the national average and nearly 2.5 times that of the poorest 10%.[18]

The CCPA study breaks down the Ecological Footprint of Canadian households into five consumption categories: food, housing, mobility, goods, and services. The results indicate that the Ecological Footprint of high-income Canadians is substantially higher in every category except food.

In the lower income households (bottom 20%), food and housing account for more than 70% of their Ecological Footprint, whereas in the richest 10% of households, food and housing account for only 45% of the total Footprint. In other words, for low- and middle- income Canadians, "much of their Ecological Footprint is associated with the consumption of basic necessities."[19]

The biggest gap between the rich and poor is in the area of mobility: the richest 10% have a Footprint nearly nine times the size of the Footprint of the poorest 10%. The ratio for goods was 3.75 times; and the ratio for services was 2.7 times (Table 20-1 below).

Table 20-1. Canadian household consumption and Ecological Footprint (gha), by income decile, 2002

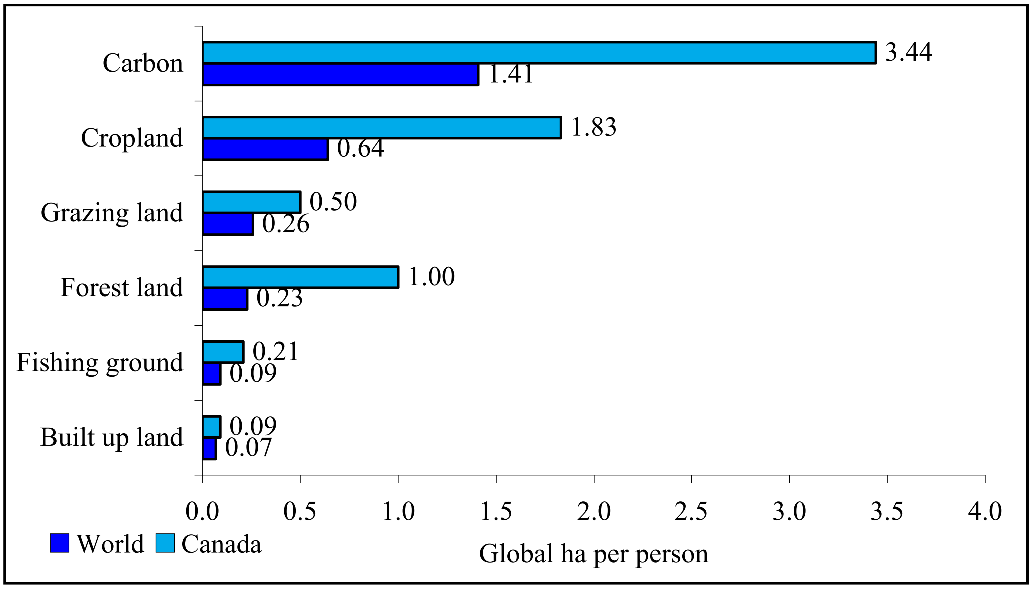
CONSUMPTION CATEGORIES	INCOME DECILE (GHA)										
	1	2	3	4	5	6	7	8	9	10	Total
Food	2.06	2.15	2.14	2.14	2.14	2.16	2.15	2.16	2.13	2.24	2.13
Housing	1.51	1.82	1.79	1.73	1.88	1.98	2.06	2.19	2.31	3.40	2.16
Mobility	0.36	0.62	0.88	1.04	1.20	1.43	1.55	1.74	2.17	3.23	1.43
Goods	0.56	0.74	0.82	0.85	0.93	1.00	1.09	1.16	1.33	2.11	0.97
Services	0.55	0.68	0.71	0.74	0.79	0.82	0.83	0.89	0.95	1.48	0.74
Size of Footprint	**5.03**	**5.66**	**6.34**	**6.48**	**6.93**	**7.36**	**7.67**	**8.12**	**8.87**	**12.42**	**7.49**

Source: Mackenzie, Hugh, Hans Messinger, and Rick Smith. 2008. Size Matters. Canada's Ecological Footprint by Income. Canadian Centre for Policy Alternatives. Ottawa. Table 1. http://www.policyalternatives.ca/Reports/2008/06/ReportsStudies1910/. Accessed August 15, 2008.

Note: These data are for 2002. The rest of the data in this update are for 2005.

When the Ecological Footprint is broken down by component, we can see more specifically why Canada's Footprint is so much larger than that of most other countries. Figure 20-3 below illustrates that, in 2005, nearly half (49%) of Canada's Footprint was attributable to the country's carbon Footprint, which includes CO_2 emissions from fossil fuel combustion. In fact, Canada's carbon Footprint of 3.44 gha was nearly two and a half times larger than the global average of 1.41 gha. Canada's combined Footprint attributable to crop production and from the use of forests made up 40% of the country's total Footprint and was more than three times larger than the global average for these two components (Figure 20-3).

Figure 20-3. Total Ecological Footprint by component (gha), Canada and the world, 2005

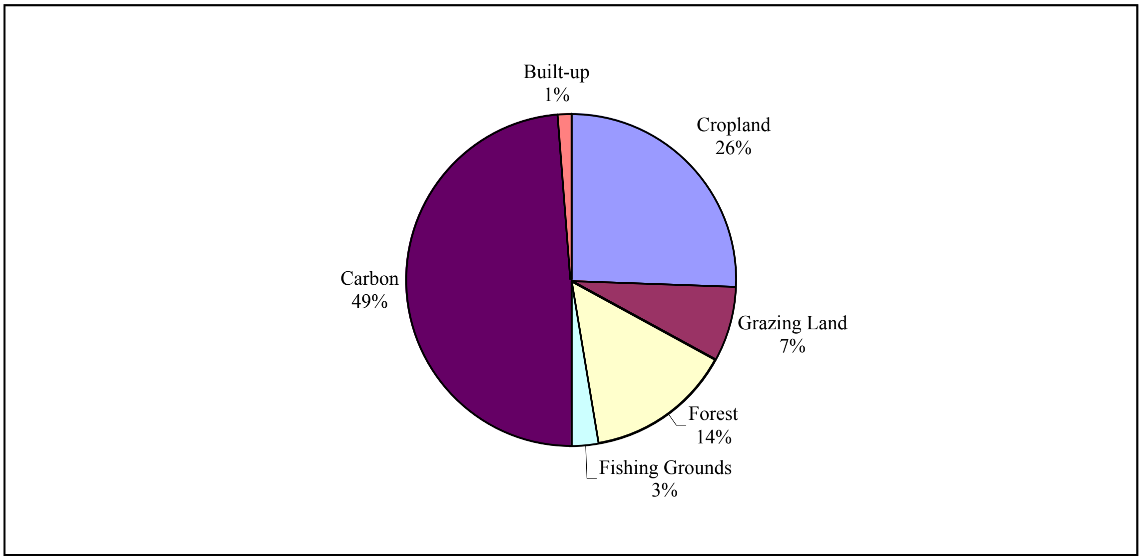


Source: World Wildlife Fund, Zoological Society of London and Global Footprint Network. 2008. Living Planet Report, Table 1. Available from http://www.panda.org/news_facts/publications/living_planet_report/index.cfm. Accessed December 2008.

Notes:
- "Carbon" includes direct CO_2 emissions from fossil fuel combustion, as well as indirect emissions attributable to the manufacture of products abroad. The world carbon Footprint also includes consumption-related emissions not allocated to individual countries, such as from flaring of gas or oil, cement production, and tropical forest fires.
- "Forest land" includes fuelwood.
- "Built-up land includes areas dammed for hydropower.

According to the most recent 2005 Ecological Footprint data for Canada from the GFN, as indicated in the 2008 edition of the Canadian National Footprint Accounts, the carbon Footprint accounts for 49% of the country's Ecological Footprint, while consumption from cropland and grazing land accounts for 33%, forest products for 14%, and fishing grounds and built-up land account for 3% and 1%, respectively (see Figure 20-4 below).

Figure 20-4. Ecological Footprint by component (%), Canada, 2005



Source: Global Footprint Network, Canadian National Footprint Accounts, 2008 edition, unpublished, provided by GFN to GPI Atlantic.

When the total Ecological Footprint for all countries was analysed by component in the 2006 *Living Planet Report*, it was discovered that the carbon Footprint—the fastest-growing component—increased more than ninefold between 1961 and 2003. According to the 2006 *Living Planet Report*:

> How is it possible for an economy to continue operating in overshoot? Over time, the earth builds up ecological assets, like forests and fisheries. These accumulated stocks can, for a limited period, be harvested faster than they regenerate. [. . .] For three decades now we have been in overshoot, drawing down these assets and increasing the amount of CO_2 in the air. We cannot remain in overshoot much longer without depleting the planet's biological resources and interfering with its long-term ability to renew them.[20]

As demonstrated in the 2006 *Living Planet Report*,[21] and in Table 20-2 below, between 1975 and 2003, the average Ecological Footprint per person has increased in most regions of the world, with the greatest relative increase in the Asia Pacific region (38%) closely followed by North America (35%) and the European Union (31%). In Africa, the Middle East and Central Asia, and the non-European Union countries of Europe, the average Footprint has decreased in the nearly 30-year period.

It should be noted that these overall averages conceal very dramatic differences between the countries within these regions. For example, in the Middle East and Central Asian region, the change in Ecological Footprint over the 30-year period ranged from -83% in Georgia to +205% in the United Arab Emirates (which now has the largest per capita Footprint of any country in the world). Similarly, in Latin America, the change ranged from -30% in Uruguay to +73% in El Salvador.

However, these relative rates of change also conceal the magnitude of absolute changes. Thus, in the Asia Pacific region, the apparently considerable 38% expansion in per capita Footprints took the region from only 0.9 to 1.3 gha per person—an increase of just 0.4 gha per person between 1975 and 2003, and still well within the 2.1 gha per person bioproductive capacity of the earth. On a per capita basis at least, Asians are still consuming at sustainable levels.

In North America, on the other hand, the 35% Footprint increase denoted a massive expansion of 2.4 gha per person, taking the region from 7 gha per person in 1975 to 9.4 gha per person in 2003—by far the largest absolute increase in Footprint size in the world, and more than four-and-a-half times greater than the per capita available bioproductive land and water. The European Union saw its per capita Footprint expand from 3.7 to 4.8 gha per person over these three decades.

By contrast, the world's poorest countries in Africa saw their consumption, and thus their Footprints, shrink even further to just 1.1 gha per person. Together with the relative changes in Footprint size denoted in Table 20-2 below, these absolute changes point to a growing real gap between rich and poor in the last three decades, as the rich countries consume an ever greater share of the world's resources and sharply expand their resource use and waste production even further beyond sustainable limits, while nearly 70% of the world's population continues to live within sustainable limits by Footprint standards.[22]

Table 20-2. Ecological Footprint change per person, %, by region, 1975-2003

REGION	% CHANGE OVERALL (1975-2003)	RANGE
Africa	-2%	–38% in Somalia to +80% in Mauritius
Middle East and Central Asia	-19%	-83% in Georgia to +205% in United Arab Emirates
Asia-Pacific	+38%	-12% in Mongolia to +143% in Korea (Rep.)
Latin America and the Caribbean	+21%	-30% in Uruguay to +73% in El Salvador
North America	+35%	+11% in Canada to +38% in United States
Europe (EU countries)	+31%	-44% in Latvia to +101% in Greece
Europe (non-EU countries)	-11%	-72% in Moldova Rep. to +39% in Switzerland

Source: World Wildlife Fund, Zoological Society of London and Global Footprint Network. 2006. Living Planet Report, Table 2. Available from http://www.panda.org/news_facts/publications/living_planet_report/linving_planet_report_timeline/lp_2006/index.cfm. Accessed December 2008.
Note: Changes from 1975 are calculated based on constant 2003 gha.

20.3. Sub-national Footprint accounts

Calculating full-fledged Ecological Footprint accounts at the regional, provincial, municipal, and community levels poses particular challenges, largely due to the absence of consistent, reliable, and regularly reported sub-national trade statistics. The reason this data gap is so troublesome is that Footprint assessments of the environmental impact of consumption patterns require detailed trade statistics as an important component of Footprint calculations, since imported consumer goods constitute part of a jurisdiction's Footprint, while exports (consumed elsewhere) do not.

To take a graphic example, Albertans' Ecological Footprint includes only the energy they consume, regardless of its origin, but not the energy they produce for export. Thus, Albertan tar sands energy constitutes part of the Footprint of those who consume it—in the United States for example, Alberta, and elsewhere. But, whereas reliable data on trade flows, consumption, energy use, and land categories are readily available at the national level, present inadequacies in the inter-provincial trade flow and other provincial-level data simply do not allow the accurate calculation of provincial Ecological Footprints in ways that are comparable to national estimates. For example, national Footprint calculations account for more than a hundred categories of traded goods—assessments that cannot be readily replicated at the sub-national level.

For this reason, sub-national Footprint estimates are generally based on adjusting national data sets to account for differences in consumption patterns. This is the approach recommended by Wackernagel who notes that "regional or municipal Footprints can be extracted from the national Footprint by comparing to what extent the consumption in the region or municipality differs from the national average and adjusting the Footprint accordingly."[23]

As noted earlier, the Global Footprint Network (GFN) has remarked that:

> National Footprint analyses are the most accurate of all Ecological Footprint assessments because complete trade statistics are available at the national level, and because national analysis does not require data on consumer behaviour or final use of resources within the country; all that is required is data on aggregate final demand.[24]

Because the Ecological Footprint—unlike natural resource accounts—assesses sustainability from the *demand* rather than supply side, other methods and data sources can potentially be used to assess consumption patterns. Data sources such as Statistics Canada's Food Expenditure Survey, Family Expenditure Survey (until 1996), and Survey of Household Spending (since 1997) can be used to assess provincial differences in consumption patterns, while provincial energy Footprints can potentially be estimated using the National Energy Use Database of Natural Resources Canada's Office of Energy Efficiency.

However, it must be acknowledged that the use of different methods and data sources to assess sub-national Footprints complicates attempts to make these Footprints comparable to national

Footprint results. Not surprisingly, a plethora of diverse efforts over the years has produced a wide range of footprint calculators and other tools designed for use at the community level—which are based on different assumptions and which are not comparable. And yet, the effort to produce consistent and meaningful provincial and community Footprints is essential if these sub-national jurisdictions are to track their own progress towards sustainability effectively.

For this reason, GFN is presently putting renewed energy into this sub-national and community-level Footprint work, in an effort to produce a more definitive Footprint calculator based on the best methods and data sources available. That, in turn, will hopefully act as a gold standard for other efforts and will greatly enhance comparability. To that end, GFN is presently partnering with the City of Calgary in a major Footprint project, which, as noted earlier, constitutes the most rigorous and reliable sub-national Footprint work currently under way in Canada. That work is briefly profiled here, since it holds the best current possibility to act as a template for future Footprint development work in Nova Scotia, Atlantic Canada, and elsewhere in Canada.

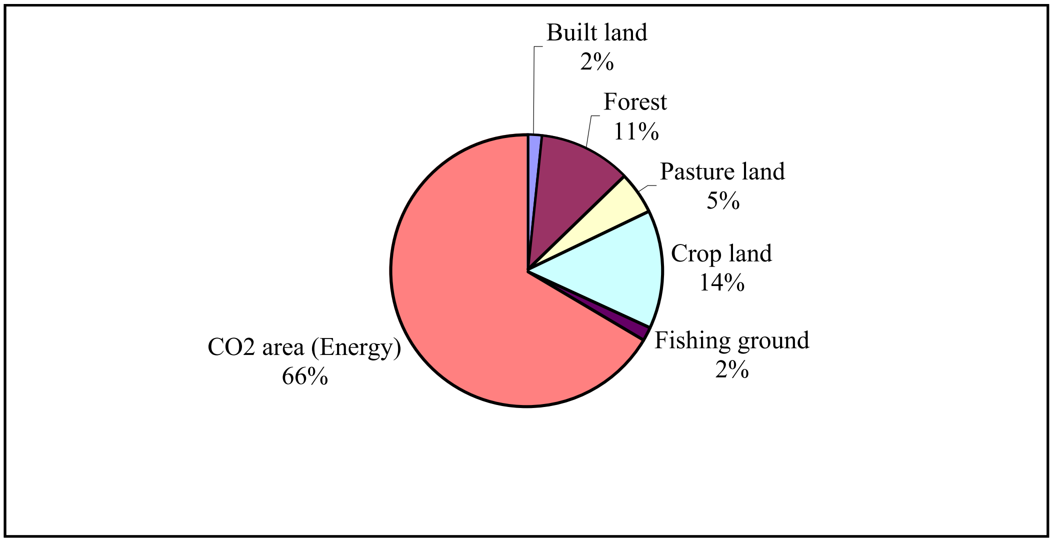
20.3.1. Calgary's Ecological Footprint

In 2005, the Canadian Federation of Municipalities announced that Calgary had the largest Ecological Footprint of any municipality in Canada. In response to this, the City of Calgary embarked on a project, with the help of GFN, to estimate its Ecological Footprint as accurately as possible given available data, so that it would be reasonably comparable to national averages, and to explore ways to reduce its Footprint. Other partners in this major project are Local Governments for Sustainability (ICLEI) and the Federation of Canadian Municipalities (FCM).[25]

This new City of Calgary study, released just this year, estimated Calgary's Ecological Footprint to be between 9.5 and 9.9 gha per person—well beyond the global average of 2.2 gha cited in that report and the 2.1 gha cited in the 2008 edition of the Canadian National Footprint Accounts. At Calgary's rate of consumption, in other words, humanity would need nearly five planets Earth to provide the necessary resources and absorb the waste produced. Calgary's Footprint is more than 25% larger than the national average of 7.6 gha per person, and is equivalent to the US average of 9.6 gha per person.

The largest component of Calgary's Footprint is energy use—comprising 66% of the total (Figure 20-5 below). This includes the carbon component, which reflects CO_2 emissions from fossil fuels used for transportation, electricity, residential heat, and hot water. Cropland accounts for 14% of the total Footprint, followed by forest land at 11%.[26]

Figure 20-5. Calgary's Ecological Footprint by component (%), 2007



Source: The City of Calgary. 2008. Toward a Preferred Future. Understanding Calgary's Ecological Footprint. Pie graph p. 4. Available from http://www.calgary.ca/docgallery/bu/environmental_management/ecological_footprint/towards_preferred_future.pdf. Accessed September 22, 2008.

Notes: Numbers have been rounded.
Definitions (all of which apply to materials consumed in Calgary regardless of where produced)

- *Carbon uptake land*: Area required to sequester carbon emissions produced by fossil fuel combustion; fossil fuel energy used to produce and transport food (crops and animals), manufacture and transport building materials, construct and operate buildings, transport people and goods, operate infrastructure, manufacture consumer goods consumed in Calgary, and operate facilities that sell goods and services.
- *Cropland*: Area required to grow crops for food and animal feed and to produce consumer goods (e.g., textiles, rubber).
- *Forest land*: Area required to grow timber to produce building materials and associated goods and services (like paper and furniture).
- *Grazing land*: Area required to graze animals and produce associated goods and services (e.g., leather, milk).
- *Fishing grounds*: Total ocean area required for marine and freshwater fishing.
- *Built-up land*: Area required to develop infrastructure for housing, transportation, industrial production, public and private buildings and services (e.g., parks, airports, schools, offices, shops, parking lots).

As noted above, a key purpose of the Calgary project was to reduce the city's Footprint and to move towards greater sustainability. To that end, the Calgary report recognizes that sustainable development that benefits everyone in society requires certain ingredients:

> The United Nations Human Development Index and Ecological Footprint illustrate that sustainable development is successful when there is a low Footprint and high quality social structures that have adequate healthcare, comprehensive education, a stable economy and broad cultural freedom. The concept provides a measurable way to implement the triple bottom line: social, economic and environmental well-being.[27]

The City of Calgary document concludes with a long-term vision:

> The assets we create today can be future-friendly or not. Future-friendly infrastructure—cities and buildings designed to be resource efficient, zero-energy buildings and pedestrian or public transit-oriented transportation systems—can enable great lives with small Footprints. Succeeding in future-proofing Calgary requires a commitment to securing Calgary's economic competitiveness even in a time when resources become unavailable or too expensive. The longer infrastructure is designed to last, the more critical it is to ensure we're not manoeuvring ourselves into resource-intensive legacies for decades to come.[28]

20.3.2. Nova Scotia's Ecological Footprint

As previously noted, there are currently no accurate and consistent provincial Footprint data available that can be reliably used here at the present time. However, GPI Atlantic is hopeful that it will be possible to build on the excellent new work accomplished in the City of Calgary to create improved and comparable sub-national and provincial Footprint accounts for this country in the not-too-distant future.

In the meantime, we use the Canadian Footprint as a placeholder—based both on the internationally comparable 2003 national Footprint data published in the WWF / GFN *Living Planet Report* and on the most recent unpublished 2005 data in the 2008 edition of the Canadian National Footprint Accounts. Without attempting to calculate a Nova Scotia Footprint at this stage, we can nevertheless explore here some of the factors specific to Nova Scotia that would likely influence the size of its Ecological Footprint.

As noted, the Ecological Footprint of any defined population (a single person, household, province, or country) is the biologically productive area required to:

- produce the food, wood, energy and all the other resources that humans consume
- provide room for infrastructure such as buildings and roads
- absorb the wastes, carbon dioxide, and other pollutants that result from human activity

For its national Footprint estimates, GFN uses a Consumption Land Use Matrix to allocate the six major Footprint land uses to the five Footprint consumption components (Table 20-3 below). The six land types are: built-up land, cropland, grazing land, forest land, fishing grounds, and CO_2 area (the land and water area required to absorb carbon emissions from fossil fuel combustion). The five consumption components—also used in the CCPA income decile study referenced above—are food, shelter, mobility, goods, and services. These categories and cells can be further disaggregated to display additional detailed information on the sub-components that comprise each of these broad categories.

In order for sub-national Footprint assessments to be comparable to GFN's national estimates, this matrix should be used to the extent possible, and it does indeed form the basis of the City of

Calgary estimates referenced above. In the meantime, and until provincial Footprint data become available, this matrix and these categories (Table 20-3 below) can at least be used for analytical purposes to assess likely regional and provincial differences in consumption and land use patterns.

Table 20-3. Consumption Land Use Matrix

	Built-up land	Carbon uptake land*	Crop land	Grazing land	Forest land	Fishing grounds	Total
Food							
Shelter							
Mobility							
Goods							
Services							
Total							

Source: Global Footprint Network. Glossary. Available from http://www.footprintnetwork.org/gfn_sub.php?content=glossary. Accessed September 23, 2008.

Note: * The Footprint of nuclear power was not included in the "CO_2 area" calculation in the 2008 edition of the Canadian National Footprint Accounts.[29]

Below, we briefly explore three areas—energy use, transportation use, and solid waste disposal (and related consumption)—in order to initiate an exploration of how particular Nova Scotian behavioural patterns likely contribute to the shelter, mobility, food, and goods and services categories of consumption in the above matrix. We also briefly note how these particular patterns have shifted in the last several years, and how they might therefore contribute to changes in Nova Scotia's overall demand on the planet's resources. In addition, we begin to explore how these particular consumption patterns might compare to patterns and trends in the rest of Canada.

20.3.2.1 Solid waste disposal and consumption patterns (Goods, Services, and Food)

Since 2001, Nova Scotians have been producing and disposing more garbage per capita and correspondingly diverting less of it from landfills. This upward trend in waste disposal, which began in fiscal year 1999/2000, has just recently begun to stabilize with a marginal reversal in the 2006/2007 fiscal year, when the per capita annual waste disposal rate dropped to 477 kg from 488 kg in 2005/2006.

The upward trend in waste disposal since 2001 is a disappointing turn of events for the province given its remarkable earlier achievements: between 1996/1997 and 1999/2000, waste disposal per capita in Nova Scotia decreased by 34%—from 543 kg per person to 357 kg—by far the sharpest decline in the country.[30]

During this period, too, Nova Scotia became the first and only province to achieve the target of 50% diversion of waste from landfills set by the Canadian Council of Ministers of the Environment in 1989, and it became a recognized international leader in leading-edge waste management methods. The success was attributable particularly to the composting component of the waste diversion strategy, though the strategy has also included almost universal access to recycling and stewardship agreements for a range of products.

The increase in solid waste disposed per person in recent years is likely due in large part to higher rates of consumption and therefore greater waste generation. Thus, real per capita expenditure-based GDP in Nova Scotia grew steadily and substantially between 1996 and 2006—from $25,369 to $34,243 ($2006)— a nearly 35% increase in per capita spending on goods and services in a ten-year period.[31] This increased consumption in turn is likely to lead to increased waste generation. Both sides of this equation will affect the province's Ecological Footprint, with decreased waste disposal from 1996-2000 reducing that Footprint, and higher rates of both consumption and waste disposal expanding that Footprint since 2001.

According to the Nova Scotia Department of Environment, the increase in solid waste disposal is attributable to a number of factors: "Economic growth in the province, changes in consumption patterns, and new products and product designs are all factors contributing to this increase." The department also notes that "improvements in data collection methodologies are also allowing more precise measures of materials not previously captured."[32]

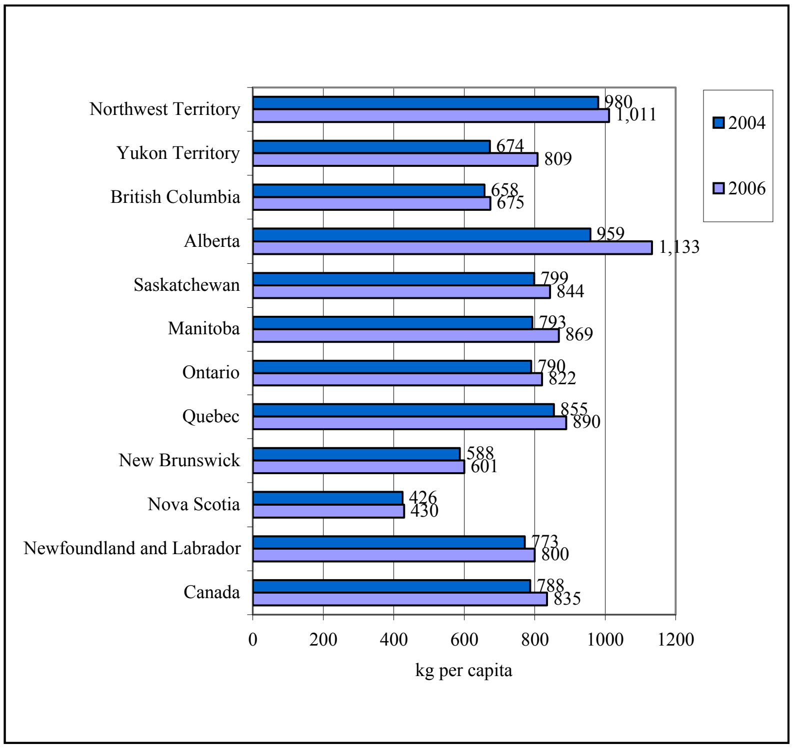
Despite the disappointing turn-around in waste disposal since 2001, however, a comparison with other provinces and territories in Canada indicates that Nova Scotia still had the lowest amount of waste disposed per capita in 2004-2006 despite its own higher rates of waste disposal.[33] In fact, since 2004, there has been an increase in the amount of solid waste disposed per capita in every Canadian province and territory.[34] Alberta, which disposed the most solid waste per person of any province in 2006, also had the most dramatic increase in that two-year period, from 959 kg to 1,133 kg per person—an increase of 18%. Nova Scotia had the smallest increase in waste disposal (just 1%)—from 426 kg per capita in 2004 to 430 kg per capita in 2006. There was a 6% increase in Canada overall in that time period (Figure 20-6 below).

In sum, it appears that while Nova Scotia's waste Footprint has generally increased in the last several years, the province still ranks below the Canadian average in terms of waste disposal and therefore in the associated Footprint. Certainly, low rates of waste disposal and a reduction in waste sent to landfills extends the lifespan of existing landfills and means that less land is required for landfill purposes, which in turn reduces the built-up land component of the Ecological Footprint.

However, there are much wider implications for the Footprint that derive more indirectly from sustainable waste resource management practices—including reduced energy needs from use of recycled rather than virgin materials (see Table 20-4 below), reduced methane emissions (a potent greenhouse gas) from landfills, and possibly even improved soil quality, productivity, and biocapacity from use of compost derived from diverted organic materials.

Figure 20-6 below shows total waste disposed in Canada, the provinces, and territories.

Figure 20-6. Per capita solid waste disposal (kg), Canada, provinces, and territories, 2004 and 2006



Source: 2004 data derived from a survey administered by RECYC-QUEBEC. 2006 data from Statistics Canada's 2006 Waste Management Industry Survey. Both years of data reported by Statistics Canada. Environment Accounts and Statistics Division. Table 1-1. Available from http://www.statcan.ca/english/freepub/16F0023XIE/2006001/t009_en.pdf. Accessed August 6, 2008.

Notes: Data for Prince Edward Island and Nunavut were unavailable. "Total waste disposed" is defined here as the amount of non-hazardous waste disposed of in public and private waste disposal facilities. This includes waste that is exported out of the source province or out of the country for disposal, but it does not include waste that is disposed in hazardous waste disposal facilities.

Table 20-4. Energy savings per tonne of waste wecycled

Material	Energy Savings
Paper	8.5 million BTUs
Plastic	20.1 million BTUs
Glass	2.4 million BTUs
Steel cans	18.4 million BTUs
Aluminium cans	166.9 million BTUs

Source: Choate, A. and H. Ferland 2002. *Waste Management and Energy Savings: Benefits By The Numbers*.

Note: In the above table, short tons were converted to metric tonnes.

20.3.2.2 Energy use for residential electricity (Shelter)[35]

As the carbon Footprint is the largest component of Canada's (and most industrialized countries') Ecological Footprint, energy use in its different forms has a very significant impact on any jurisdiction's total Ecological Footprint. Energy demand in Nova Scotia, as in most parts of the world, is heavily dependent on fossil fuels. Almost 70% of demand in the province is for oil products, while electricity (mostly from coal) accounts for 21%. Some indigenous renewable resources are used here, such as biomass for heating and hydropower for electricity, but these amount to less than 10% of final demand in Nova Scotia. All of the province's oil is imported, and only a small portion of the province's electricity is generated from domestic fuels. Although the province has some natural gas reserves that have been tapped since 1999, production has been in decline for the past three years, and only a small fraction of the gas is used domestically.

Domestic coal production declined substantially in the 1990s and amounted to only 32 kilotonnes in 2003. Imported coal is the dominant fuel used to generate electricity, representing 80.4% of the electricity generated in Nova Scotia in 2006. While significant domestic coal reserves remain, these are not currently being extracted, primarily for economic reasons. In addition, the damage to land, water, and air from coal extraction and combustion make this an undesirable fuel from an environmental point of view.

Until the last decade, almost all coal burned in the province for electricity generation and for industrial and (in some cases) residential use, came from local sources. In the mid-1990s, several local coal mines closed, and in 1996, the province began to import nearly all its coal from abroad, initially from US suppliers but eventually from Colombia and Venezuela. The shift to imported coal was a result of the end of federal subsidies for the operations of the Cape Breton Development Corporation (Devco), and Devco's inability to achieve commercial viability—not because of a shortage in indigenous supply. Although there is ongoing discussion of reviving the Nova Scotia coal mining industry, no local mines have been opened or re-opened to date.[36]

Canada's per capita energy Footprint has always been considerably smaller than Nova Scotia's, not due to less energy use, but rather to greater nationwide reliance on hydropower and less on oil and coal. In fact, the average Canadian consumes more energy than the average Nova Scotian but has a smaller Footprint due to the different sources of electric power. Thus, two thirds of Canada's electricity needs are met with hydropower.[37] Hydropower emits about 40 times less greenhouse gases than coal-fired power plants and between 18 and 30 times less than natural gas power plants.[38]

20.3.2.3 Transportation use (Mobility)[39]

Transportation use also has a significant impact on a jurisdiction's carbon Footprint. As with electricity, both quantity and type (or mode) affect Footprint size. For example, greater reliance on mass transit and active transportation modes like walking and bicycling will produce a smaller Ecological Footprint than heavy reliance on private automobiles. A larger proportion of small, fuel-efficient cars will produce a smaller Footprint than more widespread use of gas guzzling sport utility vehicles and minivans. And compact, high-density urban land use planning will generate a smaller Footprint than more automobile-dependent suburban and ex-urban subdivisions.

In Nova Scotia, both the current modal split in transportation use, and its total quantity have combined to produce a very large transportation and carbon Footprint. Total road passenger movement has steadily increased in Nova Scotia since 1990, reaching the highest levels on record in 2005 (the most recent year for which data were available at time of writing). Despite a population increase of only 2.7% between 1990 and 2005, total passenger-kms travelled in Nova Scotia were 21% higher in 2005 than in 1990. In other words, the average Nova Scotian is driving considerably more each year than in 1990.

In 2005, Nova Scotia had the third highest per capita level of road passenger movement in the country—an average of 20,500 passenger-kms a year—18% higher than in 1990 and 23.5% higher than the Canadian average of 16,600 passenger-kms a year. This is undoubtedly due to the province's larger rural population, which has limited if any access to public transit, but this reality also contributes to a substantially larger per capita carbon Footprint.

Thus, a higher proportion of Nova Scotians drive to work and fewer use public transit than Canadians in general, and they commute longer distances—both of which contribute to larger per capita carbon and transportation Footprints. According to the 2006 Census, 83.6% of Nova Scotians and 80% of Canadians use a car to get to work, while 5.9% of Nova Scotians and 11% of Canadians use public transit. Nova Scotians commute an average of 8.4 km each way to work, compared to 7.6 km for Canadians in general. On the positive side, Nova Scotians are somewhat more apt to carpool than the average Canadian, with 10.8% of Nova Scotians but only 7.7% of Canadians travelling to work as passengers rather than drivers.[40]

Transportation is the world's fastest growing form of energy use, accounting for nearly 30% of global energy demand and 95% of the planet's oil consumption. This reliance on oil is particularly unsustainable due to the ongoing depletion of extracted petroleum supplies and because the combustion of fossil fuels is linked with significant environmental damages, including climate change and air pollution.

In order to move toward greater sustainability, Nova Scotia's transportation sector must see a decrease in overall energy use and vehicle kilometres driven, a more sustainable modal split with greater reliance on public transit, carpooling, and active transportation, a shift to smaller, more fuel-efficient vehicles, and significant improvements in integrated land use / transportation planning that reduce automobile dependence. Such changes would sharply reduce the province's current high carbon Footprint and thus Nova Scotia's overall Ecological Footprint.

Unfortunately, current trends are in the opposite direction. Total transportation energy use has been climbing steadily in Nova Scotia since 1990. In 2005, total energy use by transportation reached 84.6 PJ (petajoules)—an increase of about 13% since 1990. On a per capita basis, transportation energy use in Nova Scotia increased by nearly 11% between 1990 and 2005, reaching 9.1 PJ per 100,000 residents in 2005. In 2005, Nova Scotia had the fifth highest rate of transportation energy use in the country—90.4 gigajoules (GJ) per capita—17% higher than the national average of 77.4 GJ per capita.

Similarly, greenhouse gas (GHG) emissions from transportation have continued to rise—from 5,100 kilotonnes (Kt) CO_2 equivalents in 1990 to a record 6,400 kt in 2005—an increase of 25.5%. Most disturbingly, the sharpest increase has been in recent years, with a 16% increase in transportation-related GHG emissions between 2001 and 2005 alone. We are clearly moving away from rather than approaching the Kyoto targets in this sector. Nova Scotia has the fifth highest per capita GHG emissions from transportation in the country—6.8 tonnes per capita—up 21.4% from 5.6 tonnes in 1990 and 11.5% higher than the Canadian average of 6.1 tonnes.

However, the potential for a reduction in the size of Nova Scotia's carbon and transportation Footprints should not be assessed by comparison with Canadian averages alone, since Canada has among the highest rates of transportation related energy use and GHG emissions in the world.

Thus, comparative 2000 OECD statistics illustrate that Canada has the second highest per capita transportation energy use in the world (72.8 GJ per capita)—12% less than the US at 82.8 GJ, but about double the level in the UK (36.9 GJ) and Germany (34.2 GJ).[41] Comparative 2004 OECD statistics show that Canada has the third highest per capita total GHG emissions in the world after the US and Australia—almost twice the levels in the UK and New Zealand and nearly three times the levels in France and Sweden.

20.4. Ecological Footprint scenarios

According to the *Living Planet Report 2006*: "Humanity is no longer living off nature's interest, but drawing down its capital. This growing pressure on ecosystems is causing habitat destruction or degradation and permanent loss of productivity, threatening both biodiversity and human well-being."[42]

As previously mentioned, humanity's Footprint first began surpassing the earth's biological capacity in the 1980s and the magnitude of this overshoot or ecological deficit has been increasing annually, with demand exceeding supply by roughly 30% in 2005.[43] What this means, in essence, is that the earth cannot keep up with our demand as we turn "resources into waste faster than nature can turn waste back into resources."[44]

In the 2006 edition of the *Living Planet Report*, the Global Footprint Network (GFN) presents three Ecological Footprint scenarios, one presenting what may happen if we continue along the same trajectory as at present, and two scenarios that attempt to move humanity out of overshoot. These scenarios are summarized below.

There are five factors that determine the extent of global overshoot, which in effect is the sum of all nations' "ecological deficit"—or the gap between their biocapacity and their actual Footprints. The first three factors deal with the demand side of the equation and the last two deal with the supply side. The *Living Planet Report* describes these five factors as follows:[45]

1. *Population*: Increase in population can be slowed and eventually reversed by supporting families in choosing to have fewer children. Offering women access to better education, economic opportunities, and health care are three proven approaches to achieving this.
2. *Consumption of goods and services per person*: The potential for reducing consumption depends in part on an individual's economic situation. While people living at or below subsistence may need to increase their consumption to move out of poverty, more affluent people can reduce consumption and still improve their quality of life.
3. *Footprint intensity*: The amount of resources used in the production of goods and services can be significantly reduced. This takes many forms, from energy efficiency in manufacturing and in the home to fuel-efficient cars and a reduction in the distance many goods are transported.
4. *Bioproductive area*: The bioproductive area can be extended by the reclamation of degraded lands through careful management. Good land management must ensure that bioproductive areas do not diminish, lost, for example, to urbanization, salinization, or desertification.
5. *Bioproductivity per hectare*: This depends on the type of ecosystem and the way it is managed. Agricultural technologies can boost productivity but can also diminish biodiversity. Energy intensive agriculture and heavy reliance on fertilizer may increase yields, but it comes at the cost of a larger Footprint associated with increased inputs and may so impoverish soil that yields ultimately begin to fall. Biocapacity can be preserved by protecting soil from erosion and other forms of degradation. Preventing or mitigating the impacts of climate change can also help maintain yields, as can eliminating the use of toxic chemicals that may degrade ecosystems.

The three scenarios considered in the *Living Planet Report* examine potential changes in these five factors to assess their impact on current levels of ecological overshoot and on potential movement towards sustainability. While space does not permit in-depth analysis here, results of each scenario are briefly summarized.

20.4.1. "Business as usual" scenario

Using several moderate United Nations projections for consumption patterns and population increase, it is estimated that by 2050 the average global citizen's Ecological Footprint will increase from 2.2 gha (2003 data) to 2.6 gha (by 2050). Among the separate Ecological Footprint components, it is estimated that the total Footprints of cropland and CO_2 will increase by 60%, the demand for grazing land and fishing grounds by 85%, and the use of forests by 110%.

This means that in each succeeding year, humankind's total Ecological Footprint will continue to exceed the earth's biocapacity, and humanity will therefore annually be "accruing an ecological deficit. This [ecological] debt accumulates as the sum of all annual deficits":

> Thus by 2050 under the business-as-usual scenario, the debt would equal an amount corresponding to 34 years of the planet's entire biological productivity—and the years of overshoot would still be far from over. [. . .] Biocapacity is assumed to fall to the productivity level of 1961 or below if overshoot continues to increase. This decline might accelerate as ecological debt grows, and these productivity losses may become irreversible.[46]

Thus, GFN uses the notion of ecological debt as one measure of risk indicating that "ecological resources and services will not be available in the future to meet humanity's demands."[47] GFN notes that ecological assets are not the same as financial assets because they are not substitutable or interchangeable. For example, the overuse of forests cannot be offset by decreasing demand on fisheries. At the same time, ecological assets do not exist independently of each other, and, as a result, an expansion of demand in one area has an impact on other areas. For instance, if there is a collapse in the fisheries, there will likely be more pressure placed on cropland and grazing land in efforts to find sufficient additional resources to feed humans.

20.4.2. "Slow shift" scenario

According to GFN, the slow shift scenario shows the impact of a global effort to bring humanity out of overshoot by 2100, using a strategy to reduce by 50% both CO_2 emissions and the harvest of wild fish. It is also assumed in this scenario that the demand on cropland and grazing land will increase at half the rate of population increase, due in part to lower meat consumption. Consumption of forest products is assumed to increase by 50% in order to compensate for the decreased use of fossil fuels, chemicals, and other resources.

In this scenario, humanity's total Ecological Footprint would be 15% smaller in 2100 than it was in 2003, or 1.5 gha instead of 2.2 gha. This would result in an end to global overshoot by approximately 2080.

The success of the slow shift scenario depends a great deal on the possibility of reducing humanity's dependence on fossil fuels. GFN argues that seven major shifts in fuel dependence need to take place just to keep emissions in 2050 equal to today's levels.[48] Given conservative population and economic growth scenarios, the shifts required just to maintain current emission levels include:

- a 25% reduction in CO_2 emissions from buildings that use fossil fuels
- an increase in fuel economy in two billion cars, from an average of 8 L to 4 L of fuel consumed per 100 km travelled
- a 50-fold increase in wind power
- a 700-fold increase in solar power[49]

In order to achieve the 50% cut in global CO_2 emissions by 2100, much stronger measures than these need to be put in place. As GFN points out, the challenge is formidable:

> All energy sources, be they fossil fuels or renewables, have an Ecological Footprint. Changing the fuel mix can shift the burden from one part of the biosphere to another. The main forms of renewable energy in use today—hydropower, wind power, and biomass—all reduce CO_2 emissions when substituted for fossil fuels, but increase demand on the land.[50]

Even if the challenge of beginning to wean humankind off its dependence on fossil fuels is successful to the extent envisioned by the slow shift scenario, and even if the 2080 end of overshoot predicted in this scenario is realized, many observers and analysts argue that it is unacceptable and potentially catastrophic to allow ecological deficits to continue accumulating for the next seven decades. Thus, the problem with the slow shift scenario and its predicted outcome is that—even if no further ecological deficits are incurred after 2080—the accumulated ecological debt will already be enormous at that stage and will likely have resulted in irreplaceable losses in ecological goods and services due to ongoing depletion and degradation of resources.

20.4.3. "Rapid reduction" scenario

This scenario presents what would happen if humanity made an "aggressive" effort to move out of overshoot by 2050—a scenario that would require a very high initial economic investment, but that would also carry a much lower ecological risk. Under this scenario, humanity's Footprint would be 40% smaller in 2100 than it was in 2003.

The rapid reduction scenario assumes:

- a reduction in CO_2 emissions of 50% by 2050 and of 70% by 2100
- an only 15% increase in the absolute consumption of cropland and grazing land by 2100: under median population projections, this requires a 23% reduction in the per person cropland and grazing land Footprints. GFN points out that such a shift is possible without decreasing caloric intake or nutritional food value by reducing the proportion of global crop used for animal feed.
- a growth in biocapacity of nearly 30% by 2100—achieved primarily by increasing cropland,

fisheries, and forest productivity and yields through improved technology and management[51]

In order to eliminate overshoot—the gap between humanity's Ecological Footprint and the earth's biocapacity—the rich countries and the individuals who live in them will have to shrink their Footprints sharply and work out how "this reduction in aggregate human demand is to be shared between individuals and populations."[52]

GFN presents a few potential "allocation strategies" in order to *shrink and share* the world's Ecological Footprint and to share the earth's biocapacity. For example, one option presented is the allotment of "footprint shares" (permits to consume), which could be based on the relative proportions of current global biocapacity or world population in each region. Such "permits" could be traded between individuals, nations, or regions.

A second option is to allocate to each region of the world a share of the global Footprint in proportion to its own biocapacity. In this particular allocation strategy, for example, based on the most recent 2008 data, North America's share of global biocapacity is 16%, and therefore the size of its Ecological Footprint would presumably amount to 16% of the world's total Footprint (North America's current share of the global Ecological Footprint is 17.5%).[53] Regions could then add to their Footprint share through trade with regions that have biocapacity reserves. This scenario clearly favours regions and countries (like Canada, for example) that have ample biocapacity rather than small countries (like Japan, for example) with a high population but low biocapacity.

Another option—and certainly by far the most equitable of the three presented here—is to share the global Footprint on a roughly equal per capita basis, with mechanisms in place to allow nations to trade their initial excess allocations. According to GFN:

> Negotiating, selecting, and combining these or other allocation schemes will require unprecedented global cooperation if the shrinking of humanity's Footprint is to be achieved. [. . .] In considering the costs and complexity of meeting this challenge, the global community may want to take into account not only how it will afford to undertake such a project, but also the ecological and human welfare consequences of failing to do so.[54]

Please see the original GPI Atlantic Ecological Footprint report for a wide range of more personal Footprint reduction options and their likely impacts on Footprint size. The options considered there include reductions in automobile commuting through increased use of carpooling, public transit, walking, and bicycling to work; reductions in residential energy use through a variety of means; and shifting food consumption from meat to greater reliance on grains, legumes, fruits, and vegetables. The beauty of the Ecological Footprint as a quantifiable measuring tool is that it encourages, tracks, and monitors the everyday efforts not only of governments but also of individuals and households in changing their behaviours to reduce the size of their Footprints and to live more sustainably.

21. Greenhouse Gas Emissions

For the original GPI Atlantic report on greenhouse gas emissions, please see the following:

The Nova Scotia Greenhouse Gas Accounts for the Genuine Progress Index (2001)
http://gpiatlantic.org/pdf/greenhouse/ghg.pdf

Introduction to the GPI Greenhouse Gas Accounts (1999)
http://gpiatlantic.org/pdf/greenhouse/greenhouse.pdf

Application of the Genuine Progress Index Approach to Analyzing Reduction of Greenhouse Gas Emissions in the Nova Scotia Freight Transport Sector (1999)
http://gpiatlantic.org/pdf/freight/freight.pdf

Headline Indicators

1. Total greenhouse gas emissions since 1990
2. Per capita greenhouse gas emissions since 1990
3. Total greenhouse gas emissions by sector
4. Nova Scotia performance relative to various greenhouse gas emissions reduction targets
5. Full cost accounting of Nova Scotia's greenhouse gas emissions

21.1. Introduction

Referring to evidence of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level, the Intergovernmental Panel on Climate Change (IPCC) concludes definitively that the earth's climate system is warming. According to the latest IPCC synthesis report, "Observational evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes, particularly temperature increases."[1]

The IPCC notes that 11 of the last 12 years rank among the warmest since 1850, and the warming trend in the last half century (between 1956 and 2005) has been nearly twice that of the century-long trend between 1906 and 2005. Global average sea level has risen at a rate of 1.8 mm per year since 1961, and 3.1 mm per year since 1993. Annual average Arctic sea ice has shrunk by 2.7% per decade since 1978 and mountain glaciers and snow cover have declined in both hemispheres.[2]

According to the IPCC, global atmospheric concentrations of greenhouse gases have increased markedly as a result of human activities since 1750. Global greenhouse gas (GHG) emissions due to human activities grew by 70% between 1970 and 2004 alone, and the IPCC has determined that it is very likely that most of the observed increase in globally averaged temperatures since the mid-20th century is due to the observed increase in anthropogenic (human-induced) GHG concentrations.[3]

Not only are humans contributing to climate change that is already occurring, but the IPCC projects that global GHG emissions will continue to grow over the next few decades as a result of current management and policies, and that continued GHG emissions levels at or above the current rate will cause further warming and induce many changes in the global climate system.[4]

In short, climate change is now widely acknowledged as the most serious environmental challenge of the coming century and perhaps the most serious economic and social challenge, as well. Predicted impacts of climate change in Nova Scotia include an increase in extreme weather events, particularly hurricanes, floods, and droughts, as well as adverse impacts on the province's fisheries and agricultural industries. Other serious impacts predicted for Nova Scotia include flooding in low-lying areas, coastal erosion, saltwater infiltration of groundwater, and falling lake and groundwater levels.[5]

In light of these serious concerns about climate change and the contribution of anthropogenic GHG emissions to global warming, monitoring GHG emissions in Nova Scotia is a top priority and an integral component of the Nova Scotia Genuine Progress Index (GPI). This indicator summary report updates the key trends in GPI Atlantic's 2001 *Nova Scotia Greenhouse Gas Accounts for the Genuine Progress Index*, as well as that report's cost-benefit analysis of attaining some existing GHG emissions reduction targets. This chapter also assesses whether or not the province is moving toward sustainability and genuine progress in the area of GHG emissions and climate change.

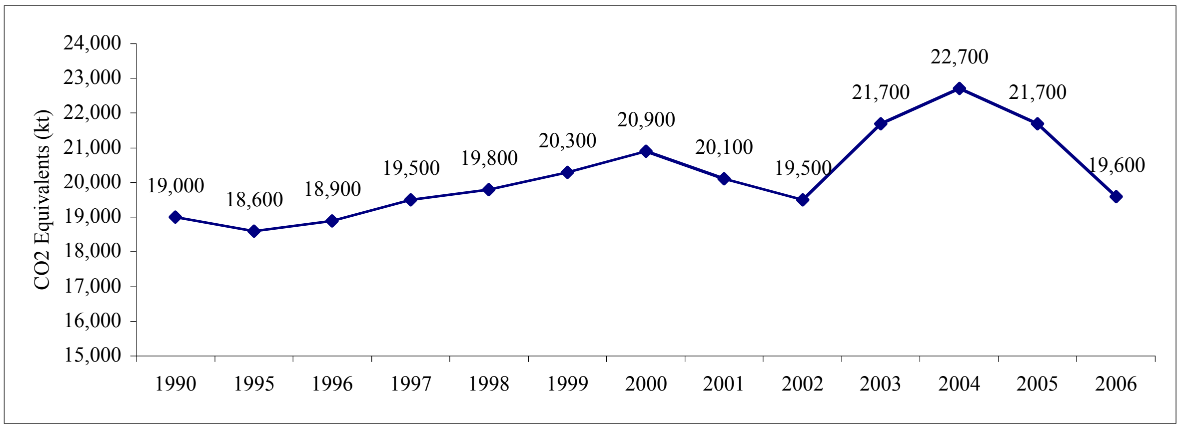
21.2. Greenhouse gas emissions (1990-2006)

Data sources: Environment Canada, National Inventory Report 1990-2006: Greenhouse Gas Sources and Sinks in Canada.

Result: Nova Scotia's GHG emissions increased in the 1990s, peaked in 2004, and then decreased by 14% between 2004 and 2006. However, this decrease is largely the result of indirect changes in energy supply and demand rather than changes in behaviour and policy, suggesting that radical changes are still needed in order to meet GHG reduction targets.

Nova Scotia's GHG emissions rose steadily through the mid- to late 1990s, peaking in 2004 at 22,500 kt. In 2006, however, the province's GHG emissions declined for the second consecutive year, reaching 19,600 kt—roughly the same level as in 1997 (Figure 21-1 below). This nearly 10% decrease in emissions in 2005/2006 alone substantially surpassed the modest 2% decrease in overall Canadian emissions in 2005/2006.

Figure 21-1. Nova Scotia total greenhouse gas emissions (kt of CO_2 equivalents), 1990-2006



Source: Environment Canada. (2008) National Inventory Report 1990–2006: Greenhouse Gas Sources and Sinks in Canada. Annex 11, table A11-6.

Note: Data on emissions for years 1991–1994 are not provided in the most recent inventory report and are, therefore omitted, from this chart.

These last two years of declining emissions in Nova Scotia stand in stark contrast to the sharp increases in GHG emissions recorded in 2003 and 2004. While it is certainly encouraging to see GHG emissions in the province declining, an investigation into the reason for these recent declines reveals that they are not necessarily attributable to government policy or changes in behaviour by Nova Scotians.

Analysis in Environment Canada's most recent GHG inventory report shows that the decline in Nova Scotia's GHG emissions from 2005 to 2006 is largely the result of some indirect changes in energy supply and demand.[6] A 10-month long labour dispute that shut down Stora Enso's Port Hawkesbury pulp and paper mill from 24 December 2005 to 29 September 2006 resulted in an 8% decrease in provincial electricity generation for that year. In addition, decreased off-road and marine transportation activity, resulting from the final decommissioning of the Cohasset Offshore Oil Project, also resulted in a significant decline in energy demand. Furthermore, Nova Scotia's 2005 GHG emissions were higher than in 2006 because petroleum coke supply issues forced Nova Scotia Power Inc. (NSPI) to use a higher intensity CO_2 fuel until supplies were re-established, and because excellent hydraulic conditions in the province in 2006 allowed for more hydroelectric production.

Nova Scotia's 2006 GHG emissions still remain 600 kt above 1990 levels, despite Canada's Kyoto Protocol commitment to reduce GHG emissions to 6% below 1990 levels by 2008-2012.

The province's 2007 Environmental Goals and Sustainable Prosperity Act now commits Nova Scotia to reduce its GHG emissions to 10% below 1990 levels by 2020. This amounts to a decrease of 13% or 2,500 kt from 2006 levels.

Given that the recent decline in Nova Scotia's GHG emissions was largely due to indirect changes in supply and demand, improvements in energy efficiency, conservation, and shifts to renewable energy are still required for the province to meet its own emission targets. The David Suzuki Foundation has argued for the more ambitious goal of a 25% reduction in GHG emissions from 1990 levels by the year 2020 and an 80% reduction by 2050—necessitating far more radical actions that currently envisioned.

21.3. Per capita greenhouse gas emissions (1990-2006)

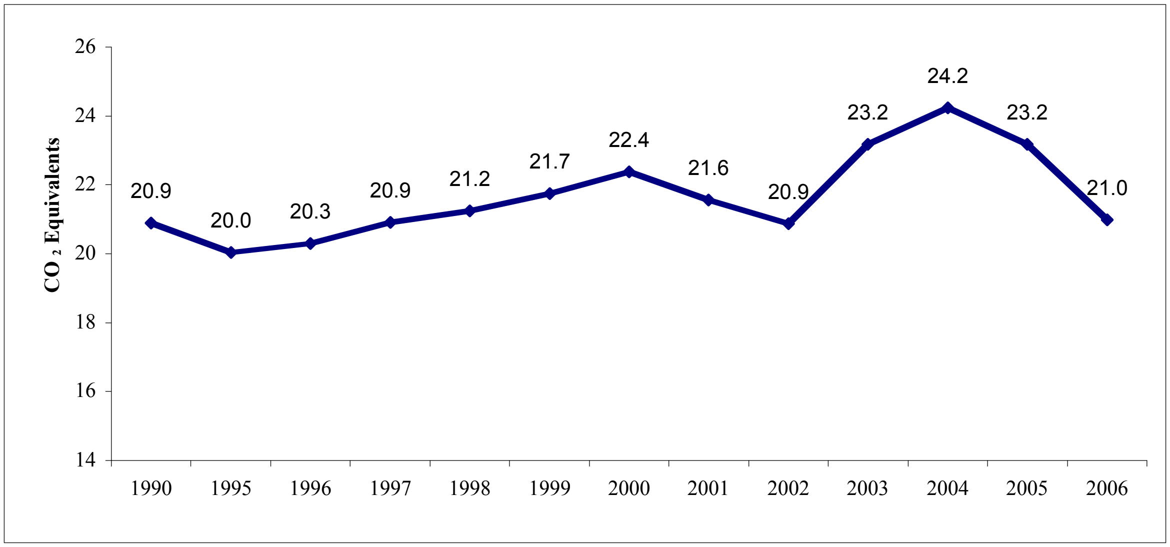
Data sources: Environment Canada, National Inventory Report 1990-2006: Greenhouse Gas Sources and Sinks in Canada; Statistics Canada, Estimates of population by age, group, and sex.

Result: Nova Scotia's per capita GHG emissions increased in the 1990s, peaked in 2004, and then decreased by 13% from 2004-2006. The province's 2006 emissions of 21 tonnes of CO_2 equivalent GHGs per capita was the fourth highest in Canada and puts Nova Scotians among the largest emitters of GHGs in the world.

On a per capita basis, Nova Scotians emitted an average of 21 tonnes of CO_2 equivalent GHGs in 2006—down nearly 10% from 23.2 tonnes per person in 2005, and just 0.1 tonnes higher than per capita emissions in 1990 (Figure 21-2 below). Nova Scotia's per capita emissions were the fourth highest in the country—about 5% below the national average (22.1 tonnes per person), and nearly double Quebec's emissions (10.7 tonnes). Oil-producing Alberta and Saskatchewan had by far the highest per capita emissions in the country—each producing about 70 tonnes of CO_2 equivalent GHG emissions per person (Figure 21-3 below).

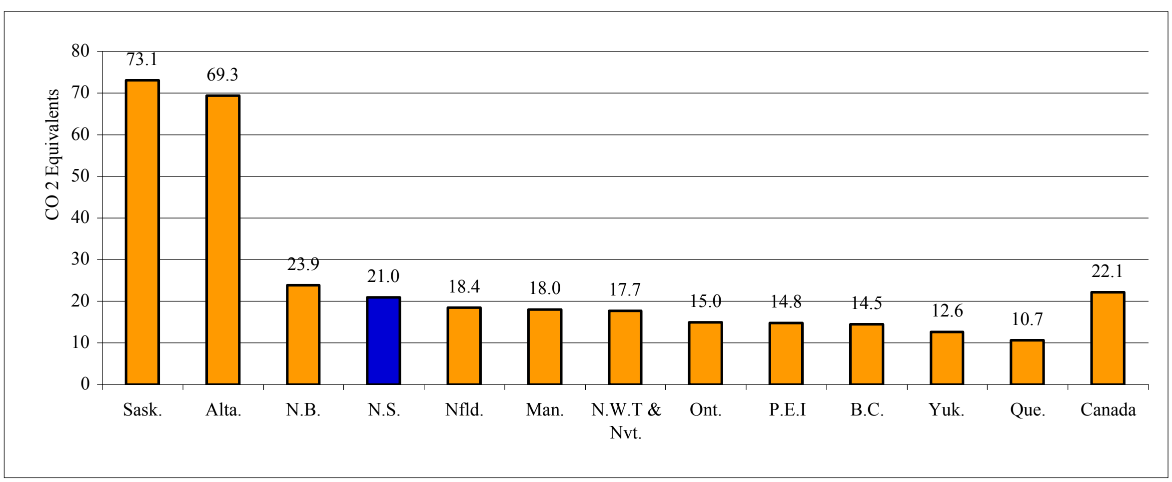
According the United Nations Framework Convention on Climate Change (UNFCC), Canada had the fourth highest per capita GHG emissions among Annex 1 (industrialized country) signatories in 2005.[7] Thus, Canadians and Nova Scotians are among the largest emitters of GHGs in the world—at more than twice the 2005 levels of the Germans (10.6 tonnes) and the French (6.8 tonnes).

Figure 21-2. Nova Scotia per capita greenhouse gas emissions (tonnes of CO_2 equivalents), 1990-2006



Sources: Environment Canada. (2008) National Inventory Report 1990-2006: Greenhouse Gas Sources and Sinks in Canada. Annex 11, table A11-6. Data on emissions for 1991-1994 are not provided in the most recent inventory report and are therefore omitted from this chart. Statistics Canada. (2007) Table 051-0001, Estimates of population by age, group, and sex, Canada, provinces and territories, annual (Persons).

Figure 21-3. Per capita greenhouse gas emissions, Canada, provinces, and territories, 2006 (tonnes of CO_2 equivalents)



Sources: Environment Canada. (2008) National Inventory Report 1990-2006: Greenhouse Gas Sources and Sinks in Canada. Annex 8, table A8-3 and Annex 11. Data on emissions for years 1991-1994 are not provided in the most recent inventory report and are therefore omitted from this chart.
Statistics Canada. (2007) Table 051-0001, Estimates of population by age, group, and sex, Canada, provinces and territories, annual (Persons).

21.4. Total greenhouse gas emissions by sector

Data sources: Environment Canada, National Inventory Report 1990-2006: Greenhouse Gas Sources and Sinks in Canada;

Result: Electricity production accounts for over 31% of Nova Scotia's total GHG emissions, highlighting the need to shift away from reliance on coal-fired power plants. Transportation accounts for 29% of total GHG emissions, with light trucks (including SUVs and minivans) accounting for over 31% of GHG emissions from road transport.

The largest source of GHG emissions in Nova Scotia is the production and consumption of energy, which accounted for nearly 94% of total emissions in 2006 (Table 21-1 below). Nearly 70% of total energy demand in Nova Scotia is for oil products—particularly for transportation and heating.

Table 21-1. Nova Scotia greenhouse gas emissions broken down by sector (kt of CO_2 equivalents), 2006

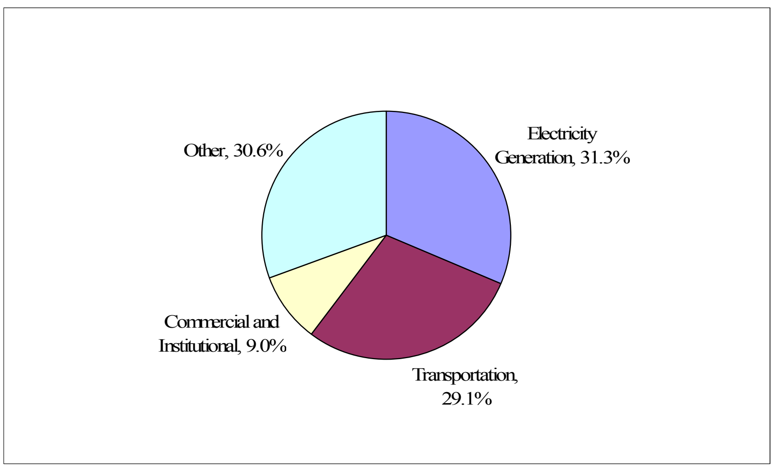
GREENHOUSE GAS SOURCE	2006 EMISSIONS	PERCENT (%) OF TOTAL
Energy Total	**18,400**	**93.9**
Electricity Generation	6,140	31.3
Fossil Fuel Industries	950	4.8
Manufacturing	462	2.4
Construction	31.3	0.2
Commercial and Institutional	1,760	9.0
Residential	1,100	5.6
Transportation Total	**5,700**	**29.1**
Road Transport	3,860	19.7
Rail	100	0.5
Marine	590	3.0
Domestic Aviation	430	2.2
Others	700	3.6
Fugitive Sources	70.8	0.4
Industrial Processes	224	1.1
Solvent and Other Product Use	9.2	0.0
Agriculture	480	2.4
Waste	520	2.7
Nova Scotia Total	**19,600**	**100%**

Source: Environment Canada. (2008) National Inventory Report 1990-2006: Greenhouse Gas Sources and Sinks in Canada. Annex 11, table A11-6. Data for electricity generation from Annex 9, table A9-4.
Notes: Totals may not always reflect sums of numbers in the table due to rounding. In order to avoid double-counting, residential energy use excludes residential transportation use (counted under "transportation") as well as the emissions resulting from electricity generation. Clearly, a change in household behaviours producing a reduction in residential energy and transportation use and consequent GHG emissions can also reduce emissions in these other sectors.

Among all forms of energy production and consumption, however, electricity generation in particular is the single most dominant source of GHG emissions in Nova Scotia, accounting for just over 31% of total provincial GHG emissions in 2006 (Figure 21-4 below). This is primarily because the province is heavily dependent on coal for electricity generation. The combustion of this fossil fuel generates significantly higher levels of emissions than other electricity sources such as hydropower.

Thus, coal accounted for 80.4% of the electricity generated in Nova Scotia in 2006, whereas two-thirds of Canada's electricity needs are met with hydropower.[8] Hydropower emits about 40 times less greenhouse gases than coal-fired power plants and between 18 and 30 times less than natural gas power plants.[9]

Figure 21-4. Major sources of GHG emissions, Nova Scotia, 2006



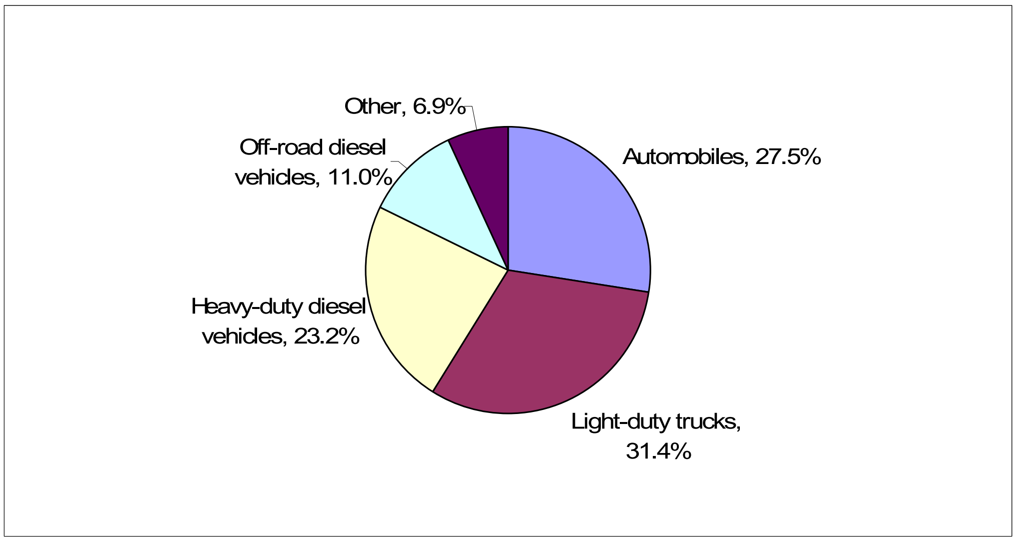
Source: Environment Canada. (2008) National Inventory Report 1990-2006: Greenhouse Gas Sources and Sinks in Canada. Annex 11, table A11-6 and data for electricity generation from Annex 9, table A9-4.

This reliance on coal for electricity generation helps account for Nova Scotia's high per capita GHG emissions (21 tonnes) by comparison with provinces more reliant on hydropower (Quebec—10.7 tonnes, B.C.—14.5 tonnes, and Ontario—15 tonnes per capita). The contrast is particularly evident when comparing GHG emission breakdowns by sector. Thus, electricity generation accounts for less than 3% of provincial GHG emissions in B.C., where hydropower is the dominant form of electricity generation, compared to 31% in Nova Scotia.

Clearly, the generation of electricity is an area where Nova Scotia could make significant reductions in GHG emissions if it switched to greater reliance on renewable energy sources. Neighbouring Prince Edward Island, for example, has a target of 100% reliance on renewable energy, particularly wind, for electricity generation by 2015, and already produces about 40% fewer greenhouse gas emissions per person province-wide than Nova Scotia.

The transportation sector was the second largest contributor to GHG emissions in 2006, accounting for 29% of emissions. Road transportation accounted for nearly 70% of transport-related GHG emissions. Light-duty trucks (including vans and SUVs) accounted for 31.4% of GHG emissions from road transport, followed by automobiles (27.5%), heavy-duty diesel vehicles (23.2%), and off-road diesel vehicles (11.5%) (Figure 21-5 below).

Figure 21-5. GHG emissions from road transport, Nova Scotia, 2006



Source: Environment Canada. (2008) National Inventory Report 1990-2005: Greenhouse Gas Sources and Sinks in Canada. Annex 11, table A11-6.

Note: Light-duty trucks include light-duty gasoline trucks and light-duty diesel trucks. Automobiles include light-duty gasoline vehicles, light-duty diesel vehicles, and propane and natural gas vehicles. "Other" includes motorcycles, heavy-duty gasoline vehicles, and off-road gasoline vehicles.

The current breakdown of road transport-related GHG emissions (Figure 21-5 above) indicates an important shift in the last decade. In 1997, automobiles accounted for 37% of road transport GHG emissions (ten percentage points more than in 2006), light-duty trucks for 27%, heavy-duty diesel vehicles for 21%, and off-road diesel vehicles for only 9%. By 2006, the automobile share had dropped to 27.5% and the light truck share had risen to 31.4%. This 1997–2006 shift, therefore, reflects a substantially increased use of less fuel-efficient SUVS and minivans by comparison with cars.

As well, the 1997-2006 shift is notable for the increased share of total transport-related GHG emissions occupied by off-road diesel vehicles—up from 9% of the total in 1997 to 11.5% of the total in 2006. That shift has actually contributed considerably to the *aggregate* increase in transport-related GHG emissions, since off-road vehicles like ATVs are rarely substitutes for on-road vehicles, but are generally an *additional* mode of fossil fuel-powered, motorized transport.

21.5. Nova Scotia performance relative to greenhouse gas emission reduction targets

Data sources: Environment Canada, National Inventory Report 1990-2006: Greenhouse Gas Sources and Sinks in Canada; Suzuki Foundation and Pembina Institute, The Case for Deep Reductions: Canada's Role in Preventing Dangerous Climate Change; Nova Scotia Environmental Goals and Sustainable Prosperity Act.

Result: Nova Scotia would have to reduce its 2006 GHG emissions by 9% within two to four years to achieve the Kyoto reduction targets; by 13% by 2020 to meet the Environmental Goals and Sustainable Prosperity Act reduction targets; and by 27% by 2020 and 81% by 2050 to meet the Suzuki Foundation targets.

Efforts are ongoing on a global scale to reduce GHG emissions in an effort to mitigate the potential impacts of climate change. A wide range of emission reduction targets has been suggested in recent years, and there is considerable debate on the feasibility, cost, and appropriateness of each target. In this section, Nova Scotia's current levels of GHG emissions are compared with various reduction targets in an effort to determine how far the province has to go to reach meaningful reductions in GHG emissions.

In 1997, Canada and 160 other countries agreed to the Kyoto protocol, in which the world's industrialized countries undertook to reduce their collective emissions of GHGs. Canada agreed to reduce its GHG emissions to 6% below 1990 levels by 2008-2012. While Nova Scotia is not bound to this specific target (since the target is a national rather than provincial objective), it is still valuable to determine the emission reductions that would be necessary for the province to meet such a target. As well, and as noted above, Nova Scotia's 2007 Environmental Goals and Sustainable Prosperity Act now commits the province to reduce its GHG emissions to 10% below 1990 levels by 2020.

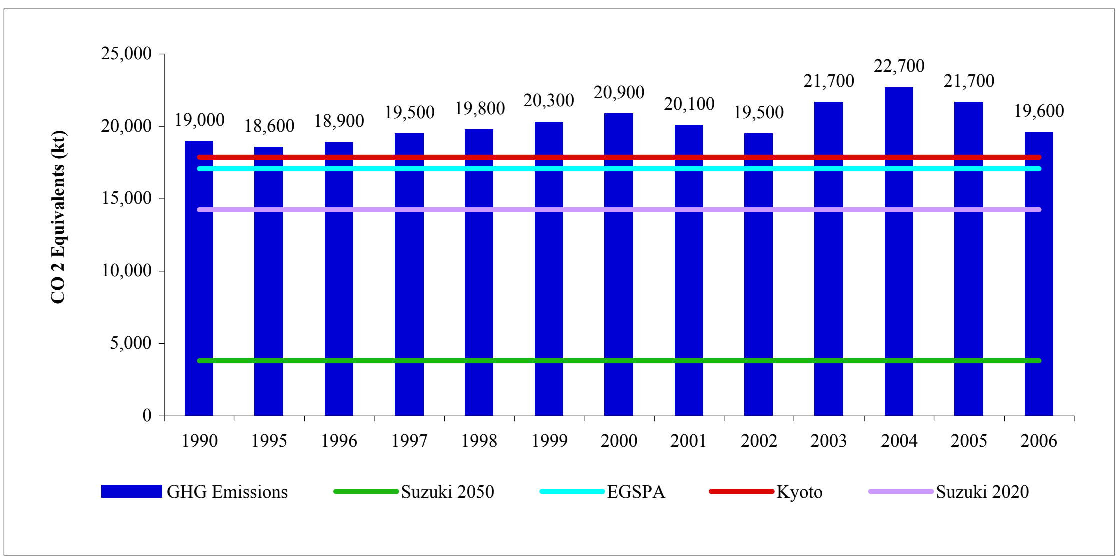
Nova Scotia's GHG emissions in 1990 amounted to 19,000 kt. In order to meet the Kyoto target, Nova Scotia would need to reach an annual GHG emissions level of 17,860 kt by 2008-2012 (6% below 1990 levels). Figure 21-6 below shows that GHG emissions in Nova Scotia have generally risen rather than fallen since 1990—peaking in 2004 at nearly 20% higher than 1990 levels. Since 2004, emissions have declined substantially primarily for the indirect energy supply / demand reasons outlined above, and Nova Scotia's GHG emissions are now only 3% higher than 1990 levels.

Figure 21-6 below indicates that Nova Scotia would have to reduce its 2006 GHG emissions (19,600 kt) by about 9% within the next two to four years in order to meet the 2008-2012 Kyoto target.

In April 2007, the Nova Scotia Government passed the Environmental Goals and Sustainable Prosperity Act.[10] As part of this legislation, the provincial government committed to reducing GHG emissions in Nova Scotia to levels at least 10% below 1990 levels by 2020, in accordance with the New England Governors and Eastern Canadian Premiers Climate Change Action Plan of 2001. Based on emission totals for 2006, this will require the province to reduce its GHG emissions by 13% by 2020 from its 2006 level of 19,600 kt, in order to meet its legislated target of 17,100 kt (Figure 21-6 below).

A report issued in 2005 by the David Suzuki Foundation and the Pembina Institute suggests that larger cuts in GHG emissions are necessary in order to help stabilize the climate, and to prevent or mitigate some of the most damaging potential impacts of climate change. They recommend that Canada reduce its GHG emissions to 25% below 1990 levels by 2020 and 80% below 1990 levels by 2050. If Nova Scotia were to adhere to these more stringent targets, the province would have to reach an annual emissions level of 14,250 kt by 2020 and 3,800 kt by 2050. This would require GHG emission reductions of 27% and 81% from 2006 levels, respectively (Figure 21-6 below).

Figure 21-6. Nova Scotia greenhouse gas emissions (kt CO_2 equivalents) relative to various emissions reduction targets, 1990-2006



Source: Environment Canada. (2008) National Inventory Report 1990-2006: Greenhouse Gas Sources and Sinks in Canada. Annex 11, table A11-6.

Notes:

- The Environmental Goals and Sustainable Prosperity Act (EGSPA) target is for Nova Scotia to reduce its greenhouse gas emissions to 10% below 1990 levels by 2020.
- Canada's agreed Kyoto target is to reduce greenhouse gas emissions to 6% below 1990 levels by 2008-2012.
- The current David Suzuki Foundation target for Canada is to reduce greenhouse gas emissions to 25% below 1990 levels by 2020, and to 80% below 1990 levels by 2050.[11]

The Suzuki–Pembina recommendation is more in line with the recent call for industrialized countries to cut emissions by between 25% and 40% by 2020, as discussed (but not yet agreed upon) at the recent United Nations climate change conference in Bali (December 2007). The more drastic cuts now being called for reflect new evidence from the IPCC that has found climate change and its impacts to be occurring at considerably faster rates than originally estimated.

Therefore, it is now widely accepted in the scientific community that considerably more drastic cuts in GHG emissions than previously envisioned will be required to stabilize the world's climate and to prevent potentially catastrophic damage. In light of this evidence and these recent developments, the Suzuki–Pembina targets may well reflect the most realistic set of targets that the province will need to consider on the basis of the actual scientific evidence rather than from the perspective of political feasibility or expediency.

21.6. Full-cost accounting of Nova Scotia's greenhouse gas emissions, 2006

Policy makers often argue that addressing climate change through large cuts in GHG emissions will be too costly and will weaken the economy. However, these arguments rarely weigh the short-term costs of action (generally the sole policy consideration) against the long-term costs of predicted environmental and economic damages resulting from climate change. Both sides of the equation must be considered in any assessment of the true costs of climate change and in order to assess whether damage avoidance may provide substantial long-term economic benefits when all costs are considered.

To that end, this section presents a full-cost accounting for Nova Scotia of the costs of climate change that would potentially be incurred if no mitigation or adaptation took place, compared to the costs of controlling or mitigating climate change through reductions in GHG emissions. To this end, two categories of costs, derived from peer-reviewed literature, are compared on the basis of "cost per tonne of CO_2 emitted":

1. Damage costs (costs of impacts of climate change assuming no mitigation measures)
2. Control costs (costs of reducing or controlling GHG emissions)

Given the uncertainty surrounding these types of estimates, a range of high- and low-cost estimates has been provided. Some of the key assumptions underlying these different estimates, which help explain the huge difference between the low- and high-cost damage cost estimates seen in Table 21-2 below, are described in GPI Atlantic's 2001 *Nova Scotia Greenhouse Gas Accounts*. Interestingly, since that time, new scientific evidence on the unexpected acceleration and intensity of predicted climate change impacts—including much faster than anticipated melting of Arctic ice that, in turn, will affect the magnitude and rapidity of sea level rise—has increasingly supported some of the assumptions underlying the higher damage cost estimates.

The 2001 GPI report also describes the methodologies used in the calculations and how the results can be understood and interpreted. For example, it is important to note that climate change damage cost estimates reflect global rather than local damage costs. Because climate change is a global phenomenon and because the climate change impacts of Nova Scotian GHG emissions will be felt far from Nova Scotia, damage cost estimates, therefore, assess impacts on the global economy rather than on the Nova Scotia economy in particular. At the same time, we have already noted that Nova Scotia itself will not be immune from climate change impacts, which are predicted to include an increase in hurricanes, floods and droughts, coastal erosion, saltwater infiltration of groundwater, falling lake and groundwater levels, and adverse impacts on fisheries and agriculture.

As well, climate change damage cost estimates are based on a long time horizon. CO_2 emitted today remains in the atmosphere for 100-200 years, contributing to the ongoing accumulation of GHGs in the atmosphere, and continuing to warm the planet and create potential damage for generations to come. In addition, climate change damages are predicted to become more serious over time as the climate warms. Thus, the marginal cost of one tonne of carbon emitted in Nova Scotia today may reflect damage a hundred years hence. Because such long-term costs are discounted on the understanding that a dollar today is worth more than a dollar in the future, the magnitude of damage cost estimates will greatly be affected by the choice of discount rate. Again, these issues are discussed in detail in the 2001 GPI GHG accounts.

Here, we summarize the steps in the GHG cost estimates, beginning with an assessment of the potential magnitude of climate change damage costs based on the peer-reviewed literature. We then consider the proportion of these climate change damage costs that could potentially be avoided by achieving a range of emission reduction targets, and the likely co-benefits of such emission reductions in reduced air pollution costs. Finally, we compare such benefits with the likely economic costs—or "control costs"—of achieving those reduction targets. From this perspective, the latter may be considered as an "investment" (rather than a simple cost) that produces a long-term return in avoided damage costs and, thus, enhanced prosperity.

21.6.1. Damage costs of Nova Scotia's GHG emissions

Damage costs from climate change are estimates of the economic costs associated with the wide range of predicted effects of global warming. These effects include:

- first order impacts like the costs of sea level rise and increased hurricane activity, which are the direct consequences of predicted atmospheric changes on environmental processes
- second order impacts, which occur in those economic sectors—such as forestry and fisheries—that are most dependent upon natural resources
- third order impacts, which are ripple effects from the first and second order impacts and include employment and production losses, loss of recreational and amenity values, and impacts on suppliers to the resource sectors

Predicted damage costs based on climate change models, as described in the peer-reviewed literature on climate change economics, range from \$20/tonne of CO_2 emitted (US\$1990)[12] to \$1,000/tonne (C\$1995).[13] These cost estimates were converted to 2006 Canadian dollars to provide low- and high-end estimates of the potential long-term damage costs associated with Nova Scotia's current GHG emissions (Table 21-2 below). The wide range of these estimates reflects uncertainties on the predicted consequences of climate change, though it must again be emphasized that the unanticipated rapidity and intensity of change evidenced in recent years is pushing more analysts towards higher end estimates. The highest damage estimates reflect impacts from positive feedback loops like the melting of permafrost and the potential for catastrophic "surprises."

Table 21-2. Global damage costs associated with Nova Scotia greenhouse gas emissions, 2006 (C\$2006 millions)

GREENHOUSE GAS SOURCE	TOTAL CO_2 EQUIVALENTS (KT)	COST (C\$2006 MILLIONS)	
		High (\$1,256/tonne)	Low (\$37/tonne)
Energy Total	18,400	\$23,110	\$681
Electricity Generation	6,140	\$7,712	\$227
Fossil Fuel Industries	950	\$1,193	\$35
Manufacturing	462	\$580	\$17
Construction	31.3	\$39	\$1
Commercial and Institutional	1,760	\$2,211	\$65
Residential	1,100	\$1,382	\$41
Transportation Total	5,700	\$7,159	\$211
Road Transport	3,860	\$4,848	\$143
Rail	100	\$126	\$4
Marine	590	\$741	\$22
Domestic Aviation	430	\$540	\$16
Others	700	\$879	\$26
Fugitive Sources	70.8	\$89	\$3
Industrial Processes	224	\$281	\$8
Solvent and Other Product Use	9.2	\$12	\$0
Agriculture	480	\$603	\$18
Waste	520	\$653	\$19
Nova Scotia Total	**19,600**	**\$24,618**	**\$725**

Note: Totals may not always reflect sums of numbers in the table due to rounding.

Nova Scotia's 2006 GHG emissions could cost the global economy between \$725 million and nearly \$25 billion in climate change damage costs, depending on whether the high or low damage cost estimate is applied (Table 21-2 above). Therefore, it is clear that Nova Scotia's GHG emissions, while only a tiny fraction of the world's emissions, will still have a significant adverse impact on the world. The 2006 GHG emissions released from Nova Scotia's electricity generation stations alone are predicted to produce between $227 million and $7.7 billion in climate change damages to the global economy.

Per capita GHG emissions in Nova Scotia reached 21 tonnes in 2006, which translates into global damage costs of between $777 and $26,376 for each Nova Scotian. Despite the province's small size and population, Nova Scotians are among the highest per capita emitters of GHGs in the world, so the magnitude of damage caused by their GHG emissions is significant.

21.6.2. Cumulative damage cost avoidance

Based on these estimates of the predicted damage costs of Nova Scotia's GHG emissions, it is next important to consider the damage costs that can potentially be avoided by reducing GHG emissions in the coming years. These avoided costs are explored here in the context of two of the emission reduction targets discussed above—the Nova Scotia Government's commitment to reduce GHG emissions to at least 10% below 1990 levels (namely to 17,100 kt) by 2020 as outlined in the province's 2007 Environmental Goals and Sustainable Prosperity Act (EGSPA); and the more aggressive reduction targets proposed by the Suzuki Foundation for Canada to reduce emissions to 25% below 1990 levels (namely to 14,250 kt) by 2020.

Since these targets would be met by gradual reductions each year rather than by one large reduction in the final year, it is assumed here that the targets are met through graduated emission reductions starting in 2008. On this basis, Table 21-3 below points to a potential savings of between $92.6 million and $3.1 billion in avoided climate change damages due to lower 2020 emissions alone, through achieving the 2.5 million tonne reduction required under the EGSPA commitment, compared to the "business as usual" (BAU) scenario for that year that assumes 2006 emission levels in 2020. Achieving the more ambitious Suzuki Foundation GHG emissions target of 25% below 1990 levels would save between $198 million and $6.7 billion dollars in avoided global damage costs.

On a cumulative basis—adding the predicted savings from each year's reduced Nova Scotia emissions over the 13-year period from 2008 to 2020—achieving the EGSPA target can potentially avoid between $648 million and $22 billion in global damage costs. Achieving the Suzuki Foundation target can save between $1.4 billion and $47.1 billion in avoided climate change damages.

These *cumulative* savings are a result of the fact that GHGs emitted in Nova Scotia in 2010 will still be present in the atmosphere in 2020 and, therefore, contributing to climate change and causing concomitant damage. By the same logic, each year's reduction in GHG emissions continues to produce savings in avoided damages in each successive year, compared to a "business as usual" (BAU) scenario that sees current emission levels continuing into the future.

Table 21-3. Cumulative potential damage cost avoidance through achieving the NS Environmental Goals and Sustainable Prosperity Act and Suzuki Foundation targets (based on graduated emission reductions from 2008-2020)

YEAR	EGSPA TARGET (10% BELOW 1990)			SUZUKI TARGET (25% BELOW 1990)		
	Emission Reductions (tonnes)	Damage Cost Avoidance (C$2006 millions)		Emission Reductions (tonnes)	Damage Cost Avoidance (C$2006 millions)	
		$37 per tonne	$1,256 per tonne		$37 per tonne	$1,256 per tonne
2008	192,500	$7.1	$241.8	412,000	$15.2	$517.5
2009	385,000	$14.2	$483.6	824,000	$30.5	$1,034.9
2010	577,500	$21.4	$725.3	1,236,000	$45.7	$1,552.4
2011	770,000	$28.5	$967.1	1,648,000	$61.0	$2,069.9
2012	962,500	$35.6	$1,208.9	2,060,000	$76.2	$2,587.4
2013	1,155,000	$42.7	$1,450.7	2,472,000	$91.5	$3,104.8
2014	1,347,500	$49.9	$1,692.5	2,884,000	$106.7	$3,622.3
2015	1,540,000	$57.0	$1,934.2	3,296,000	$122.0	$4,139.8
2016	1,732,500	$64.1	$2,176.0	3,708,000	$137.2	$4,657.2
2017	1,925,000	$71.2	$2,417.8	4,120,000	$152.4	$5,174.7
2018	2,117,500	$78.3	$2,659.6	4,532,000	$167.7	$5,692.2
2019	2,310,000	$85.5	$2,901.4	4,944,000	$182.9	$6,209.7
2020	2,502,500	$92.6	$3,143.1	5,356,000	$198.2	$6,727.1
Total	**17,517,500**	**$648.1**	**$22,002.0**	**37,492,000**	**$1,387.2**	**$47,090.0**

Note: Totals are cumulative emissions reduced and associated damages avoided over the 13-year period. Totals may not add due to rounding. All dollar values are in C$2006 millions.

21.6.3. Co-benefits of reducing Nova Scotia's GHG emissions

In addition to avoided climate change damage costs, as outlined in the previous section, reducing GHG emissions has other secondary benefits for the global and Nova Scotian populations and economies. For example, a reduction in fossil fuel use will lead not only to reduced GHG emissions (with their concomitant costs), but also to reductions in emissions of criteria air contaminants (sulphur dioxide, nitrogen oxides, particulate matter, carbon monoxide, and volatile organic compounds), while a reduction in automobile usage can also lead to reductions in accident costs, road building and maintenance expenditures, policing, and so on.

Inclusion of these secondary benefits provides a more complete picture of the potential gains to be made through GHG reduction strategies that will necessarily seek to conserve energy and reduce fossil fuel consumption. Based on the literature, it is conservatively estimated that these secondary benefits can range from $11 to $17 per tonne of carbon in 1997 Canadian dollars, which translates to approximately $13 to $20 in 2006 Canadian dollars. Table 21-4 below shows the predicted value of the co-benefits that could potentially be achieved through reductions in

Nova Scotia's GHG emissions between 2008 and 2020 designed to achieve the EGSPA and Suzuki targets.

In the year 2020, the predicted co-benefits derived from meeting the EGSPA emissions target would likely range from $32.5 to $50.1 million. If this target were achieved on a gradual basis between 2008 and 2020, the cumulative co-benefits would likely range from $228 to $350 million. If the more ambitious Suzuki target were met, the value of co-benefits in the year 2020 alone would likely range from $70 to $107 million, and the cumulative benefits—if emissions were reduced gradually between 2008 and 2020—would likely range from $487 million to $750 million (Table 21-4 below).

Note that these savings do not include other co-benefits like a reduced rate of fossil fuel depletion, which, in turn, can sustain higher levels of economic activity in the short-term than a more rapid rate of depletion. A delay in impending "peak oil"—at which time demand will exceed supply and likely produce a sharp increase in oil prices—may also buy time for adjustments to a low carbon economy and to alternative fuel sources. These and other economic co-benefits of GHG emission reductions are additional to those quantified in Table 21-4 below.

Table 21-4. Cumulative potential co-benefits through achieving the NS Environmental Goals and Sustainable Prosperity Act and Suzuki Foundation targets (based on graduated emission reductions from 2008-2020)

YEAR	EGSPA TARGET (10% BELOW 1990)			SUZUKI TARGET (25% BELOW 1990)		
	Emission Reduction (tonnes)	Co-Benefits (C$2006 millions)		Emission Reductions (tonnes)	Co-Benefits (C$2006 millions)	
		$13 per tonne	$20 per tonne		$13 per tonne	$20 per tonne
2008	192,500	$2.5	$3.9	412,000	$5.4	$8.2
2009	385,000	$5.0	$7.7	824,000	$10.7	$16.5
2010	577,500	$7.5	$11.6	1,236,000	$16.1	$24.7
2011	770,000	$10.0	$15.4	1,648,000	$21.4	$33.0
2012	962,500	$12.5	$19.3	2,060,000	$26.8	$41.2
2013	1,155,000	$15.0	$23.1	2,472,000	$32.1	$49.4
2014	1,347,500	$17.5	$27.0	2,884,000	$37.5	$57.7
2015	1,540,000	$20.0	$30.8	3,296,000	$42.8	$65.9
2016	1,732,500	$22.5	$34.7	3,708,000	$48.2	$74.2
2017	1,925,000	$25.0	$38.5	4,120,000	$53.6	$82.4
2018	2,117,500	$27.5	$42.4	4,532,000	$58.9	$90.6
2019	2,310,000	$30.0	$46.2	4,944,000	$64.3	$98.9
2020	2,502,500	$32.5	$50.1	5,356,000	$69.6	$107.1
Total	**17,517,500**	**$227.7**	**$350.4**	**37,492,000**	**$487.4**	**$749.8**

Note: Totals are cumulative emissions reduced and associated co-benefits over the 13-year period. Totals may not add due to rounding. All dollar values are C$2006 millions.

21.6.4. Control costs

The above estimates of the potential avoided damage costs and co-benefits associated with reductions in GHG emissions inevitably bring us to the final part of the accounting equation—namely, the actual costs of reducing (or "controlling") GHG emissions and of achieving the EGSPA and Suzuki targets. These "control costs," as they are often called, presently dominate the policy debate on climate change mitigation, and are often considered in isolation. In fact, they are only meaningful by comparison with the costs of *not* controlling such emissions (climate change damage costs) and with the benefits of controlling them (avoided damage costs and co-benefits).

The fairest method of comparison and benefit-cost analysis is one based on a specific quantity of emission reductions—either on a per tonne basis or in relation to a specific target like the EGSPA and Suzuki goals considered above. Here, we estimate first the actual control costs of meeting those two targets (Table 21-5 below), and we then compare those costs with the predicted damages avoided and co-benefits achieved by meeting the targets (Table 21-6 below). Based on the peer-reviewed literature on control costs, it was estimated that the economic costs of reducing GHG emissions by one tonne of CO_2 equivalent emissions can range from as low as $12 to as high as $145 (C$2006).

Table 21-5. Control cost estimates of meeting the NS Environmental Goals and Sustainable Prosperity Act and Suzuki Foundation targets (based on graduated emission reductions from 2008-2020)

YEAR	EGSPA TARGET (10% BELOW 1990)			SUZUKI TARGET (25% BELOW 1990)		
	Emission Reduction (tonnes)	Control Cost (C$2006 millions)		Emission Reductions (tonnes)	Control Cost (C$2006 millions)	
		$12 per tonne	$145 per tonne		$12 per tonne	$145 per tonne
2008	192,500	$2.3	$27.9	412,000	$4.9	$59.7
2009	385,000	$2.3	$27.9	824,000	$4.9	$59.7
2010	577,500	$2.3	$27.9	1,236,000	$4.9	$59.7
2011	770,000	$2.3	$27.9	1,648,000	$4.9	$59.7
2012	962,500	$2.3	$27.9	2,060,000	$4.9	$59.7
2013	1,155,000	$2.3	$27.9	2,472,000	$4.9	$59.7
2014	1,347,500	$2.3	$27.9	2,884,000	$4.9	$59.7
2015	1,540,000	$2.3	$27.9	3,296,000	$4.9	$59.7
2016	1,732,500	$2.3	$27.9	3,708,000	$4.9	$59.7
2017	1,925,000	$2.3	$27.9	4,120,000	$4.9	$59.7
2018	2,117,500	$2.3	$27.9	4,532,000	$4.9	$59.7
2019	2,310,000	$2.3	$27.9	4,944,000	$4.9	$59.7
2020	2,502,500	$2.3	$27.9	5,356,000	$4.9	$59.7
Total	**17,517,500**	**$30.0**	**$362.9**	**37,492,000**	**$64.3**	**$776.6**

Note: Totals may not add due to rounding. See further explanations below.

In Table 21-5 above, it should be noted that control costs—unlike damage and damage avoidance costs—are not calculated on a cumulative basis. Rather, they are calculated on an additive basis, on the assumption that whatever investment is made in control technology in one year will continue to reduce GHG emissions in subsequent years. For example, $4.9 million dollars invested in equipment in 2009 will reduce emissions by 412 kt in 2009, 412 kt in 2010, 412 kt in 2011, and so on. The *additional* $4.9 million investment in 2010 are assumed to reduce emissions by a *further* 412 kt, and so on.

It should also be noted that the high-end $145/tonne control cost estimate is the "marginal cost" of reducing the last tonne of CO_2 in the year 2020. Although earlier reductions are likely to be considerably cheaper, the same $145/tonne estimate is here applied in each year, which will produce a considerably more conservative and pessimistic (i.e., higher) estimate of control costs than would likely be the case in practice.[14]

Table 21-5 above indicates that it would require a total investment of approximately $30 million to $363 million between 2008 and 2020 in order to achieve the EGSPA target by 2020, and an investment of $64 million to $777 million over the same period to reach the Suzuki emission reduction target.

While these investments are often deemed by policy makers to be too costly to the economy, they are seen to be quite modest by comparison with the damage costs avoided and other benefits gained by reducing GHG emissions. In fact, a comparison of control costs with the benefits of GHG reductions reveals that the short-term costs of reducing emissions yield long-term economic benefits that far exceed the initial costs. Table 21-6 below indicates that the benefits and savings derived by cutting GHG emissions to the levels specified in the EGSPA and Suzuki targets far outweigh the financial investments required to meet those targets.

Using the low estimates of damage and control costs, every $1 invested in reducing GHG emissions in 2020 will produce approximately $54 dollars in savings due to the avoided primary and secondary climate change damage costs and co-benefits achieved by reducing GHG emissions to the levels recommended in the EGSPA and Suzuki targets. Using the high estimates from the literature, every $1 invested in reducing emissions in 2020 will produce up to $114 dollars in savings.

Using the cumulative estimate over the 2008-2020 period, every $1 invested in reducing GHG emissions through this entire period will save $29 in avoided damages using the low-end estimates and up to $62 using the high-end estimates.

When control costs are subtracted from the benefits attained by avoiding climate change damages and achieving co-benefits like cleaner air, the net cumulative benefit to society if Nova Scotia achieves the EGSPA greenhouse gas emissions target by 2020 is between $846 million and $22 billion. Meeting the Suzuki target will produce a net cumulative benefit of between $1.8 billion and $47.1 billion.

The results reveal that there is a large net benefit to society from reducing GHG emissions, regardless of whether the low-end or high-end damage and control cost estimates are used. In fact, GPI Atlantic's 2001 *Nova Scotia Greenhouse Gas Accounts* took this analysis a step further by comparing the most conservative (low-end) damage costs with the most pessimistic (high-end) control costs. In other words, the costs of reducing GHG emissions were assumed to be very high, while the climate change damages avoided were assumed to be modest and based on the most conservative climate models (e.g., those that assumed fairly small temperature increases and did not account for positive feedback loops and catastrophic surprises). Even in that case—using the most conservative possible cost assumptions—the economic benefits of reducing emissions were still found to exceed the actual costs of reducing emissions.

What this means, in essence, is that *greenhouse gas emission reductions are cost effective at any price* when compared to potential climate change damage costs—using any range of estimates in the accepted literature.

This conclusion also appears to be strongly supported by the most thorough and comprehensive analysis of the economics of climate change ever undertaken—by Lord Nicholas Stern, former Chief Economist of the World Bank and Head of the United Kingdom's Government Economic Service for the British Prime Minister and Chancellor of the Exchequer. The 700-page *Stern Review on the Economics of Climate Change*, published October 30, 2006, reaches the following conclusion, highlighted as a separate paragraph in bold type in the report's executive summary: "**The benefits of strong, early action on climate change outweigh the costs.**"[15]

The executive summary further notes: "The costs of stabilising the climate are significant but manageable; delay would be dangerous and much more costly." That stabilisation is in line with the strongest Suzuki Foundation target referenced above. According to Stern, "stabilisation [of greenhouse gases]—at whatever level—requires that annual emissions be brought down to more than 80% below current levels."

Stern's global analysis concluded that addressing climate change effectively now through GHG emission reductions substantial enough to stabilise atmospheric GHG concentrations will cost about 1% of global GDP per year. According to the climate and economic models he examined, doing nothing will cost the world the loss of 5% of GDP per year "now and forever" according to the best case scenario of climate change damages. Accounting for all risk factors raises the figure to as high as 20% of GDP.[16]

Table 21-6. Summary of damage avoidance benefits and control costs—in year 2020 and cumulatively over 2008-2020 (C$2006 millions)

CO_2 EQUIVALENT REDUCTION	IN YEAR 2020		CUMULATIVE OVER 2008–2020	
	Low estimate[a]	High estimate[b]	Low estimate[a]	High estimate[b]
Maximum Environmental Goals and Sustainable Prosperity Act (2,500,000 tonnes)				
Damage avoidance				
Climate change mitigation	$92.6	$3,143.1	$648.1	$22,002.0
Co-benefits	$32.5	$50.1	$227.7	$350.4
Total damage avoidance	$125.1	$3193.2	$875.8	$22,352.4
Control costs	$2.3	$27.9	$30.0	$362.9
Ratio of damage avoidance to control costs	54:1	114:1	29:1	62:1
Net benefits	$122.8	$3,165.3	$845.8	$21,989.5
Maximum Suzuki Foundation (5,350,000 tonnes)				
Damage avoidance				
Climate change mitigation	$198.2	$6,727.1	$1,387.2	$47,090.0
Co-benefits	$69.6	$107.1	$487.4	$749.8
Total damage avoidance	$267.8	$6,834.2	$1,874.6	$47,839.8
Control costs	$4.9	$59.7	$64.3	$776.6
Ratio of damage avoidance to control costs	55:1	114:1	29:1	62:1
Net benefits	$262.9	$6,774.5	$1,810.3	$47,063.2

Note: Net benefits are calculated as total damage cost avoidance plus co-benefits minus control costs.
[a] Low estimates are based on $12/tonne for control costs,[17] $37/tonne for damage costs, and $13/tonne for co-benefits.[18]
[b] High estimates are based on $145/tonne for control costs,[19] $1,256/tonne for damage costs, and $20/tonne for co-benefits.

22. Transportation

For the original GPI Atlantic reports on transportation, please see the following:

The GPI Transportation Accounts: Sustainable Transportation in Halifax Regional Municipality (2008)
http://gpiatlantic.org/pdf/transportation/hrmtransportation.pdf

The GPI Transportation Accounts: Sustainable Transportation in Nova Scotia (2006)
http://gpiatlantic.org/pdf/transportation/transportation.pdf

Application of the Genuine Progress Index Approach to Analysing Reduction of Greenhouse Gas Emissions in the Nova Scotia Freight Transport Sector (1999)
http://gpiatlantic.org/pdf/freight/freight.pdf

NOTE: The overall road passenger transportation costs presented in this chapter aggregate costs associated with private automobiles, light trucks (including SUVs, minivans, and pick-up trucks), motorcycles, and buses. Buses account for about 2% of total costs. Therefore, references to "private passenger road transportation costs," "costs of driving," "car costs," etc. in this chapter are actually about 2% lower than the aggregate road transportation costs indicated here. For further detail on how the road transportation costs break down by mode of transport, please refer to Table 68 in the original GPI Transportation Accounts: http://www.gpiatlantic.org/pdf/transportation/transportation.pdf.

Headline Indicators

1. Total road passenger movement
2. Road passenger movement per capita, in Nova Scotia and Canada-wide
3. Total transportation energy use
4. Per capita transportation energy use
5. Total greenhouse gas emissions from transportation
6. Per capita greenhouse gas emissions from transportation, Nova Scotia and Canada-wide
7. Number of fatalities and injuries from road accidents per 100,000 residents, Nova Scotia and Canada-wide
8. Commute modal split
9. Commuting distance
10. Government spending on public transit as percent of total spending on road transportation
11. Road passenger transportation costs
12. Private spending on transportation

22.1. Introduction

Transport activity refers to the movement of people and goods. In this summary chapter, we focus specifically on road transport. Trends in transport activity influence trends in some other key indicators of genuine progress that are assessed in this report, since increases or decreases in road travel can lead to changes in a range of environmental, social, and economic variables. For example, increases in road travel influence total energy demand and may produce increases in greenhouse gas and air pollutant emissions from the transportation sector.

Transport patterns in Canada and Nova Scotia, like those in most developed countries, have become increasingly automobile-dependent, with high levels of per capita vehicle ownership and use, and declining transport options. During the last half-century, transit service has generally declined; homes and businesses have become more dispersed; more neighbourhoods have been built that lack sidewalks; roads and paths have become less connected (with larger blocks and more dead-end streets); and the barrier effect (delay and risk that motor vehicle traffic causes non-motorized modes) has increased, making non-motorized travel more difficult. In addition, alternative modes of transportation have sometimes been stigmatized. The overall effect of these trends—at least in Canada and the U.S.—is that people drive more kilometres each year and spend more money on transportation, while non-drivers have fewer alternative options.

These trends are, in part, a result of various market distortions that encourage private motor vehicle travel—including under-pricing of road and parking facilities, fixed insurance premiums and registration fees that are unrelated to kilometres driven, uncompensated crash risks and damages, un-priced environmental and social impacts, planning and investment practices that favour improvements in private motor vehicle travel, and various land use policies that favour more dispersed development practices. Although individually some of these distortions may seem modest and justified, their impacts are cumulative and synergistic (i.e., total impacts are greater than the sum of individual impacts).

As a result, a significant portion of current motor vehicle travel is economically inefficient. In other words, in a more efficient and equitable market that accounted accurately for the full benefits and costs of different transportation modes, Canadians and Nova Scotians would choose to drive significantly less, rely more on alternative modes of transportation, and be better off overall as a result. The present "economically excessive" private motor vehicle travel—defined here as motor vehicle travel that results from market distortions—contradicts sustainability objectives. As a result, at the margin, and compared with current transport patterns, reductions in private motor vehicle travel are considered to increase sustainability.

In GPI Atlantic's 2006 report, *The GPI Transportation Accounts: Sustainable Transportation in Nova Scotia*[1], a sustainable transportation system was defined as one that:

• (Environment) limits emissions and waste within the planet's ability to absorb them, uses renewable resources at or below their rates of generation, uses non-renewable resources at or

below the rates of development of renewable substitutes, re-uses and recycles its components, and maintains the integrity of ecosystems;
• (Society) meets the basic access needs of society safely and in a manner consistent with human and ecosystem health, including minimizing noise, and promotes equity within and between generations;
• (Economy) is affordable, operates fairly and efficiently, offers choice of transport mode, supports sustainable local, regional, and national economies, and identifies and accounts for the full costs of transportation systems in an equitable manner.

The following chapter provides updates on recent trends for some of the key transportation indicators explored in GPI Atlantic's 2006 report on sustainable transportation in Nova Scotia. These indicators are used to determine if Nova Scotia is making genuine progress towards a sustainable transportation system.

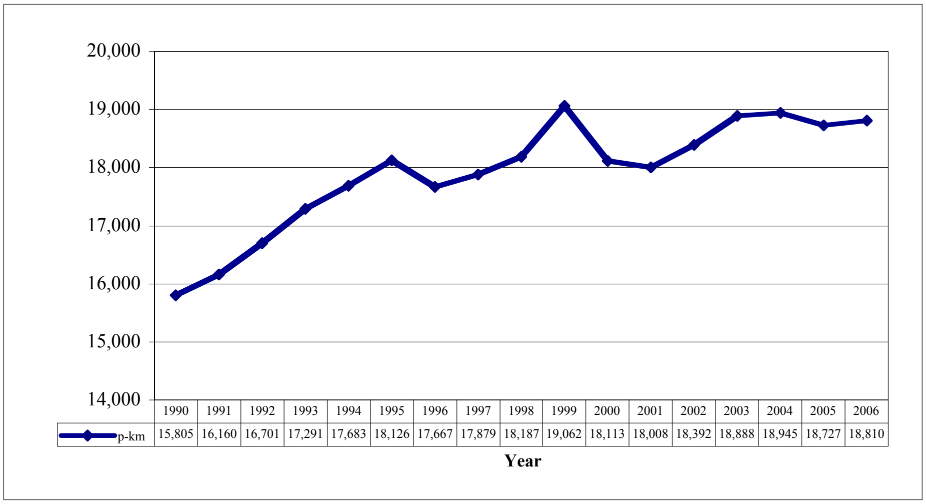
22.2. Total road passenger movement (1990–2006)

Data sources: Natural Resources Canada, 2006 Comprehensive Energy Use Database.

Results: Total road passenger movement has increased by 19% overall since 1990. The use of light trucks (including SUVs and minivans) increased by 65% between 1990 and 2006, while passenger movement by bus decreased by nearly 10% in that same time period.

Total road passenger movement in Nova Scotia increased steadily from 1990 to 1999, then fell off by 6% before resuming its increase in 2002–03. Since then, total road passenger transportation in the province has remained stable, and stood at 18,810 million passenger-kilometres in 2006—up by 19% overall since 1990 (Figure 22-1 below). With only a 2.8% increase in population between 1990 and 2006, it is apparent that Nova Scotians are driving considerably more than they did in the early 1990s.

Figure 22-1. Total road passenger movement (millions of passenger-kilometres), Nova Scotia, 1990–2006



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
p-km	15,805	16,160	16,701	17,291	17,683	18,126	17,667	17,879	18,187	19,062	18,113	18,008	18,392	18,888	18,945	18,727	18,810

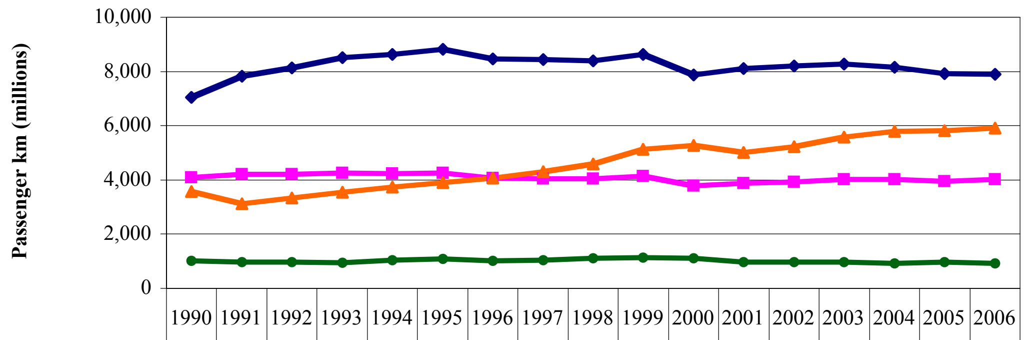
Source: Passenger-kms are from Natural Resources Canada *2006 Comprehensive Energy Use Database* – Nova Scotia, Table 12.[2]

Given the environmental, social, and economic impacts associated with road travel (to be discussed in the following sections), this steady increase in passenger travel since 1990 is of concern when assessing the Province's genuine progress towards a sustainable transportation system.

Figure 22-2 belowd shows the trends in road passenger movement for different vehicle classes in Nova Scotia between 1990 and 2006. In 2006, light trucks (including SUVs and minivans) accounted for nearly 32% of all passenger movement (up from 23% in 1990); small cars for 42%, large cars for 21%, and buses for just less than 5%. The use of light trucks has increased by over 65% since 1990; large car use has remained stable; small car use increased by 25% from 1990 to 1995 and has declined by 10% since then; and the use of buses has decreased by nearly 10%.

The sharply increased use of fuel-inefficient light trucks, including SUVs and minivans, and the decline in public transit use reflect movement away from sustainability.

Figure 22-2. Total road passenger movement by vehicle type (millions of passenger kilometres), Nova Scotia, 1990–2006



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Small Car	7,053	7,815	8,142	8,499	8,623	8,810	8,456	8,429	8,391	8,621	7,875	8,103	8,204	8,275	8,159	7,922	7,889
Large Car	4,085	4,198	4,203	4,253	4,232	4,262	4,068	4,054	4,034	4,135	3,779	3,881	3,936	4,023	4,020	3,957	4,009
Truck	3,575	3,113	3,332	3,538	3,729	3,908	4,076	4,295	4,585	5,119	5,280	5,002	5,217	5,579	5,785	5,809	5,908
Buses	1,011	967	961	941	1,041	1,090	1,006	1,051	1,112	1,135	1,117	969	974	957	915	960	915

Source: Passenger kms are from Natural Resources Canada, *2006 Comprehensive Energy Use Database*—Nova Scotia, Tables 21, 22, 24, and 35.

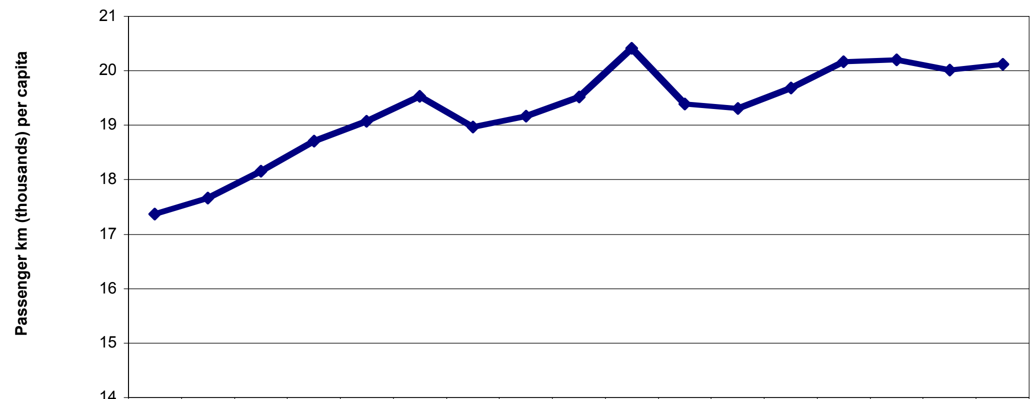
22.3. Road passenger movement per capita, Nova Scotia and Canada-wide

Data sources: Natural Resources Canada, *2006 Comprehensive Energy Use Database*; Statistics Canada, CANSIM table 051-0001.

Results: Per capita road passenger movement in Nova Scotia has increased by 16% overall since 1990, and in 2006 was the third highest in Canada after PEI and New Brunswick. Per capita road travel using light trucks (including SUVs and minivans) increased by 61% between 1990 and 2006, while per capita passenger movement by bus decreased by nearly 12% in that same time period.

On a per capita basis, Nova Scotia's road passenger movement peaked in 1999 at 20,400 passenger kilometres per person. Following a sharp decrease in 2000, per capita road travel increased again in 2002–03, and has remained stable since then, reaching 20,100 passenger kilometres in 2006—up by 16% from 1990 (Figure 22-3 below). In 2006, Nova Scotia's per capita rate of road travel was third highest in Canada after PEI and New Brunswick—nearly 26% higher than the national average of 16,000 passenger-kilometres per person, and 53% higher than in Manitoba and B.C. (13,100) (Figure 22-4 below).

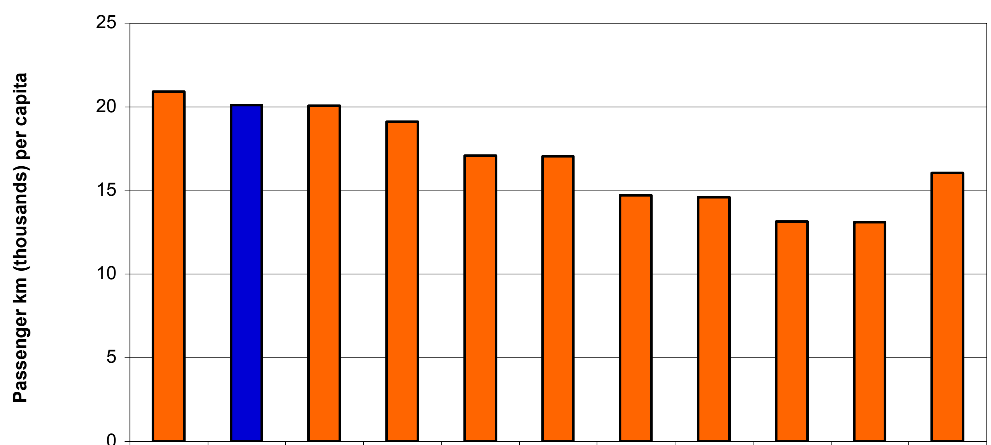
Figure 22-3. Road passenger movement per capita (thousands of passenger kilometres), Nova Scotia, 1990–2006



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
p-km (x1000)	17.4	17.7	18.2	18.7	19.1	19.5	19.0	19.2	19.5	20.4	19.4	19.3	19.7	20.2	20.2	20.0	20.1

Source: Passenger kms are from Natural Resources Canada, *2006 Comprehensive Energy Use Database*—Nova Scotia, Table 12. Population estimates are from CANSIM Table 051-0001.

Figure 22-4. Road passenger movement per capita by province (thousands of passenger-kilometres), Canada, 2006

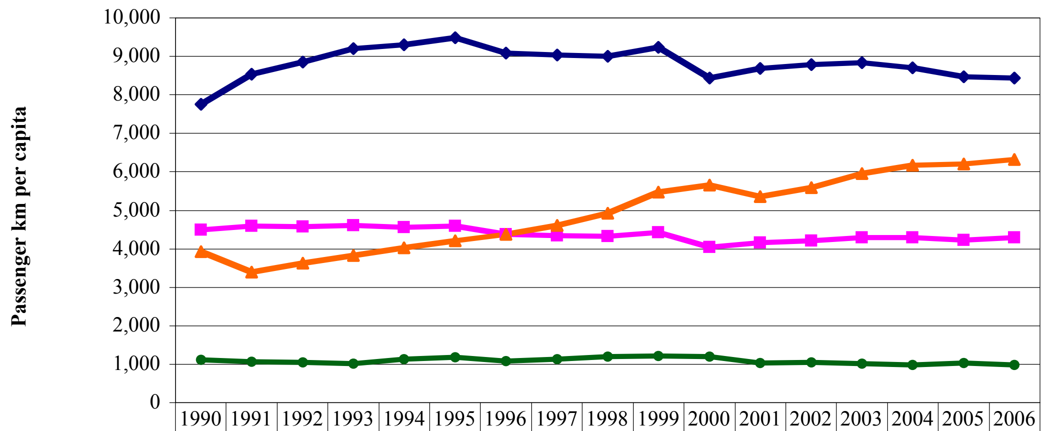


	PEI	NS	NB	SK	ON	AB	QC	NF	MB	BC and Terr	Canada
p-km (x1000)	20.9	20.1	20.1	19.1	17.1	17.0	14.7	14.6	13.1	13.1	16.0

Source: Passenger kms are from Natural Resources Canada *2006 Comprehensive Energy Use Database*—Nova Scotia, Table 12, and Canada, Table 12. Population estimates are from CANSIM Table 051-0001.

Although the average Nova Scotian is still travelling more by road than in 1990, it is the mode of travel that indicates the greatest movement away from sustainability. There has been a nearly 61% increase in passenger-km travel per capita for fuel-inefficient light trucks (including pick-ups, SUVS, and minivans), while passenger-km per capita for small cars has declined since peaking in 1995, and per capita passenger-km for bus travel has declined by nearly 12% since 1990 (Figure 22-5 below).

Figure 22-5. **Road passenger movement per capita by vehicle type (thousands of passenger-kilometres), Nova Scotia, 1990–2006**



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Small Car	7,754	8,540	8,854	9,198	9,302	9,491	9,078	9,039	9,004	9,231	8,432	8,691	8,779	8,836	8,699	8,464	8,437
Large Car	4,491	4,587	4,571	4,603	4,565	4,592	4,368	4,348	4,329	4,428	4,047	4,162	4,212	4,296	4,285	4,228	4,287
Trucks	3,930	3,401	3,624	3,829	4,023	4,210	4,376	4,606	4,920	5,481	5,654	5,364	5,583	5,957	6,167	6,206	6,318
Buses	1,111	1,057	1,045	1,018	1,124	1,174	1,081	1,128	1,193	1,215	1,196	1,040	1,042	1,022	976	1,025	978

Source: Passenger-kms are from Natural Resources Canada, *2006 Comprehensive Energy Use Database*—Nova Scotia, Tables 21, 22, 24, and 35. Population estimates are from CANSIM Table 051-0001.

22.4. Total transportation energy use

Data sources: Natural Resources Canada, *2006 Comprehensive Energy Use Database*

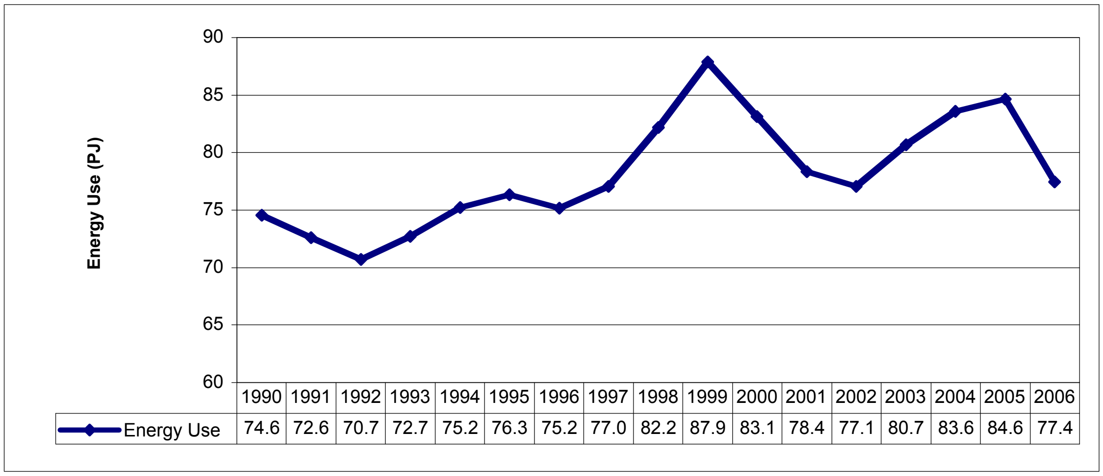
Results: Total transportation energy use in Nova Scotia has fluctuated—increasing steadily through the 1990s, then declining to 2002, increasing again to 2005, and dropping off by nearly 9% between 2005 and 2006. Energy use by off-road vehicles has increased by 170% since 1990.

Transportation is the world's fastest growing form of energy use, accounting for nearly 30% of global energy demand and 95% of the planet's oil consumption.[3] This reliance on oil is particularly unsustainable due to the ongoing depletion of petroleum reserves and the predicted imminent advent of "peak oil" (when demand will exceed supply), and because the combustion of fossil fuels is linked with significant environmental damages, including climate change and emissions of air pollutants. In order to move toward sustainability, Nova Scotia's transportation sector needs to decrease its energy use.

Total transportation energy use in Nova Scotia declined by nearly 9% between 2005 and 2006 after three years of steady increases between 2002 and 2005 (Figure 22-6 below). In 2006, transportation energy use was up approximately 4% from 1990 levels, but down by nearly 12% since the peak of 87.9 PJ in 1999.

The peak in transportation energy use in Nova Scotia in 1999 partly reflects activities related to the Sable Island Offshore Energy Project (SOEP)—which developed an offshore natural gas pipeline. The sheer size of that project (which cost over $4 billion) increased transportation energy demand significantly, particularly for freight shipments of building materials by road, rail, and marine transport. The project spanned the period from 1997 through 2000 and construction peaked in 1999, with this peak mirroring energy use trends particularly for truck and marine freight.[4] Overall transportation energy use also peaked in Canada in 1999, so the Sable Island gas development is certainly not the whole explanation for the Nova Scotia peak in that year.

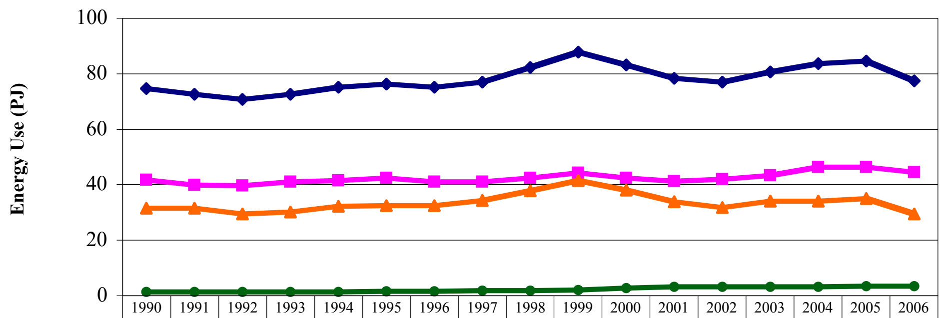
Figure 22-6. Total transportation energy use (petajoules (PJ)), Nova Scotia, 1990–2006



Source: Transportation energy use is from Natural Resources Canada, *2006 Comprehensive Energy Use Database*—Nova Scotia, Table 7.

Energy use by passenger vehicles has increased by 4% since 1990, while freight transport energy use has declined by nearly 7% since 1990 (Figure 22-7 below). Energy use by off-road vehicles has increased by 170% since 1990. The rise in off-road transport, which includes All-Terrain Vehicles (ATV's, or "dune buggies"), snowmobiles, and amphibious vehicles, has particular implications for sustainability, as ATV use in particular has been shown to be detrimental to wildlife habitat. In Nova Scotia, a heated controversy has arisen about the uncontrolled use of ATVs in the countryside. The most common complaints have been about safety, particularly with respect to use by minors, and about noise pollution. In Nova Scotia, ATV accidents have increased dramatically, rising by 63% between 1996 and 2002 alone.[5]

Figure 22-7. Total transportation energy use by transport function (petajoules (PJ)), Nova Scotia, 1990–2006



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Total	74.6	72.6	70.7	72.7	75.2	76.3	75.2	77.0	82.2	87.9	83.1	78.4	77.1	80.7	83.6	84.6	77.4
Passenger	41.7	39.8	39.7	41.1	41.5	42.4	41.1	40.9	42.4	44.3	42.4	41.3	42.0	43.3	46.2	46.2	44.5
Freight	31.6	31.5	29.6	30.2	32.3	32.4	32.5	34.3	37.8	41.5	37.9	33.9	31.7	34.2	34.0	35.0	29.5
Off-Road	1.3	1.3	1.4	1.4	1.5	1.5	1.7	1.8	1.9	2.2	2.8	3.2	3.3	3.2	3.3	3.4	3.5

Source: Transportation energy use is from Natural Resources Canada *2006 Comprehensive Energy Use Database*—Nova Scotia, Table 7.

22.5. Per capita transportation energy use (1990–2006)

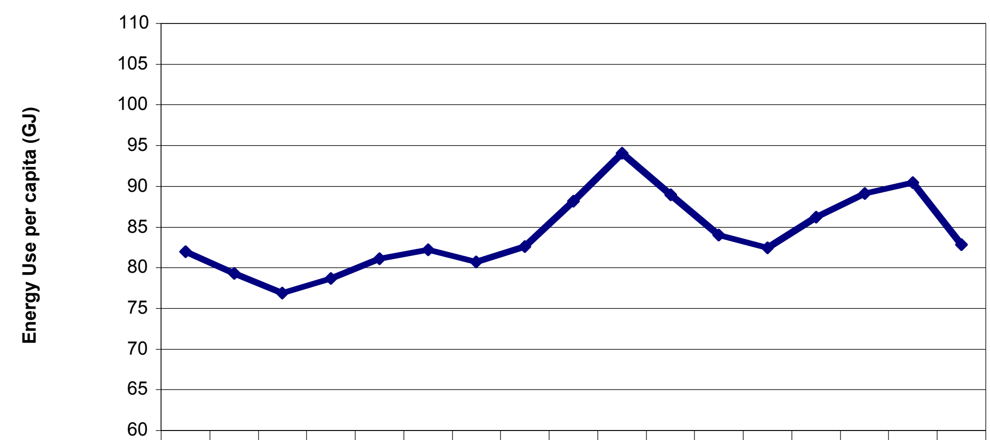
Data sources: Natural Resources Canada, *2006 Comprehensive Energy Use Database*; Statistics Canada, CANSIM table 051-0001.

Results: Per capita transportation energy use declined by 8.4% between 2005 and 2006 after increasing by 10% from 2002 to 2005. Nova Scotia's per capita transportation energy use (82.8 GJ) was the 6th highest in the country and 8.5% above the national average.

On a per capita basis, transportation energy use in Nova Scotia decreased by just over 8% between 2005 and 2006, falling from 90.4 to 82.8 GJ per person (Figure 22-8 below). This decline followed a period of steady increase in per capita transportation energy use between 2002 and 2005, so that 2006 levels remained marginally higher than in 2002 (82.5 GJ). Per capita transportation energy use in 2006 also stood just marginally higher than in 1990 (82 GJ) and the mid-1990s. Per capita transportation energy use in Nova Scotia peaked in 1999, in part due to the transport energy demands of the massive $4 billion Sable Island Offshore Energy Project, as noted above.

Nova Scotia's 2006 per capita transportation energy use ranks 6th highest in Canada—nearly 9% above the national average of 76.3 GJ per person, a third more than Quebec (62 GJ), but well below oil-producing Alberta (120 GJ) and Saskatchewan (104.9 GJ)   (Figure 22-9 below).

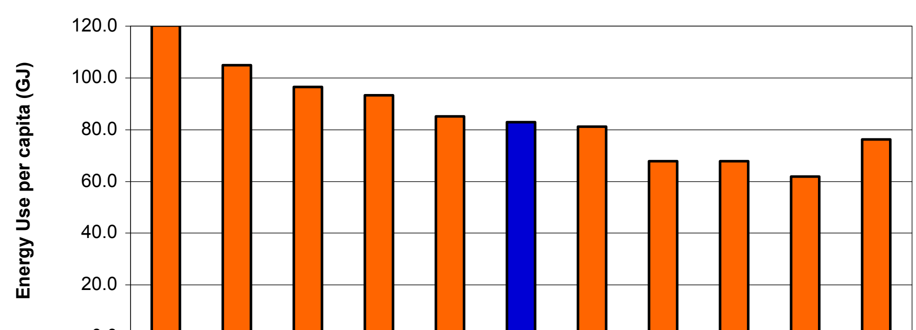
Figure 22-8. Transportation energy use per capita (gigajoules (GJ)), Nova Scotia, 1990–2006



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Energy Use	82.0	79.3	76.9	78.7	81.1	82.2	80.7	82.6	88.2	94.1	89.0	84.0	82.5	86.2	89.1	90.4	82.8

Source: Transportation energy use is from Natural Resources Canada *2006 Comprehensive Energy Use Database* — Nova Scotia, Table 7. Population estimates are from CANSIM Table 051-0001.

Figure 22-9. Transportation energy use per capita by province (gigajoules (GJ)), Canada, 2006



	Alta.	Sask.	Nfld.	N.B.	P.E.I.	N.S.	B.C. and Terr.	Ont.	Man.	Que.	Canada
Energy Use	120.1	104.9	96.5	93.2	85.0	82.8	81.2	67.9	67.8	62.0	76.3

Source: Transportation energy use is from Natural Resources Canada *2006 Comprehensive Energy Use Database*—Provinces, Table 7, and Canada, Table 7. Population estimates are from CANSIM Table 051-0001.

22.6. Total greenhouse gas emissions from transportation (1990–2006)

Data sources: Environment Canada, *National Inventory Report 1990–2006: Greenhouse Gas Sources and Sinks in Canada*

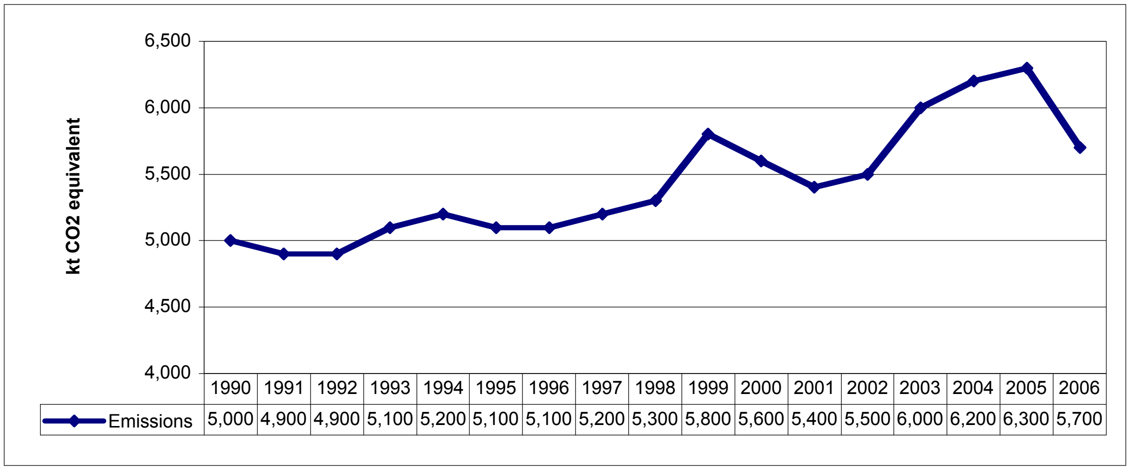
Results: Greenhouse gas emissions from Nova Scotia's transport sector declined by nearly 10% between 2005 and 2006, but remained 14% higher than 1990 levels. Road transportation accounted for 68% of transport-related GHG emissions in the province in 2006. The share of transport-related GHG emissions from light trucks (including SUVs and minivans) has increased sharply—from 14% of all transport emissions in 1990 to 23% in 2006.

One of the key environmental impacts linked with the combustion of fossil fuels in the transportation sector is the release of GHG emissions into the atmosphere, which in turn contributes to global climate change. Based on the GPI Atlantic definition of sustainable transportation above, a reduction in transport-related GHG emissions represents genuine progress and a move towards sustainability.

After increasing steadily since the early 1990s, greenhouse gas emissions from Nova Scotia's transportation sector declined by nearly 10% in 2006 from their 2005 peak, when they stood at 26% above 1990 levels. Nova Scotia's transport-related GHG emissions in 2006 are still 14% higher than in 1990, despite Canada's Kyoto commitment to reduce overall GHG emissions to 6% below 1990 levels by 2008–2012 (Figure 22-10 below).

Analysis in Environment Canada's most recent GHG inventory report shows that the decline in Nova Scotia's overall GHG emissions from 2005 to 2006 was largely the result of particular indirect changes in energy supply and demand, rather than being attributable to more generalized conservation and efficiency measures.[6] In the transportation sector, the closure of Stora-Enso's Port Hawkesbury pulp and paper mill and decreased off-road and marine transportation activity resulting from the final decommissioning of the Cohasset Offshore Oil Project together resulted in a significant decline in overall energy demand in the province, and partially explain the sharp decline in emissions in 2006.

Figure 22-10. Total greenhouse gas emissions from transportation (kt CO_2 equivalents), Nova Scotia, 1990–2006



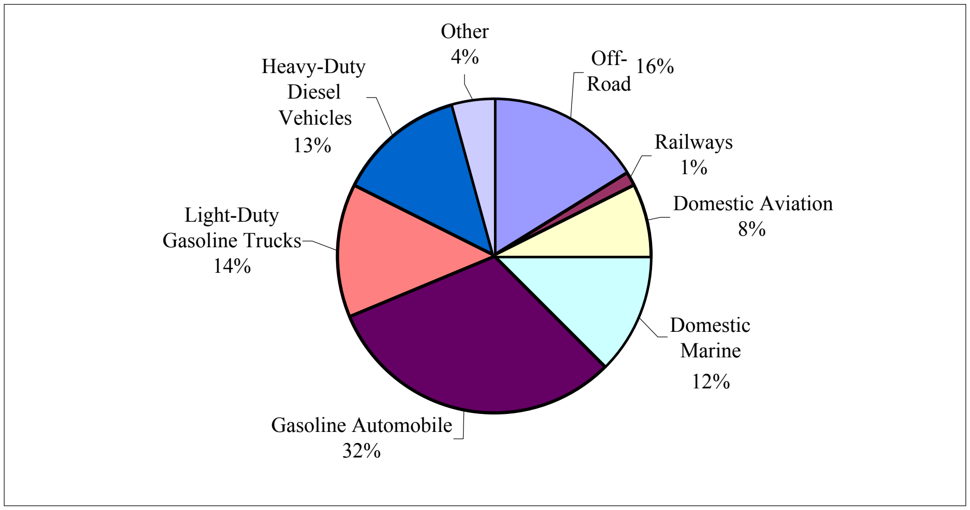
Source: GHG emissions are from Environment Canada *National Inventory Report 1990–2006: Greenhouse Gas Sources and Sinks in Canada* Annex 11, table A11-6.

Road transportation was the primary contributor of transport-related GHG emissions in Nova Scotia in 2006, contributing 68% of transport-related emissions (Figure 22-12 below). The second largest contributor was off-road vehicles, which at 12%, exceeded the emissions of domestic marine transportation (10%), aviation (8%), and rail (2%).

Comparisons with the 1990 modal breakdown reveal that while road transport accounted for a similar percentage of transport-related GHG emissions in 2006, trends *within* the road transport sector have changed significantly. GHG emissions from gasoline automobiles fell sharply from 32% of total transport-related emissions in 1990 to 22% in 2006, while emissions from light trucks (including SUVs and minivans) jumped from 14% of transport-related emissions in 1990 to 23% in 2006—reflecting the consumer trend toward SUVs and larger, less fuel-efficient passenger vehicles. Significantly, GHG emissions from light trucks, SUVs, and minivans now exceed emissions from cars in Nova Scotia. Emissions from heavy-duty diesel trucks increased from 13% to 19% of transport-related GHG emissions in the province (Figures 22-11 and 22-12 below).

It is apparent from these statistics that the Nova Scotian transportation sector is moving away from sustainability in terms of the GHG emissions indicators. Overall levels of GHG emissions from the transportation sector have increased steadily since 1990 and currently remain 14% higher than in 1990. Nova Scotia has committed to reducing its overall GHG emissions to levels at least 10% below 1990 emissions by 2020. Since the 2005–2006 decline in Nova Scotia's transport-related GHG emissions was largely due to indirect changes in supply and demand, significant improvements in energy efficiency and conservation, and shifts to active forms of transportation and use of public transit will be required for the province to fulfil its commitments and meet its own emission targets.

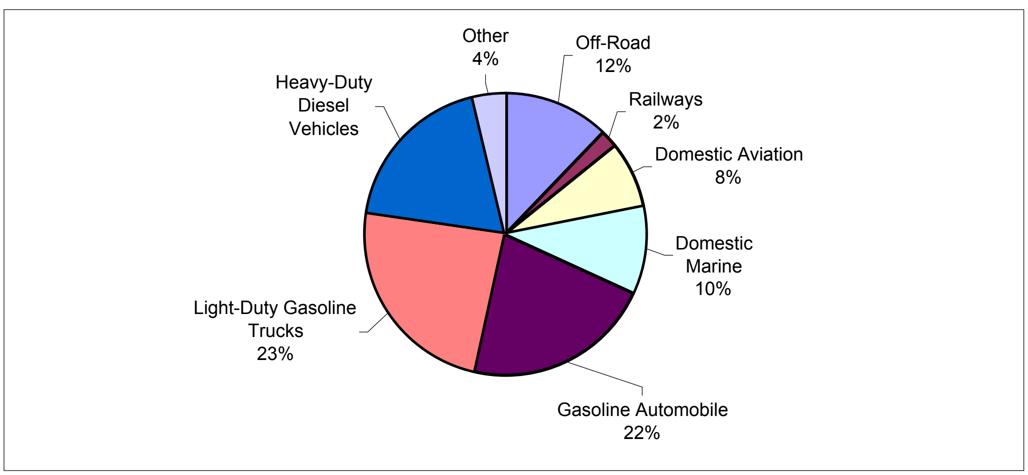
Figure 22-11. Total greenhouse gas emissions from transportation by mode and vehicle type, Nova Scotia, 1990



Source: GHG emissions are from Environment Canada *National Inventory Report 1990–2006: Greenhouse Gas Sources and Sinks in Canada* Annex 11, table A11-6.

Note: The category of "Other" denotes heavy-duty gasoline vehicles, diesel automobiles, light-duty diesel trucks, motorcycles, and propane and natural gas vehicles.

Figure 22-12. Total greenhouse gas emissions from transportation by mode and vehicle type, Nova Scotia, 2006



Source: GHG emissions are from Environment Canada *National Inventory Report 1990–2006: Greenhouse Gas Sources and Sinks in Canada* Annex 11, table A11-6.

Note: The category of "Other" denotes heavy-duty gasoline vehicles, diesel automobiles, light-duty diesel trucks, motorcycles, and propane and natural gas vehicles.

22.7. Per capita greenhouse gas emissions from transportation (1990–2006)

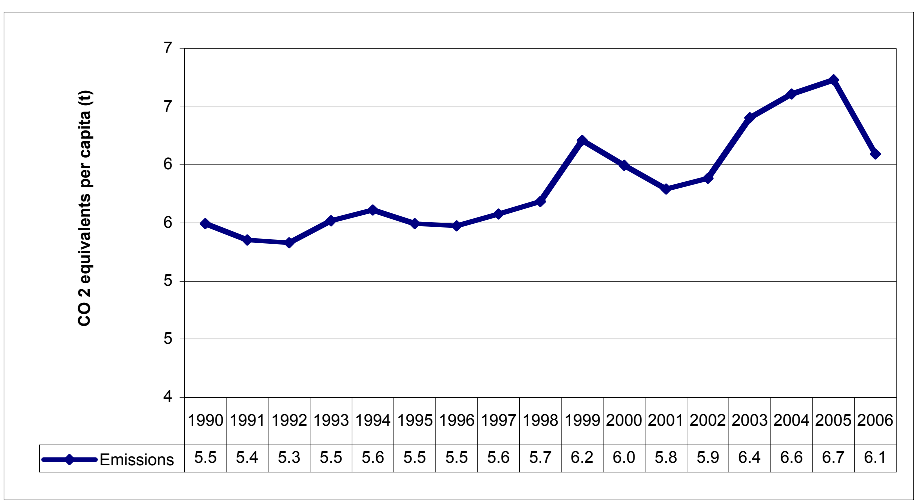
Data sources: Environment Canada, *National Inventory Report 1990–2006: Greenhouse Gas Sources and Sinks in Canada*; Statistics Canada, CANSIM table 051-0001.

Results: Per capita GHG emissions from transportation in Nova Scotia fell by 9% from 2005 to 2006, but still remain nearly 11% higher than in 1990. Among the provinces, Nova Scotia had the 7th highest per capita GHG emissions from transportation in the country.

Nova Scotia's per capita GHG emissions from transportation fell by 9% between 2005 and 2006, after peaking at 6.7 tonnes of CO_2 equivalent emissions per Nova Scotian in 2005. At 6.1 tonnes per person in 2006, Nova Scotia's per capita GHG emissions from transportation were still 11% higher than in 1990 (Figure 22-13 below).

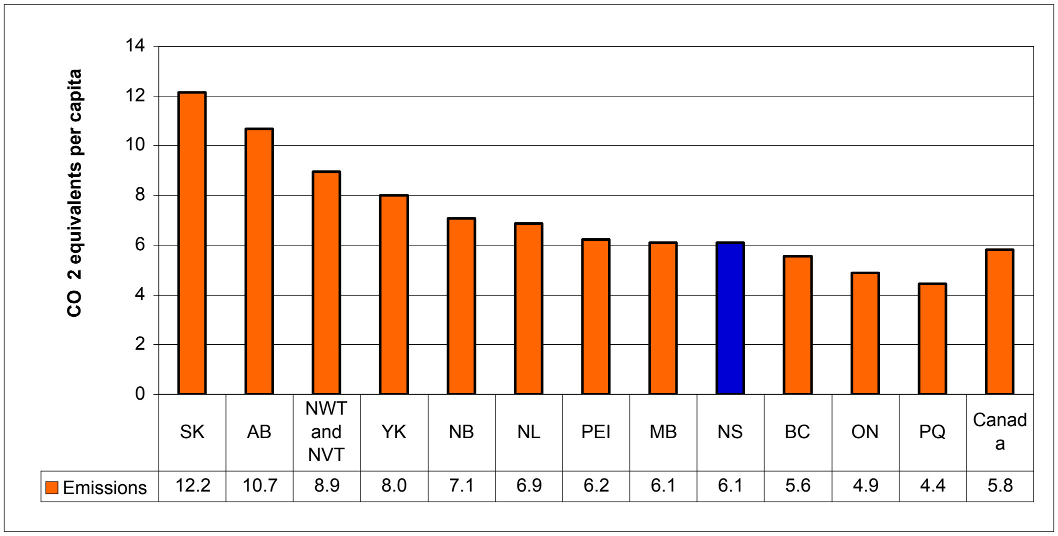
Among the provinces, Nova Scotia had the 7th highest level of per capita GHG emissions from transportation in the country in 2006 (6.1%)—half the level of oil-producing Saskatchewan (12.2 tonnes per person) and 43% below Alberta (10.7), but still 5% higher than the national average (5.8) and 39% above Quebec (4.4) (Figure 22-14 below).

Figure 22-13. Greenhouse gas emissions from transportation per capita (tonnes CO_2 equivalents), Nova Scotia, 1990–2006



Source: GHG emissions are from Environment Canada *National Inventory Report 1990–2006: Greenhouse Gas Sources and Sinks in Canada* Annex 11, table A11-6. Population estimates are from CANSIM Table 051-0001.

Figure 22-14. Greenhouse gas emissions from transportation per capita by province (tonnes CO_2 equivalents), Canada, 2006



Source: GHG emissions are from Environment Canada *National Inventory Report 1990–2006: Greenhouse Gas Sources and Sinks in Canada*, Annex 11. Population estimates are from CANSIM Table 051-0001.

22.8. Fatalities and injuries from road accidents (1990–2005)

Data sources: Nova Scotia Department of Transportation and Infrastructure Renewal, 2005 Motor Vehicle Collision Statistics.

Results: The total number of injuries and fatalities from road transportation declined by 11% and 52% respectively between 1990 and 2005. In 2005, traffic injuries per 100,000 residents in Nova Scotia were 20% below the national average, and traffic fatalities per 100,000 residents were 15% below the national average.

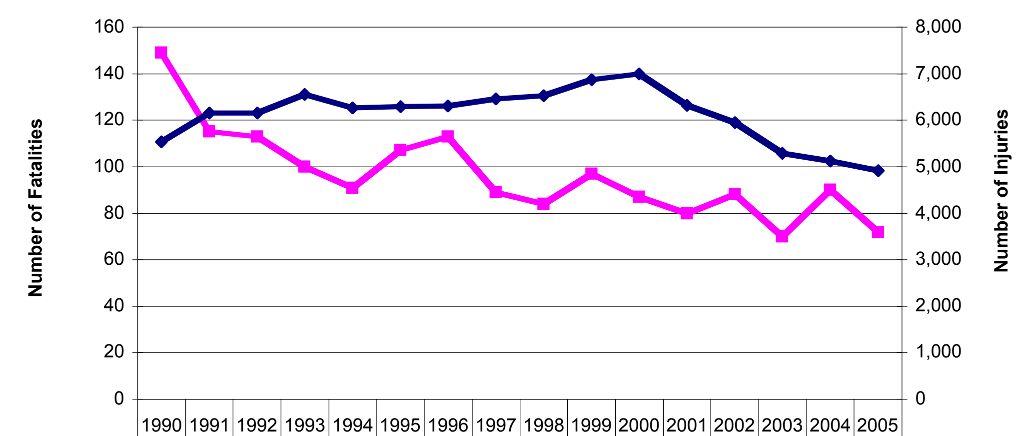
Transport accidents are a leading cause of disability and death. Because they tend to kill and injure people at a much younger age than most major medical risks, they are a leading cause of potential years of life lost. Traffic accidents also impose economic costs, including property damage, medical and rehabilitation costs, disability compensation payments, and lost productivity.[7] Movement toward a sustainable transportation system therefore includes reductions in the number of transport accidents and in associated social and economic costs.

The number of casualties from road accidents in Canada has been steadily declining since the early 1990s. Nationwide, injuries are down nearly 19% since 1990, and fatalities are down nearly 33%.[8] Nova Scotia has seen a sharp decline in fatalities since 1990 and in injuries since 2000.

The recent decline in injuries follows several years of increases in the number of injuries between 1993 and 2000. Overall, between 1990 and 2005, injuries from road accidents in Nova Scotia declined by about 11% and fatalities declined by about 52% (Figure 22-15 below). Per capita declines were 14% for injuries and 53% for fatalities. These declines reflect genuine progress in transportation safety.

Among the Canadian provinces, Nova Scotia had the second fewest traffic fatalities and injuries per 100,000 residents in the country in 2005—15% below the national average for fatalities, and nearly 20% below the national average for traffic injuries (Figures 22-16 to 22-18 below).

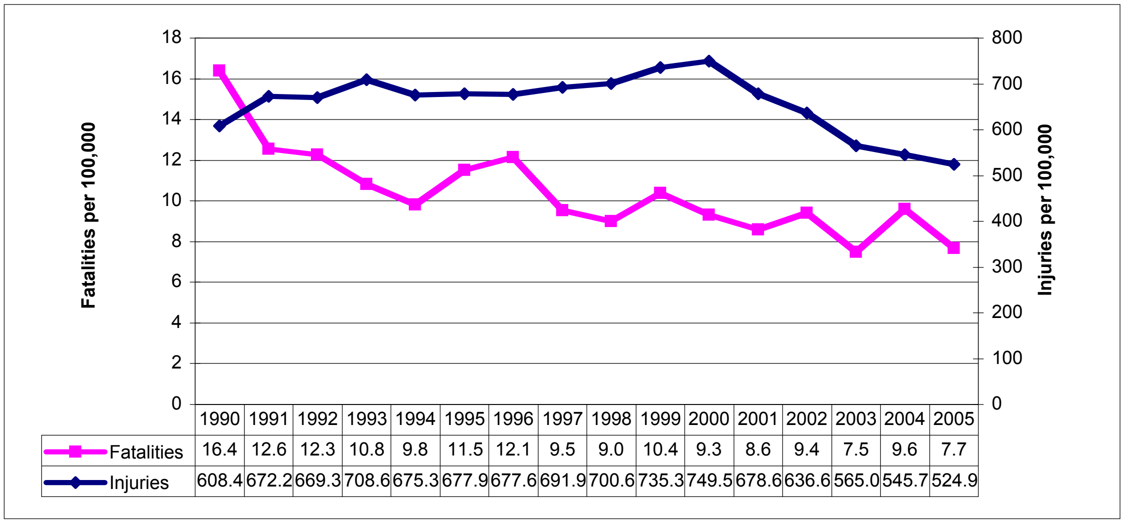
Figure 22-15. Total number of fatalities and injuries from road accidents, Nova Scotia, 1990–2005



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Fatalities	149	115	113	100	91	107	113	89	84	97	87	80	88	70	90	72
Injuries	5,534	6,151	6,155	6,548	6,260	6,292	6,311	6,452	6,529	6,867	6,999	6,327	5,949	5,291	5,118	4,913

Source: Nova Scotia Department of Transportation and Infrastructure Renewal *2005 Motor Vehicle Collision Statistics*.

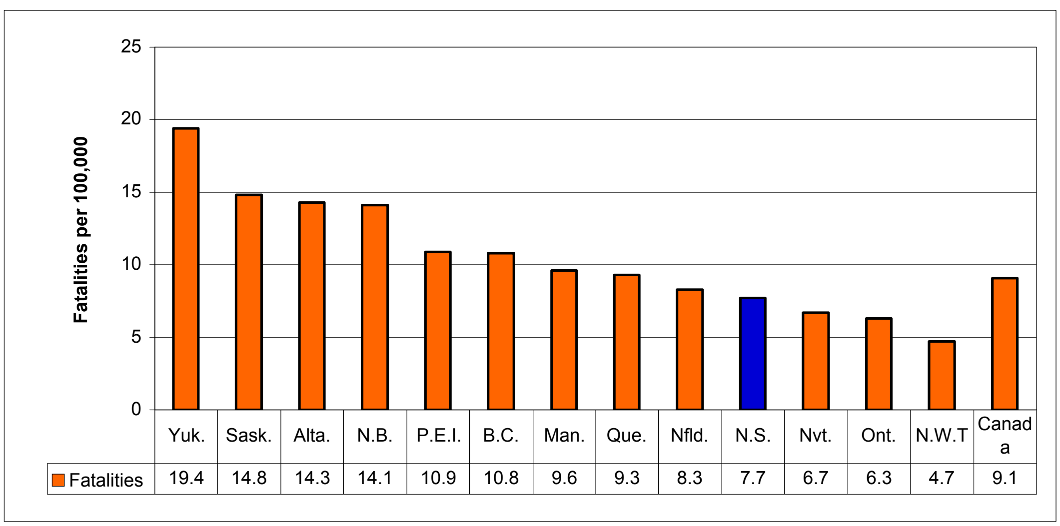
Figure 22-16. Number of fatalities and injuries from road accidents per 100,000 residents, Nova Scotia, 1990–2005



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Fatalities	16.4	12.6	12.3	10.8	9.8	11.5	12.1	9.5	9.0	10.4	9.3	8.6	9.4	7.5	9.6	7.7
Injuries	608.4	672.2	669.3	708.6	675.3	677.9	677.6	691.9	700.6	735.3	749.5	678.6	636.6	565.0	545.7	524.9

Source: Accident statistics are from the Nova Scotia Department of Transportation and Infrastructure Renewal *2005 Motor Vehicle Collision Statistics*. Population estimates are from CANSIM Table 051-0001.

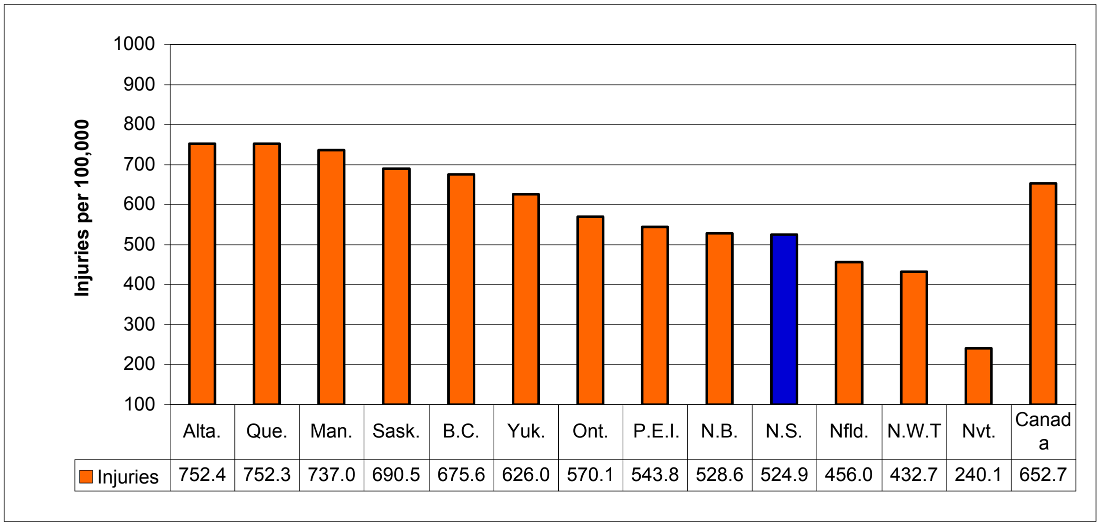
Figure 22-17. Number of fatalities from road accidents per 100,000 by province, Canada, 2005



	Yuk.	Sask.	Alta.	N.B.	P.E.I.	B.C.	Man.	Que.	Nfld.	N.S.	Nvt.	Ont.	N.W.T	Canada
Fatalities	19.4	14.8	14.3	14.1	10.9	10.8	9.6	9.3	8.3	7.7	6.7	6.3	4.7	9.1

Source: Nova Scotia accident statistics are from the Nova Scotia Department of Transportation and Infrastructure Renewal *2005 Motor Vehicle Collision Statistics*. Other accident statistics are from Transport Canada—*2005 Canadian Motor Vehicle Traffic Collision Statistics*. Population estimates are from CANSIM Table 051-0001.

Figure 22-18. Number of injuries from road accidents per 100,000, by province, Canada, 2005



Source: Nova Scotia accident statistics are from the Nova Scotia Department of Transportation and Infrastructure Renewal *2005 Motor Vehicle Collision Statistics*. Other accident statistics are from Transport Canada—*2005 Canadian Motor Vehicle Traffic Collision Statistics*. Population estimates are from CANSIM Table 051-0001.

22.9. Commute modal split (1996, 2001, 2006)

Data sources: Statistics Canada, Census 2006; GPI Atlantic, *The GPI Transportation Accounts: Sustainable Transportation in Nova Scotia* (based on 1996 and 2001 Census statistics)

Results: Since 1996, about 84% of commuters in Nova Scotia have travelled to work in an automobile—the vast majority of them alone. Fewer than 15% of Nova Scotians used public transit or a form of active transportation to get to work in 2006, while only 11% carpooled.

Commute mode split refers to the form of transportation used by people to travel to work or school. According to the definition of sustainable transportation above, this study considers increases in the portion of commuting by alternative modes (walking, bicycling, ridesharing, and public transit) to reflect progress towards sustainability, since such increases indicate a more diverse and environmentally benign transportation system and more accessible land use patterns that tend to increase transportation system efficiency and equity. Increased use of alternative modes tends to:

- Reduce traffic congestion, which in turn improves quality of life, reduces business costs, and makes cities more competitive and attractive.

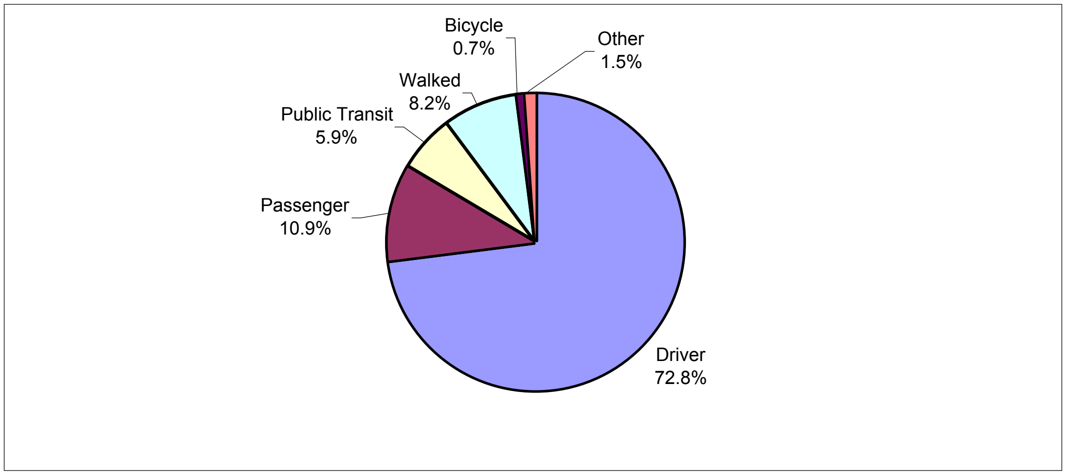
- Improve air quality and consequently reduce respiratory illness due to pollution.
- Abate other environmental impacts, including climate change, natural resource depletion, and water and solid waste pollution, all of which are associated with growth in automobile traffic.
- Increase physical activity and health. Transit travel also tends to increase the amount of time people spend walking, thereby improving public health, and provides a safer alternative to car travel, thus reducing automobile accidents.[9]

In 2006, nearly 84% of commuters in Nova Scotia travelled to work by automobile. Nearly 87% of those commuters were drivers and 13% were passengers. Fewer than 9% of Nova Scotians got to work using active modes of transportation in 2006—8.2% by walking and 0.7% by bicycling, and only 5.9% of commuters used public transit (Figure 22-19 below).

A comparison of 1996, 2001, and 2006 Census data on commuting shows only very marginal changes over time. The share of commuters walking or bicycling from 1996-2006 remained virtually unchanged at 9%, while public transit use only increased from 5.1% to 5.9% over that same time frame. The share of commuters using automobiles to get to and from work remained relatively constant at about 84%, and car-pooling only increased from 10.2% to 10.8% of commuters. The proportion of drivers fell marginally from 74.3% of all commuters in 1996 to 72.8% in 2006 (Figure 22-20 below).

Changes in commute mode split over the decade are inadequate to denote movement towards a more sustainable transportation system.

Figure 22-19. Transportation to work by modal share (percentage of all commuters), Nova Scotia, 2006

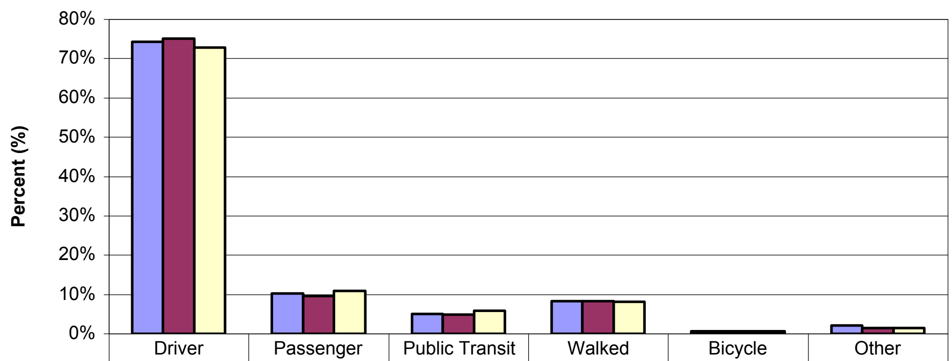


Source: Statistics Canada Census 2006, catalogue #97-561-XWE200610.

Note: “Other” includes commuting to work by motorcycle, taxi, and other modes not listed.

Figure 22-20. Transportation to work by modal share (percentage of all commuters), Nova Scotia, 1996–2006

Sources: Statistics Canada Census 2006, catalogue #97-561-XWE200610; GPI Atlantic, *The GPI Transportation*



	Driver	Passenger	Public Transit	Walked	Bicycle	Other
1996	74.3%	10.2%	5.1%	8.3%	0.7%	2.1%
2001	75.2%	9.6%	4.8%	8.3%	0.6%	1.5%
2006	72.8%	10.8%	5.9%	8.2%	0.7%	1.5%

Accounts: Sustainable Transportation in Nova Scotia.

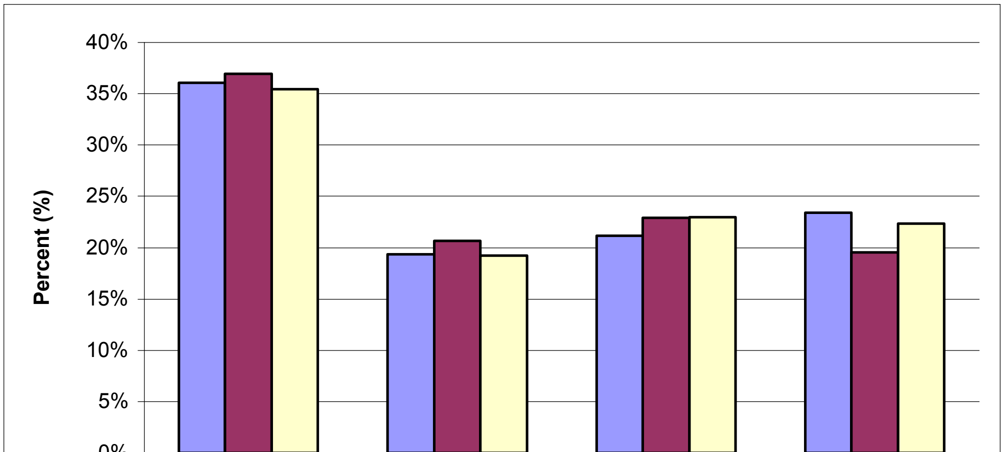
Note: "Other" includes commuting to work by motorcycle, taxi, and other modes not listed.

22.10. Commuting distance (1996, 2001, 2006)

In 2006, nearly 55% of all Nova Scotia commutes where under 10 km—down marginally from 1996 and 2001. The number of medium distance commutes (10–20 km) remained virtually unchanged from 2001 to 2006 at 23% of all commutes—an increase from 21% in 1996. The number of long commutes of 20 km or more increased by 2.8 percentage points from 2001 to 2006, though it remains marginally below 1996 levels (23.4%) (Figure 22-21 below).

Nova Scotia had the second highest rate in the country of commuters travelling 20 km or more to work each day—22.3% versus the national average of 19.4% (Figure 22-22 below).

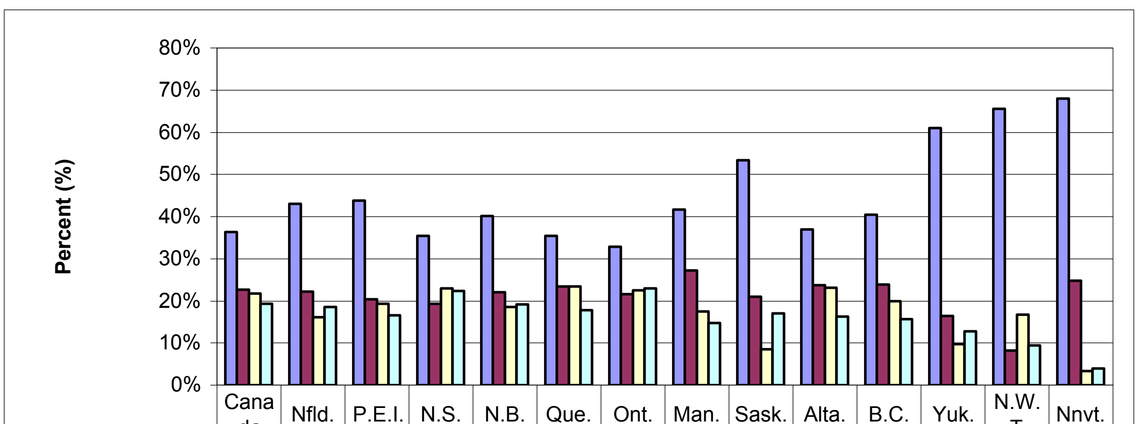
Figure 22-21. Average commuting distances, as a percentage of total commutes, Nova Scotia, 1996–2006



	< 5 km	5 - 9.9 km	10 - 19.9 km	20+ km
1996	36.1%	19.4%	21.2%	23.4%
2001	36.9%	20.6%	22.9%	19.5%
2006	35.4%	19.2%	23.0%	22.3%

Sources: Statistics Canada Census 2006, catalogue #97-561-XWE200610; GPI Atlantic*, The GPI Transportation Accounts: Sustainable Transportation in Nova Scotia.*

Figure 22-22. Average commuting distances by province and territory, as a percentage of total commutes, Canada, 2006



	Canada	Nfld.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Yuk.	N.W.T	Nnvt.
< 5 km	36.3%	43.1%	43.8%	35.4%	40.2%	35.4%	32.8%	41.6%	53.5%	36.9%	40.5%	61.1%	65.6%	68.0%
5 - 9.9 km	22.7%	22.2%	20.4%	19.2%	22.1%	23.4%	21.6%	27.2%	20.9%	23.7%	23.8%	16.4%	8.3%	24.9%
10 - 19.9 km	21.7%	16.1%	19.2%	23.0%	18.6%	23.4%	22.5%	17.5%	8.6%	23.1%	20.0%	9.7%	16.8%	3.3%
20+ km	19.4%	18.6%	16.6%	22.3%	19.1%	17.8%	23.0%	14.7%	17.1%	16.3%	15.7%	12.8%	9.4%	3.9%

Source: Statistics Canada Census 2006, catalogue #97-561-XWE200610.

22.11. Government spending on public transit (1990–2006)

Data sources: Transport Canada, Transportation in Canada 2006; Statistics Canada, CANSIM table 051-0001.

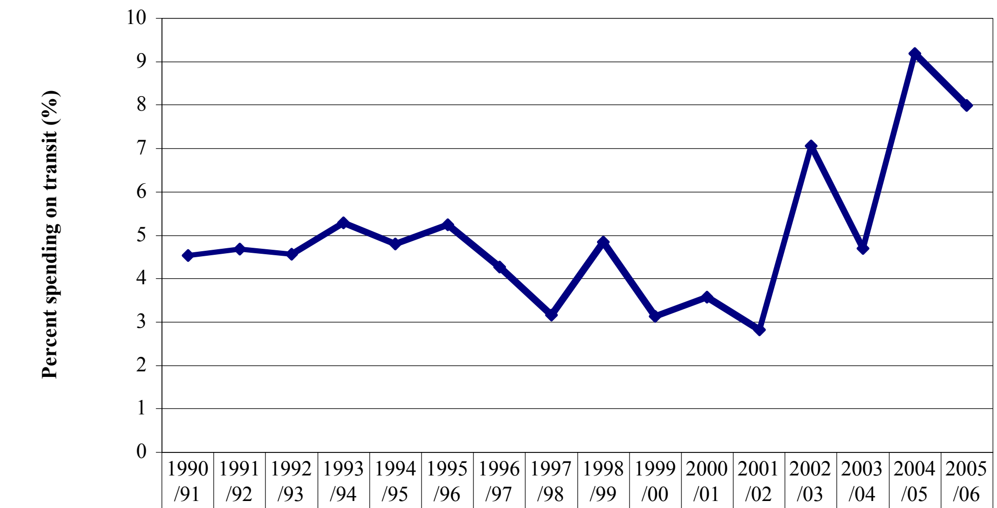
Results: Government spending on public transit in Nova Scotia increased from 4.5% of total spending on road transportation in 1990–91 to 8% in 2005–06. However, this remains the 5th lowest in Canada and is nearly 50% below the national average of 15.7%.

A sustainable transportation system includes a well-managed public transit system that provides widespread access to commuters. Any shift from private vehicle use to public transit can help reduce the overall amount of driving that Nova Scotians do, which in turn can reduce energy consumption in the transport sector, as well as GHG and air pollutant emissions and traffic accidents that result in injuries and fatalities. For such a shift to take place, however, public transit must become more viable, convenient, and attractive.

The level of funding available to support public transit systems is a key limiting factor in the capacity to create and maintain competitive and attractive transit systems. While funding is not a direct determinant of the success of a transit system, allocation of a greater percentage of transportation budgets to transit would make it possible to improve infrastructure and access to transit and to make it more affordable. That in turn would encourage more people to use these systems rather than their cars, which in turn would enhance the sustainability of the transportation system.

Government spending on public transit as a percentage of total spending on road transportation in Nova Scotia increased from 4.5% in 1990/91 to 8.0% in 2005/06 (Figure 22-23 below). This nevertheless remains the 5th lowest rate in Canada, and is nearly 50% below the national average of 15.7% (Figure 22-24 below). While the recent Nova Scotia increase is highly encouraging, the current level of funding for public transit—at 8% of the total road transportation budget—remains low and is insufficient to denote sustainability for this indicator.

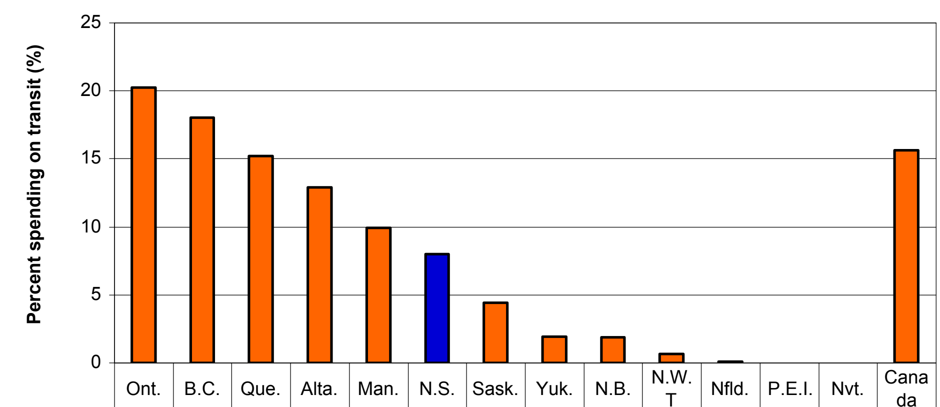
Figure 22-23. Government spending on transit as a percentage of total spending on road transportation, Nova Scotia, 1990/1991–2005/2006



	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
Spending	4.5	4.7	4.6	5.3	4.8	5.2	4.3	3.2	4.8	3.1	3.6	2.8	7.1	4.7	9.2	8.0

Source: Transport Canada Annual Report, *Transportation in Canada 2006*, Addendum, table A3-7.

Figure 22-24. Government spending on transit as a percentage of total spending on road transportation by province, Canada, 2005/2006



	Ont.	B.C.	Que.	Alta.	Man.	N.S.	Sask.	Yuk.	N.B.	N.W.T	Nfld.	P.E.I.	Nvt.	Canada
Spending	20.3	18.0	15.2	12.9	9.9	8.0	4.4	1.9	1.9	0.6	0.1	0.0	0.0	15.7

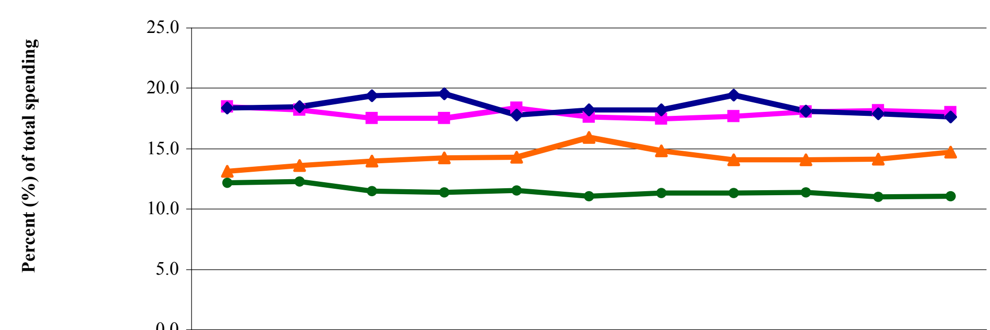
Source: Transport Canada Annual Report, *Transportation in Canada 2006*, Addendum, table A3-7.

22.12. Private spending on transportation (1997–2007)

Of the four top household direct expenditures, which account for about 63% of total household spending, transportation is the only one that has risen as a proportion of total household budgets—from 13.1% in 1997 to 14.7% in 2007. During the same period, food, shelter, and taxation expenditures all fell as a proportion of total household spending.

In fact, the increase in transportation costs was so large as to negate the combined decline in spending on all other essentials. In other words, the proportion of household disposable income available for *discretionary* (i.e., non-essential) spending—beyond these four "essentials"—fell during this period solely because of the increase in transportation costs. This denotes a decline in transportation affordability, and therefore of the economic sustainability of the current system (Figure 22-25 below).

Figure 22-25. Top four household expenditures as a percentage of total spending, Nova Scotia, 1997–2007



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Food	12.2	12.3	11.5	11.4	11.5	11.1	11.3	11.3	11.4	11.0	11.1
Shelter	18.5	18.2	17.5	17.5	18.4	17.6	17.5	17.7	18.1	18.2	18.0
Transportation	13.1	13.6	14.0	14.3	14.3	15.9	14.8	14.1	14.1	14.1	14.7
Personal taxes	18.4	18.5	19.4	19.5	17.8	18.2	18.2	19.4	18.1	17.9	17.6

Source: Statistics Canada, *Survey on Household Spending* (1997–2007). Estimates are from CANSIM Table 203-0001.

22.13. Full cost of passenger road transportation in Nova Scotia

22.13.1. Introduction

The following section provides a summary of the full cost accounting carried out for passenger road transportation in Nova Scotia, as published in GPI Atlantic's 2006 report, *The GPI Transportation Accounts: Sustainable Transportation in Nova Scotia*. At the time of publication of this summary 2008 Genuine Progress Index report, resources did not allow an update of this costing section, which is one of the most exhaustive full cost accounting exercises undertaken to date by GPI Atlantic.

Key methodological issues and results from GPI Atlantic's 2006 report are therefore briefly summarized here. For further details on the data sources, methodology, and analysis of results, as well as a prior literature review, please see GPI Atlantic's 2006 transportation report.[10]

22.13.2. Methodology

"Externalities" are the uncompensated effects an activity imposes on other individuals or groups. Transportation facilities and activities impose a variety of economic, social, and environmental externalities. For example, congestion delays, parking subsidies, pollution and climate change damages, and accident risks that motor vehicle travel imposes on others are "external" costs. Since consumers do not bear these costs directly, they tend to undervalue those impacts when making decisions on what type of vehicle to purchase or what mode to use when making a particular trip. For example, when parking facilities are subsidized, consumers will tend to drive more and rely less on alternative transport modes than if parking costs are borne directly by users.

Neglecting these "external" costs results in inefficient resource allocation and inflates the demand for goods with high external costs. Economic efficiency requires that externalities be internalized so that prices (what people pay directly for a good or service) reflect the full marginal costs of producing that good or service, unless a subsidy is specifically justified. This is sometimes called the "polluter pays" principle, particularly when applied to environmental externalities.

Full-cost accounting involves quantifying and—to the extent possible—monetizing all of the impacts associated with an activity, including non-market external costs. This process can be challenging. There are many types of external, non-market costs associated with transportation for which money is a poor valuation tool, and some monetization techniques are complex. As well, raw data and physical information on many of these costs are currently limited, as for example for transport-related water pollutants. But the non-market effects of economic activity are, nonetheless, no less real and costly in practice than many costs that are conventionally counted. The taxpayer-funded hospital and other medical costs due to car crashes and air pollution, for example, may be an externality for drivers but are as real in dollar terms as car repairs or gas. Quantifying these external costs to the extent possible at least allows them to be given the attention they deserve in policy analysis and other decisions.

A number of research projects have applied full-cost accounting analyses to transportation planning. One of the earliest attempts to analyse the costs and benefits of alternative transportation modes in the United States came from the American Association of State Highway Officials in 1952. This study considered factors such as safety; comfort and convenience; fuel costs; operating costs; and vehicle ownership costs. In 1975, a project in California produced cost data, including a range of external costs, which were used to compare the benefits and costs of car, bus, and rail transport in the San Francisco Bay Area. In the 1990s, numerous studies were carried out on the full costs of transportation in different jurisdictions in both the United States and Canada, with the methods of deriving non-market costs and benefits becoming increasingly more sophisticated.

In its Fifth Action Programme of 1992, the European Community also called for the adoption of full-cost accounting methods, so that the consumption and use of environmental resources would properly be recognized as part of the cost of production and thereby reflected in market prices. In its 2001 report, “Transport Policy for Europe’s Citizens,” the European Commission endorsed infrastructure charging, which takes into account external costs and encourages the use of the least polluting modes of transport.

These Canadian, U.S., and European assessments, goals, and strategies clearly require reliable methods of estimating the external costs and benefits of transportation. Fortunately, the transportation sector is an area of the economy for which full-cost accounting methods are already well developed and where several excellent practical applications of the methods exist.

Transport Canada has committed to sustainable transportation planning that reflects full-cost accounting principles. In its 2004–2006 sustainable development strategy, Transport Canada explicitly recognizes the importance of full-cost accounting, which is defined as “an accounting method that determines total value or final price by internalizing non-market values such as environmental costs and benefits,” and it describes cost internalization as a fundamental economic principle that promotes efficiency. Cost internalization is described as a process “whereby the costs of transportation reflect, to the extent possible, their full economic, social and environmental impacts.” Transport Canada is sponsoring research to develop practical full cost accounting tools.

The Victoria Transport Policy Institute (VTPI) has conducted comprehensive full-cost accounting analyses for transportation over a number of years. After a thorough review of existing costing studies in transportation, VTPI developed a framework for the full-cost accounting of passenger road transportation, published as Transportation Cost and Benefit Analysis: Techniques, Estimates and Implications. This work provides default monetized estimates of 20 cost categories, with separate estimates for 11 travel modes (or their equivalent, in the case of telework) under three travel conditions (urban peak, urban off-peak, and rural) expressed in U.S. dollars per vehicle-mile, and for some categories, per passenger-mile.

GPI Atlantic has used VTPI's work as a template for this full-cost accounting section of the current report, itemizing all but two of VTPI's cost categories in applying the method to transportation in Nova Scotia. The excluded categories are (a) "Equity and Option Value" (sometimes called Transportation Diversity Value, which refers to the value of having a variety of transportation options available), and (b) "Land Use Impacts" (which assesses the degree to which transportation decisions support strategic land use planning objectives). Those two categories were excluded from the Nova Scotia GPI cost analysis, because these impacts are particularly difficult to quantify and monetize, and because Nova Scotia data in these areas are currently severely limited. It should be emphasised here that these omissions should not be taken as signifying that these two categories are unimportant, and it is hoped that future data and methodological improvements will allow their incorporation into future updates of the GPI transportation work.

Based on an analysis of numerous transportation studies performed throughout North America, and in some cases, in other parts of the world, VTPI developed a set of "generic" cost values for different transportation impacts. VTPI recommends adjusting these values as appropriate to reflect location-specific conditions and circumstances more accurately. For example, vehicle operating cost values should be adjusted to reflect current fuel costs in the jurisdiction under study, and parking costs should be adjusted to reflect prevailing land values and construction costs in a particular area. Because of data limitations for Nova Scotia, this study has relied largely on VTPI cost values, except where more definitive local data were readily available. Future updates of the GPI full-cost accounting analysis of Nova Scotia transportation should make further adjustments that account for specific Nova Scotian conditions, as further local data become available and as research capabilities and resources permit.

VTPI's costing framework primarily reflects passenger travel. It does not include a complete set of freight transport cost values. While many of the default costs are transferable to freight transport, some adjustments are needed, and some of the data needed for an analysis of freight transport in Nova Scotia are missing. For example, GPI Atlantic was unable to obtain records for tonne-kilometres of goods moved in Nova Scotia by rail, marine, or air transport. Lacking these key data that are essential to assess specific freight transport cost values, GPI Atlantic decided not to calculate overall freight costs for Nova Scotia at this time. However, by using GPI Atlantic's previous work on the cost of greenhouse gas and air pollutant emissions attributable to freight transport in Nova Scotia, it was possible to include some cost estimates for road freight transport in the calculations at least for this pair of cost categories.

Another point of divergence between the cost accounting in the Nova Scotia GPI study and that of VTPI is that the GPI cost accounting for accidents includes all vehicular traffic, rather than passenger movement only. In this instance, the VTPI cost estimate was not used because GPI Atlantic had access to the actual numbers of road transportation injuries and fatalities in Nova Scotia, and did not therefore need to extrapolate estimated accident costs from other studies. The Nova Scotia accident statistics were then monetized using the costing methodology adopted by Anielski Management Inc. for its study of traffic safety in Alberta.

In general, however, GPI Atlantic has followed the VTPI framework, except where this was not appropriate to Nova Scotia conditions, or was impossible due to inadequate data. VTPI provides cost estimates for 11 transport modes, including walking, cycling, telecommuting, and various forms of automobile and public transit. However, our analysis does not, for example, include the "electric bus/trolley" category, since none are currently operating in Nova Scotia, nor do we include the "electric car" mode, since there are very few such vehicles in the Province, though both are included in the VTPI analysis. Walking, cycling, and telecommuting are also not accounted for in the GPI analysis due to data limitations.

For those costs where direct provincial data were not readily available, cost estimates for Nova Scotia, unless otherwise noted, are extrapolated from other cost studies and are derived as follows:

As noted, the Victoria Policy Transport Institute (VTPI) has derived cost estimates for each of 20 transportation impacts and for 11 different modes of passenger transportation based on a wide-ranging review of copious evidence and numerous transportation costing studies. These costs are expressed by VTPI on a per vehicle-kilometre basis (or on a per passenger-kilometre basis where appropriate) to allow aggregation using a common metric, and to facilitate comparison between cost estimates for different impacts and different modes.

For this GPI study for Nova Scotia, 15 transportation impacts have been examined for four different modes of motor vehicle transportation—automobiles, light trucks (including SUVs, minivans, and pick-up trucks), buses, and motor-cycles. Two cost categories (as noted above) and seven modes of transportation (including non-motorized modes) were not examined due to data limitations and methodological challenges. As well, three cost categories—congestion, operating subsidy, and barrier effect costs—were presented in the GPI study for illustrative and comparative purposes only, but were netted out from total costs in order to avoid double-counting, since congestion and the barrier effect are actually sub-components of travel time costs, and operating subsidy costs are part of vehicle ownership costs.

For most of the cost categories considered here, VTPI cost estimates per vehicle-kilometre—as based on the evidence and literature examined by VTPI—were then multiplied by the number of kilometres travelled annually within Nova Scotia by each of the four passenger transportation modes, in order to derive the total cost estimates for each mode and each impact. Cost totals for each category were then summed to assess the total cost of each transport-related impact (congestion, traffic services, noise, etc.) in Nova Scotia attributable to motor vehicle passenger transportation in the province. The cost totals were then divided by the Nova Scotia population (934,507 in 2002) in order to assess per capita costs by mode for that year.

The GPI analysis focuses on transportation costs and so does not provide all of the information needed for a full cost-benefit analysis. This focus on costs is not intended to ignore transportation benefits, though a comprehensive monetization of these benefits was not possible here, due to limited resources. At the same time, cost analysis is often the basis for quantifying incremental benefits. For example, improved mobility is often measured in terms of travel time cost savings, and improved safety is measured based on avoided accidents and reduced crash costs. Of course, transportation provides many benefits to users and society, which, in total, are huge. However, the evidence also demonstrates that, beyond a certain optimal level, additional mobility provides declining and eventually negative marginal benefits due to costs that escalate beyond that optimal level. As a result, the greatest benefits to society may result from policies that increase transportation system efficiency and so reduce total vehicle travel while still ensuring needed mobility.

Studies have shown that non-automobile transportation services tend to provide special types of benefits, such as those described below:

- Mobility and accessibility benefits. This refers to the benefits that result when improved transportation options allow people who are physically or economically disadvantaged to travel more and access more services and activities. For example, improved walking and cycling conditions, improved ridesharing, and efficient public transit services, can allow people with physical disabilities or low incomes to better access medical services, shops, education, employment, and people, and therefore to enjoy more economic and social opportunities.

- Efficiency and cost reduction benefits. This refers to the benefits that result when improved transportation options allow people to shift travel to more efficient and affordable modes. For example, improved walking and cycling conditions, and more efficient and convenient public transit service may allow commuters to drive less, and therefore reduce vehicle costs, traffic congestion, road and parking facility costs, accidents, and environmental damages.

- Economic productivity and development benefits. This refers to the benefits to individuals and society if improved transportation system efficiency reduces costs (such as congestion, travel time, and subsidized parking) and thereby stimulates economic activity, including employment, business productivity, and increased property values and tax revenues.

- Fitness and public health benefits. This refers both to the health benefits and to the consequent enhanced human capital and productivity outcomes that result when more people are able to achieve the level of physical activity required for basic health—pegged at 20–30 minutes a day of moderate physical activity, such as walking and cycling.

This categorization of benefits indicates the types of benefits that can in fact be demonstrated by a costing analysis. In other words, a comparative assessment of costs and potential cost reductions by transport mode can point to the benefits attributable to particular types of transportation. So a costing analysis certainly does not exclude consideration of a wide range of transportation benefits, though it must be emphasized again that the GPI study does not attempt the kind of full benefit-cost analysis that would clearly be highly desirable if resources become available.

22.13.3. Summary of results

As a complement to its study of sustainable transportation indicators for Nova Scotia, GPI Atlantic developed estimates of the full costs of road passenger travel in Nova Scotia. This is in accord with the GPI mandate to develop two complementary sets of measures for the province—indicators that assess progress, and accounts that assess value. As noted above, the GPI analysis builds on a wide range of previous research that quantifies and monetizes transportation costs—using particularly the evidence assembled and synthesized by the Victoria Transport Policy Institute (VTPI).

In accord with the VTPI analytical framework, which accords well with the GPI accounting framework, the cost categories used in this study are divided into three broad categories:

- *internal-variable* (costs like gas and car repairs that are borne directly by users according to how much they drive),
- *internal-fixed* (costs like payments on vehicle loans and annual registration and insurance fees that are borne directly by users, but not significantly affected by how much a motorist drives), and
- *external* (costs like air pollutant and climate change damages, congestion, and taxpayer-funded crash costs that are imposed on others).

In general, economists tend to consider costs that are fixed or external as *inefficient*—since efficiency specifically requires that prices equal marginal costs—and they consider costs that are external as *inequitable*—since specifically, users should bear the full costs resulting from their consumption decisions unless a subsidy is explicitly justified. The degree to which externalities can be internalized and fixed costs translated into variable costs therefore becomes a measure of improved transportation efficiency and equity. London's congestion tax is an example of internalizing externalities, while assessing registration and insurance payments in proportion to vehicle fuel efficiency and kilometres driven would be an example of translating fixed to variable costs.

Table 22-1 below presents the estimated value for each cost category, both in total costs and on a per capita basis. In 2002, the full cost of transportation in Nova Scotia is estimated at $7.2 billion ($2007) a year on the low end and $14.8 billion on the high end. (The large variation is due almost entirely to huge variations in climate change damage cost estimates in the literature, depending on the models used. Nearly half the high end figure is attributable to predicted climate change damage costs and reflects the impacts of positive feedback loops and more catastrophic scenarios including destruction caused by sea level rise, and by extreme storm and hurricane activity.)

The total cost estimates translate into a per capita annual cost of $8,541 ($2007), using a reasonably low-end climate change damage cost estimate (though not the lowest) and a mid-range air pollution damage cost estimate. For its public cost estimates, GPI Atlantic always errs on the conservative side and references lower bound rather than high end cost estimates—with the $8,541 per capita cost here considered a conservative estimate.

NOTE: As noted at the start of this chapter, the overall road passenger transportation costs presented in this chapter aggregate costs associated with private automobiles, light trucks (including SUVs, minivans, and pick-up trucks), motorcycles, and buses. Buses account for about 2% of total costs. Therefore, references to "private passenger road transportation costs," "costs of driving," "car costs," etc. in this chapter are actually about 2% lower than the aggregate road transportation costs indicated here. For further detail on how the road transportation costs break down by mode of transport, please refer to Table 68 in the original GPI Transportation Accounts: http://www.gpiatlantic.org/pdf/transportation/transportation.pdf.

Table 22-1. Per capita road passenger transportation costs ($2007), Nova Scotia, 2002

COST	PER CAPITA COSTS			TOTAL COSTS (MILLIONS)	
	Internal-Variable	Internal-Fixed	External	Low	High
Vehicle ownership		$2,122		$1,983	$4,046
Travel time	$1,371			$1,281	$1,281
Vehicle operation	$1,167			$1,090	$1,233
Climate change* **			**$776	$110	$5,181
Internal crash	$771			$721	$721
External parking			$562	$526	$526
Air pollution* **			**$262	$62	$426
External crash			$385	$360	$360
Internal parking		$244		$228	$228
Resource externalities			$236	$221	$221
Land value			$139	$130	$130
Water pollution			$114	$106	$106
Road facilities			$109	$101	$101
***Barrier effect**			$80	$74	$74
Traffic services			$79	$74	$74
Noise			$74	$69	$69
Waste			$18	$17	$17
***Operating subsidy**			$18	$13	$13
***Congestion**			$14	$13	$13
Per Capita Costs	$3,309	$2,366	$2,866		
Total Per Capita Costs	$8,541			$7,179	$14,820

Notes: *"Congestion," "operating subsidy," and "barrier effect" costs are presented here for illustrative and comparative purposes only. They have been netted out to indicate that they are not included in the totals presented in order to avoid double-counting, since congestion and the barrier effect are actually sub-components of the travel time costs, while operating subsidy costs are a part of vehicle ownership costs.
**The per capita cost estimates for climate change and air pollution are based on a relatively low-end estimate for climate change (though not the lowest available, which has questionable assumptions), and a mid-range estimate of air pollution damage costs, rather than on the lowest or highest cost estimates. These two cost categories also include both road freight costs and road passenger costs, since data are not available for passenger vehicles only.
***Low and high estimates for climate change and air pollution are calculated by using different costing methods than the other cost categories. Please see GPI Atlantic's 2006 transportation report for methodological explanations of estimation methods.
****It should be noted here that the overall road transportation costs in Table 22-1 above include diesel bus costs. However, buses account for roughly 2% of the total costs presented, thereby demonstrating that the overwhelming proportion of the cost estimates (98%) refer to private not public vehicle use. This 2% does not include all of the costs associated with transit, since crashes, air pollution, and climate change costs were not costed out by mode. For further detail on how the road transportation costs break down by mode of transport, please refer to Table 68 in the original GPI Transportation Accounts: http://www.gpiatlantic.org/pdf/transportation/transportation.pdf.

The full GPI transportation report discusses in detail how each cost is quantified and monetized. In most cases, cost estimates per vehicle-kilometre travelled—derived from the wide range of evidence examined by VTPI—were first scaled to reflect Nova Scotian conditions and then multiplied by the amount of vehicle travel that occurs in the province. These cost estimates incorporate a high degree of uncertainty (due to data constraints) and variability (since many costs vary significantly depending on factors such as type of vehicle, driver, and travel conditions).

Despite these limitations, however, these estimates are useful because they do reflect the value of indirect and non-market goods and services and thus indicate the general magnitude of impacts that are often overlooked in conventional economic analysis. Whatever the uncertainties and variables, the results provided here are also far more accurate and comprehensive than conventional transportation cost estimates that ignore a wide range of real transportation impacts and thus implicitly (and mistakenly) assign such “externalities” a zero value. The accounting framework used here also allows these indirect and non-market impacts to be compared with more conventionally evaluated impacts using a common metric. The effort to value these non-market factors is also a spur to improved data collection in these areas, which in turn can reduce the uncertainties and variables over time as better data sources become available.

In terms of the comparative magnitude of these costs, the largest costs are vehicle ownership and operation, travel time, crash costs, and parking. Vehicle ownership and operation, travel time, and a portion of parking, crash, and roadway costs, are *internal*, and are paid or borne directly by owners and operators and by user fees (e.g., residential parking costs, insurance, road taxes, and fuel). *External* costs, such as congestion, air pollution, and roadway land value, tend to be smaller individually, and so are easily overlooked, but they constitute a considerable cumulative cost. As well, if the predictions of a growing number of scientists are correct that major climate change impacts will happen sooner and be more serious than hitherto assumed, then higher end climate change damage costs could become the largest cost category.

In any case, and even at the lower end of climate change costs, the fixed and external costs of driving are very large in total when added together, representing more than two-thirds of all transportation costs. This indicates that transportation markets are presently highly distorted, since fixed costs and externalities conceal full transportation impacts that are a function both of actual vehicle usage and of real transportation effects on non-market goods and services.

This point is even more evident when the costs that are paid directly by Nova Scotians are compared against the “invisible” costs that are paid indirectly (for example, through taxes, higher prices for consumer goods, or costs associated with reduced health). Statistics Canada’s household spending data reveal that each Nova Scotian spent an average of $3,036 ($2002) on road transportation costs in 2002. These costs include vehicle ownership and operating costs, transit fares, and out-of-pocket parking expenses.

What most Nova Scotians do not realize is that there is an additional $4,562 in indirect costs associated with their driving that are not counted in their conventional transportation expenditures. These costs are either non-market costs, like travel time and climate change costs, or are costs paid through taxes, rent, and mortgage and other payments, like road facility expenditures, some taxpayer funded medical costs associated with automobile crashes, and residential off-street parking. In other words, Nova Scotians are only directly paying for about 40% of the full costs of passenger road transportation.

This indicates that automobile travel is presently significantly under-priced, and—to the degree that these costs are overlooked in economic analysis—policy and planning decisions are skewed to favour automobile transportation improvements. That in turn results in economically excessive automobile travel, excessive automobile-dependency, and reduced transportation options. The more that costs are transferred from the fixed and external categories to the internal variable category, the more distortions will be rectified and removed, and the more users will pay the full costs of the transport modes they choose. That in turn will naturally encourage development of a wider range of more sustainable transportation options.

To give just one example: Failure to charge users for road space and environmental externalities favours truck over rail freight, which in turn increases the environmental impacts, road wear, congestion delays, and accident risks that heavy truck traffic imposes on motorists. An earlier GPI Atlantic report that undertook a full-cost accounting analysis of freight traffic on the Halifax-Amherst corridor found that a 10% shift of freight from road to rail would save more than $10 million annually (see Appendix A of the Nova Scotia GPI Greenhouse Gas Accounts at wwww.gpiatlantic.org, or the separate freight study at http://gpiatlantic.org/pdf/freight/freight.pdf).

The accounting framework used in this report provides a tool for incorporating these generally hidden impacts into policy and planning decisions, and thereby provides guidance both in identifying more sustainable transportation options and in reducing total transportation-induced costs to society.

22.13.4. Policy reforms

At first glance, the transportation analysis and results provided here may seem discouraging, because they identify such a variety of problems and unsustainable trends. However, there is actually a very positive message that emerges from the evidence and particularly from the identification and compilation of full transportation costs. This analysis does indicate that the current transportation system is distorted in various ways that result in economically excessive motor vehicle travel—that is, more motor vehicle travel than would occur in an efficient market—which in turn is harmful in a number of ways. But what this means on the positive side is that market reforms which correct existing distortions can provide a wide range of economic, social, and environmental benefits that will increase transportation efficiency and options, enhance wellbeing, produce cost-savings, improve environmental quality, and boost long-term prosperity.

For example, improved walking and cycling conditions, better public transit services, and more efficient pricing can help reduce traffic congestion, road and parking facility costs, consumer costs, accident risk, energy consumption, and pollution emissions, while improving public fitness and health, increasing beneficial economic activity, supporting strategic land use objectives (such as reducing sprawl), and even supporting specific objectives such as urban redevelopment, tourism activities, and heritage preservation.

A wide range of tested and proven policy and planning reforms can help provide such benefits. We call them “win-win transportation solutions” because each intervention achieves multiple benefits across economic, social, and environmental dimensions. They are cost-effective and technically feasible market reforms that help solve transportation problems by increasing consumer options and removing market distortions that encourage inefficient travel behaviour. Although their individual impacts may appear modest, their combined benefits can be substantial.

If fully implemented to the degree that is economically justified, Win-Win Solutions like those outlined in Table 22-2 below can provide very significant total benefits. They are “no regrets” measures that are justified regardless of uncertainties about global warming or other environmental and social impacts. They therefore represent true sustainability strategies, as opposed to strategies like highway twinning that may help address one or two planning objectives in isolation, but which exacerbate other problems by increasing total motor vehicle travel and sprawl. Table 22-2 below lists examples of these strategies in summary form. Each of these options has been described in detail in the literature that is cited in the full GPI report and in the referenced VTPI materials, which also contain examples of best practices from jurisdictions that have actually implemented some of these measures.

Table 22-2. Win-win solutions for genuine progress toward sustainable transportation

NAME	DESCRIPTION	TRANSPORT IMPACTS
Least-Cost Planning Reforms	More comprehensive and neutral planning and investment practices.	Increases investment and support for alternative modes and mobility management, improving transport options.
Regulatory Reforms	Reduced barriers to transportation and land use innovations.	Tends to improve transport options.
Transportation Demand Management Programs	Local and regional programs that support and encourage use of alternative modes.	Increased use of alternative modes.
Commute Trip Reduction (CTR)	Programs by employers to encourage alternative commute options.	Reduces automobile commute travel.
Commuter Financial Incentives	Offers commuters financial incentives for using alternative modes.	Encourages use of alternative commute modes.
Fuel Taxes—Tax Shifting	Increases fuel taxes and other vehicle taxes with concomitant reductions in income tax.	Encourages fuel-efficiency, and reduces vehicle fuel consumption and mileage.
Pay-As-You-Drive Pricing	Converts fixed vehicle charges into mileage-based fees.	Reduces vehicle mileage.

NAME	DESCRIPTION	TRANSPORT IMPACTS
Road Pricing	Charges users directly for road use, with rates that reflect costs imposed.	Reduces vehicle mileage, particularly under congested conditions.
Parking Management	Various strategies that result in more efficient use of parking facilities.	Reduces parking demand and facility costs, and encourages use of alternative modes.
Parking Pricing	Charges users directly for parking facility use, often with variable rates; provides cash payments to employees not using parking.	Reduces parking demand and facility costs, and encourages use of alternative modes.
Transit and Rideshare Improvements	Improves transit and rideshare services.	Increases transit use, vanpooling and carpooling.
HOV (High Occupancy Vehicle) Lane Priority	Improves transit and rideshare speed and convenience.	Increases transit and rideshare use, particularly in congested conditions.
Walking and Cycling Improvements	Improves walking and cycling conditions.	Encourages use of non-motorized modes, and supports transit and smart growth.
Smart Growth Policies	More accessible, multi-modal land use development patterns.	Reduces automobile use and trip distances, and increases use of alternative modes.
Location Efficient Housing and Mortgages	Encourages businesses and households to choose more accessible locations.	Reduces automobile use and trip distances, and increases use of alternative modes.
Mobility Management Marketing	Improved information and encouragement for transport options.	Encourages shifts to alternative modes.
Freight Transport Management	Encourages businesses to use more efficient transportation options.	Reduced truck transport.
School and Campus Trip Management	Encourage parents and students to use alternative modes for school commutes.	Reduced driving and increased use of alternative modes by parents and children.

Source: Litman, Todd. *Win-Win Transportation Solutions: Cooperation for Economic, Social and Environmental Benefits*, Victoria Transport Policy Institute, 2005f. http://www.vtpi.org.

Note: This list is not complete but is presented here for illustrative purposes only. There are various other win-win solutions, in addition to those listed here, which also encourage more efficient transportation.

Because they provide multiple benefits, win-win solutions offer opportunities for cooperation and coordination among various organizations and political interests. For example, developers can support these strategies because they reduce parking costs; social service agencies can support them because they improve affordable mobility for non-drivers; health professionals can support them for their health benefits; and environmentalists can support them because they reduce energy consumption, greenhouse gas and pollutant emissions, and sprawl.

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24. Endnotes

Executive Summary

[1] According to one recent analysis, a substantial part of GDP growth in the U.S. in 2001 and 2002 was due to Mortgage Equity Withdrawals (MEW)—where consumers borrow money against the real value of their homes. According to a report by John Mauldin based on data collected by Alan Greenspan, well known U.S. economist and former Chairman of the Federal Reserve (1987–2006): "Without U.S. homeowners using their homes as an ATM, the economy would have been very sluggish indeed, averaging much less than 1% for the six years of the Bush presidency [. . .]. Without MEWs, the period from 2001–2007 would have seen GDP growth of less than 1%." Mauldin, John. October 17, 2008. Thoughts from the Front Line: The Economic Blue Screen of Death. Available from http://www.2000wave.com/index.asp. Accessed October 23, 2008.
[2] Environment Canada assessment cited in Walker, Sally et al. GPI Atlantic 2001. The Nova Scotia Greenhouse Gas Accounts for the Genuine Progress Index. Available at http://www.gpiatlantic.org/pdf/greenhouse/ghg.pdf. Accessed September 23, 2008.
[3] Wealth is defined as assets minus debts. It is also referred to as net worth.
[4] Unemployment cost estimates are in 2006 constant dollars.
[5] Crow Iain, Paul Richardson, Carol Riddington, and Frances Simon. 1989. Unemployment, Crime and Offenders. Routledge. New York, p. 10. Cited in Pannozzo, Linda and Ronald Colman. 2004. Work Hours and the Future of Work in Canada: A Nova Scotia GPI Case Study. GPI Atlantic. Halifax, p. 327.
[6] Data provided by Smith, Paul K., Policy, Planning and Research Division. N.S. Department of Justice. Personal communication, May 1, 2003. Cited in Pannozzo and Colman (2004), Tables 39 and 40.
[7] Unemployment rates from Statistics Canada, *Estat Database*, and *Canadian Economic Observer, Historical Statistical Supplement,* catalogue no. 11-210-XPB; robbery rates from Statistics Canada, *CANSIM Database,* matrix 2200. Reported in Dodds, Colin and Ronald Colman. 1999. Cost of Crime in Nova Scotia. GPI Atlantic. Halifax, pages 78–79
[8] Wright, Ronald. 2004. *A Short History of Progress*. Anansi Press, Toronto, p. 79.
[9] CCME criteria require that diversion rates be based on the diversion of solid waste from landfills in each year compared to the amount of waste sent to landfills in 1989.

Chapter 1: Civic and Voluntary Work

[1] Colman, Ronald. 1998. *The Economic Value of Civic and Voluntary Work in Nova Scotia*. GPI Atlantic. Available from http://www.gpiatlantic.org/pdf/volunteer/volunteer.pdf. Accessed June 25, 2008. p. 8.
[2] Colman (1998), p. 8.
[3] Jeremy Rifkin, "The End of Work," *New City Magazine*, Vol.17(4), Summer, 1997, pp. 10–18. Cited in Colman (1998), p. 8.
[4] Hawken, Paul. 2007. *Blessed Unrest: How the Largest Movement in the World Came into Being and Why No One Saw It Coming*. Viking Press. New York.
[5] Rifkin (1997), p. 6.
[6] See, for example: Mustard, J.F., and Frank, J. (1991). *The Determinants of Health*, (CIAR Publication No. 5) Canadian Institute for Advanced Research, Toronto. Cited in Colman, Ronald. *The Economic Value of Civic and Voluntary Work in Atlantic Canada*. 2003 Update. GPI Atlantic. Halifax. Available from http://www.gpiatlantic.org/pdf/volunteer/volunteerupdate03.pdf.
[7] For example, Newfoundlanders have lower incomes and higher rates of unemployment than the rest of Canada, as well as high levels of behavioural risk factors, all of which are conventionally associated with health problems. Yet they consistently record the highest rates of self-reported excellent and very good health, the highest rates of psychological wellbeing, the lowest stress and depression rates, and the lowest rates of several chronic ailments in the country. It has been suggested that strong communities and social networks may help explain this apparent anomaly. Cited in Colman (2003), *The Economic Value of Civic and Voluntary Work in Atlantic Canada*.
[8] Health Canada (1999), *Toward a Healthy Future: Second Report on the Health of Canadians*, Ottawa, p. 60. Cited in Colman (2003).
[9] Health Canada (1999), op. cit., pp. 60-62.
[10] In the Treasury Board's 2002 report *Canada's Performance 2002*, it noted the "declining performance" of volunteerism, using data from the National Survey on Giving, Volunteering and Participating (NSGVP). However,

in its latest report, titled *Canada's Performance Report 2006–07*, there is no trend reported for this volunteerism indicator, because data from the new Canada Survey on Giving, Volunteering and Participating (CSGVP) conducted in 2004 are not comparable to data from earlier surveys. The Treasury Board report is available from http://www.tbs-sct.gc.ca/reports-rapports/cp-rc/2006-2007/cp-rctb-eng.asp. Accessed July 2, 2008.

[11] Statistics Canada. 2006. *Caring Canadians, Involved Canadians*. Highlights from the 2004 Canada Survey of Giving, Volunteering and Participating. Catalogue no. 71-542-XIE. Minister of Industry, p. 41.

[12] Statistics Canada does not provide this calculation for volunteer service hours per capita, even though it is probably the most accurate way of assessing the actual impact of the voluntary sector on Canadians, and is also a key variable in analysing the potential health impacts of volunteerism. GPI Atlantic simply derives volunteer service hours per capita by dividing the total annual volunteer hours (from the NSGVP) by the total population of Canada and of each province. This per capita indicator takes into account population changes over time.

[13] Statistics Canada, 2000 National Survey of Giving, Volunteering and Participating, cited in Colman, Ronald. *Economic Value of Civic and Voluntary Work in Atlantic Canada*. 2003 Update. GPI Atlantic. Halifax. p. 6.

[14] Ibid.

[15] Colman, Ronald. *Economic Value of Civic and Voluntary Work in Atlantic Canada*. 2003 Update. GPI Atlantic. Halifax. pp. 5–6.

[16] Ibid. p. 7.

[17] Hall, Michael, Larry McKeown, and Karen Roberts. 2001. *Caring Canadians, Involved Canadians: Highlights from the 2000 National Survey of Giving, Volunteering and Participating*. Statistics Canada, p. 9. Cited in Colman (2003 update), p. 9.

[18] Statistics Canada General Social Survey, Time Use Studies Cycle 19. 2005 time stress data show 22.7% of Nova Scotian women and 18.6% of women in the rest of Canada with high levels of time stress compared to 13.4% of Nova Scotian men and 13.9% of men in the rest of Canada.

[19] Colman (2003), p. 12.

[20] Hall, Michael, David Lasby, Glenn Gumulka, and Catherine Tryon. 2006. *Caring Canadians, Involved Canadians: Highlights from the 2004 Canada Survey of Giving, Volunteering and Participating*. Statistics Canada. Minister of Industry. Ottawa.

[21] Assuming 40 hours of work per week for 48 weeks.

[22] Hall et al. (2006) p. 35.

[23] According to Statistics Canada, much of the CSGVP data reported for Nova Scotia, including total annual volunteer hours, average annual volunteer hours, and percentage of total volunteer hours, should be used with caution due to the limited sample size of the survey. Breakdowns by labour force status for the unemployed in Nova Scotia were too unreliable to be published.

[24] Hall et al. (2006) p. 41.

[25] Ibid. p. 37.

[26] Ibid. p. 38.

[27] Ibid. p. 48, Figure 2.18.

[28] Statistics Canada. 1999. General Social Survey, 1998. Cited in Colman, Ronald. 1998. *The Economic Value of Civic and Voluntary Work in Nova Scotia*. Halifax. p. 6.

[29] The 1/3–2/3 split between formal and informal voluntary work is estimated both from the initial screening questionnaire of the 1987 National Survey of Volunteer Activity, and from comparisons between the aggregate voluntary work time reported in the 1992 GSS and the formal volunteer hours reported in the 1987 National Survey. Thus, formal volunteer hours are estimated to constitute 46 million hours (34%) out of the total estimated 135 million hours of voluntary work time contributed in Nova Scotia. Colman (1998), p. 46.

[30] Statistics Canada. 1999. *Overview of the Time Use of Canadians*. Table 1: Canada, Regions and Provinces. Housing, Family and Social Statistics Division. Ottawa.

[31] Statistics Canada. 2006. *Overview of the Time Use of Canadians*, 2005. Minister of Industry, Ottawa. Data in minutes/day for Canada and provinces provided by Statistics Canada.

[32] Average number of volunteer hours from 2005 GSS. Data for Canada's population 15 years and older calculated using http://www.statcan.ca/Daily/English/060328/d060328e.htm and 2006 Census data from http://www12.statcan.ca/english/census06/analysis/agesex/tables/table2.htm. According to 2006 Census, roughly 17.7% of Canadian population was aged less than 15 years (82.3% aged 15 or older). Monetary value of volunteer work has been calculated for Canada using $19.63/hour ($2007), based on the specialist replacement cost of

volunteer work reported in Statistics Canada, *Households' Unpaid Work: Measurement and Valuation*. Catalogue no. 13-603E, #3. December, 1995, and updated to 2007 constant dollars using the Consumer Price Index.

[33] In 1995, Statistics Canada estimated the specialist replacement value of voluntary work by looking at the market value of the work that volunteers actually in the FORMAL volunteer sector and is the basis for the $19.63 and $16. 28 ($2007) numbers used in this update. However, voluntary work done *informally* is often of the domestic variety, e.g., cooking, cleaning, shopping for a sick neighbour, doing yard work for someone who is disabled, etc. This informal voluntary work is often less skilled and requires less expertise than the formal variety offered through organizations, so it should probably be valued at a lower rate of pay, since it would cost less to replace in the market economy than, say, the volunteer treasurer of a board. In GPI Atlantic's 1998 Value of Civic and Voluntary Work study, informal voluntary work was valued at the *generalist replacement value* that Statistics Canada used to value unpaid household work (which is a lower hourly rate and more similar in type to a lot of informal voluntary work), rather than at the *specialist replacement value*. Therefore, different hourly pay scales were applied to the formal and informal voluntary sectors. However, due to time restraints, this step was not taken here and as such a result the total economic value of voluntary work may be somewhat overestimated because the specialist replacement value (which has a higher hourly rate than the generalist replacement value) was used for *all* voluntary work—formal and informal—rather than only for the formal sector. Nonetheless, this overestimate is likely balanced by another factor that yields an underestimate. In GPI Atlantic's 1998 report, out-of-pocket expenses of volunteers (which include the cost of gas to get to meetings and assignments, equipment, materials, sometimes even uniforms, etc.) were added to the total value of voluntary work. We have *not* added those out of pocket expenses here, which results in an underestimate of the total value of voluntary work. This will likely roughly balance the overestimate that results from using the specialist replacement method rather than the generalist replacement method for informal voluntary work.

[34] Assuming 40 hours of work per week for 48 weeks.

[35] Statistics Canada estimated the replacement cost rate for volunteer work to be $19.63 for Canada and $16.28 ($2007). Statistics Canada. *Households' Unpaid Work: Measurement and Valuation*. Catalogue no. 13-603E, #3. December, 1995. The Consumer Price Index has been used to scale values to 2007 constant dollars.

[36] Monetary values are derived using Statistics Canada's replacement cost (specialist) imputation for volunteer work, in Statistics Canada, *Households' Unpaid Work: Measurement and Valuation*, Table A4, p. 71, adjusted to 2007 dollars. For monetary valuation methodologies see Colman, Ronald. 1998. *The Economic Value of Civic and Voluntary Work in Nova Scotia*. GPI Atlantic, Halifax. pp. 17–20 and 34–43.

[37] Average number of volunteer hours from 2005 GSS. Data for NS population 15 years and older in 2005 calculated using 2006 Census data from Statistics Canada. 2007. Census trends for Canada, provinces and territories (table). 2006 Census. Statistics Canada Catalogue no. 92-596-XWE. Ottawa. Released December 4, 2007. http://www12.statcan.ca/english/census06/data/trends/Index.cfm. Roughly 16% of NS population is under the age of 15 years (84% or 767,308 are older). Monetary value of volunteer work calculated for NS using $16.28/hour ($2007).

[38] GPI Atlantic's 1998 report (Colman, Ronald. GPI Atlantic. Halifax. July, 1998, page 28) estimated the value of voluntary work hours in 1997 at $1,754 million ($1997) which amounts to $2,192 million in $2007.

[39] Nova Scotia population 15 and older (729,243) used for 1998 are from 1996 Census data. Statistics Canada. 2007. Census trends for Canada, provinces and territories (table). 2006 Census. Statistics Canada Catalogue no. 92-596-XWE. Ottawa. Released December 4, 2007. Available from http://www12.statcan.ca/english/census06/data/trends/Index.cfm. The dollar value is determined by multiplying the total hours by $16.28—Statistics Canada's estimated specialist replacement value for volunteer work in Nova Scotia reported in Statistics Canada. *Households' Unpaid Work: Measurement and Valuation*. Catalogue no. 13-603E, #3. December, 1995, and updated to 2007 constant dollars using the Consumer Price Index.

[40] Methodology for estimating gain or loss in the rate of volunteer services: (1) Take the average time spent on civic and voluntary work (minutes per day) per person for the total population 15 years and older, as provided in the GSS. (2) Multiply by 365 to get total average hours per year per person. (3) Multiply the total average hours per year per person by the population aged 15 and over. (4) Multiply this product by the hourly replacement cost of $19.63 ($2007) for Canada and $16.28 ($2007) for Nova Scotia. (5) Divide the product of step 3 (total volunteer hours given by all volunteers within the population 15 years and older) by the total population to get voluntary services per capita—the rate at which voluntary services are received by the population. (6) Extrapolate 1992 voluntary service hours per capita to 2005 by asking the question: Had voluntary service hours per capita in 2005 been offered at the

same rate as in 1992, how many hours would have been offered? To do this, take the voluntary service hours per capita in 1992 and multiply that number by the total population in 2005. This gives the number of voluntary hours that would have been offered had voluntary services been offered at the same rate in 2005 as in 1992. (7) Multiply result of step 6 by the hourly replacement cost of $19.63 ($2007) for Canada and $16.28 ($2007) for Nova Scotia. (8) Subtract the number of total voluntary hours *actually* offered in 2005 from the result of Step 6 above (which is the number of voluntary hours that would have been offered had voluntary services been offered at the same rate in 2005 as in 1992). The difference is the loss in voluntary services actually experienced by the Canadian and Nova Scotian populations. (9) To get the dollar value of that loss in voluntary services compared to the 1992 voluntary service rate, either a) multiply the result of Step 8 by $19.63 for Canada and $16.28 for NS, or b) subtract the dollar figure in Row 3 from that in Row 5 in Table 3 above.

Chapter 2: Unpaid Housework and Childcare

[1] In 2007 the average hourly wage for all female employees 15 years and older was $15.80, compared to $18.07 for men. Statistics Canada. 2007. Labour Force Historical Review, 2007. Catalogue Number: 71F0004XCB. Ottawa; Statistics Canada. 2004. Labour Force Historical Review, 2004. Catalogue Number: 71 F00044XLB ISSN: 1480-5502. Ottawa; Statistics Canada. Labour Force Historical Review, 2001. Cited in Colman, Ronald. 2003. *A Profile of Women's Health Indicators in Canada*. p. 5. Available from www.gpiatlantic.org. Accessed 10 August, 2008. For additional information on industries with a wider male–female wage gap, see *The Source: Women's Health Directory: Labour Force Participation*. Available from http://www.womenshealthdata.ca/printcategory.aspx?category_id=87. Accessed 13 September, 2008.

[2] Wage levels from CUPE Collective Agreement Information System (CAIS), cited in "Wages for Child Care Workers: The Link with Quality." CUPE. November, 2004. Available from http://cupe.ca/updir/Wages_for_Child_Care_Workers_-_The_Link_With_Quality_Fact_Sheet_-_Eng1.pdf. Accessed 13 September, 2008.

[3] Shannon, Michael and Michael Kidd, 2001, "Projecting the Trend in Canadian Gender Wage Gap 2001–2031", *Canadian Public Policy*. Vol. XXVII, No. 4, 447–467. Cited in Rathje, Kelly, "Male Versus Female Earnings – Is the Gender Wage Gap Converging?" *Economica*. Spring 2002 (7.1). Available from http://www.economica.ca/ew07_1p2.htm. Accessed 13 September, 2008.

[4] Statistics Canada, *Canadian Social Trends,* Autumn 1991, catalogue no. 11-008-XPE, page 14. Judith Frederick, *As Time Goes By . . . Time Use of Canadians,* Statistics Canada, catalogue no. 89-544E, page 25; Statistics Canada, *Women in the Workplace,* catalogue no. 71-534, page 55; Colman, Ronald. 1998. *The Economic Value of Unpaid Housework and Childcare in Nova Scotia*. GPI Atlantic. Halifax; Harvey, Andrew, and Arun K. Mukhopadhyay, "When Twenty-Four Hours is Not Enough: Time Poverty of Working Parents," *Social Indicators Research,* volume 82, no. 1. May, 2007. Statistics Canada time use data show that lone-parent mothers working full-time spend an hour and a half less per day caring for their children than those who are not employed. Full-time employed lone-parent mothers spend only an hour a day total, or 7 hours a week, on primary child-care. Harvey and Mukhopadhyay (2007) have estimated that more than half of all Canadian single parents, overwhelmingly women, suffer "time poverty," which may be defined as less than the minimum necessary to accomplish basic household tasks, and that 88% of full-time employed single parents with one child and 98% of those with two children are time-poor.

[5] Statistics Canada, *Canada's Workforce: Unpaid Work: 2001 Census,* available from http://www.statcan.ca/english/IPS/Data/97F0013XCB2001000.htm. Cited in Colman, Ronald. 2003. A Profile of Women's Health Indicators in Canada. GPI Atlantic. Halifax, p. 72.

[6] Statistics Canada, *Households' Unpaid Work: Measurement and Valuation,* System of National Accounts, Catalogue no. 13-603E, no. 3, 1995, p. 3. Cited in Colman (2003), p. 72.

[7] Marshall, Katherine. *Converging Gender Roles: Perspectives. July, 2006.* Volume 7, no. 7. Statistics Canada. Catalogue no. 75-001-XIE. Available from http://www.statcan.ca/english/freepub/75-001-XIE/10706/art-1.pdf. Accessed July 8, 2008.

[8] Marshall (2006), p. 7.

[9] Statistics Canada attributes this decline to labour-saving devices, greater use of semi-prepared foods and frozen foods, the growing service-oriented economy geared towards the busy family (take-out meals, and services for snow removal, groundskeeping, and housecleaning), and a general decline in housework standards. Ibid. p.9.

[10] Trends and sources in Colman, Ronald (2000), *Women's Health in Atlantic Canada,* Atlantic Centre of Excellence for Women's Health and GPI Atlantic, Halifax, p. 26.

[11] Statistics Canada, General Social Surveys. 1992 and 2005. Cited in Harvey, Andrew and Ronald Colman, *The Value of Free Time.* GPI Atlantic. Halifax. September, 2008. Table 1.
[12] Statistics Canada, "Study: Time with the Family." *The Daily.* 13 February, 2007. Available from http://www.statcan.ca/Daily/English/070213/d070213b.htm. Accessed 13 September, 2008.
[13] Statistics Canada, 2001 Census. Cited in Colman, Ronald. 2003. *A Profile of Women's Health Indicators in Canada*. GPI Atlantic. Halifax, pp. 74-75.
[14] Statistics Canada. *The Daily*, General Social Survey: Time Use. November 9, 1999. Available from http://www.statcan.ca/Daily/English/991109/d991109a.htm. Accessed July 5, 2008.
[15] Statistics Canada, *Overview of the Time Use of Canadians in 1998,* catalogue no. 12F0080-XIE, Ottawa, November, 1999, Table 1, page 5, and Table 3, page 14.
[16] Marshall (2006), p. 7.
[17] Zukewich, Nancy. 1998. *Work, Parenthood and the Experience of Time Scarcity*. Housing, Family and Social Statistics Division. Statistics Canada. Appendix B. Also, General Social Survey. Cycle 19. Time Use. Questionnaire. Available from http://www.statcan.ca/english/sdds/instrument/4503_Q1_V4_E.pdf. Accessed September 29, 2008.
[18] General Social Survey. Cycle 19. Time Use. Questionnaire. Module: Main Source of Stress, p. 51. Available from http://www.statcan.ca/english/sdds/instrument/4503_Q1_V4_E.pdf. Accessed September 29, 2008. Respondents are asked: "Thinking about the amount of stress in your life, would you say that most days are: not at all stressful? not very stressful? a bit stressful? quite a bit stressful? or extremely stressful?" Those who report having at least some stress are then asked: "Are you stressful because you don't feel you have enough time?" Then the question thread continues to ask respondents about the main source of their stress (i.e., work, financial concerns, family, school work, or other), and then, again: "Do you think this is the main source of stress because you feel you do not have enough time?"
[19] 1992 and 1998 data are from Statistics Canada, *Overview of the Time Use of Canadians in 1998*, General Social Survey, catalogue no. 12 F0080-XIE, November, 1999, and Statistics Canada, *The Daily*, November 9, 1999, available from http://www.statcan.ca/Daily/English/991109/d991109a.htm. Accessed 13 September, 2008. 2005 data are derived from Statistics Canada's GSS micro-data files by Dr. Andrew Harvey, Director, Time Use Research Program, Saint Mary's University. Halifax.
[20] Data for time stress levels in 2005 (and therefore for trends in time stress from 1992 to 2005) were not publicly available from Statistics Canada. Statistics Canada also did not report 2005 GSS time use survey results in the same detail as reported in 1998. This is very unfortunate given the importance of this issue and its relevance to Canadians' actual daily lives. Because time stress profoundly affects quality of life and has significant health implications, it is incumbent upon Canada's national statistical agency to make these vital data and trends publicly available. As it is, these important data are collected only very infrequently (1992, 1998, 2005), and it may well be 2014 before these data next become publicly available. Ideally, time use and time stress data would be collected much more frequently. But at least after they are collected, they should be made fully and publicly available.
[21] Statistics Canada, *The Daily*, November 9, 1999. Available as cited above.
[22] Micro-data compilations by Andrew Harvey from Statistics Canada's 1998 and 2005 General Social Surveys. Cited in Harvey, Andrew and Ronald Colman, *The Value of Free Time in Nova Scotia.* GPI Atlantic. Halifax. September, 2008.
[23] Statistics Canada. General Social Survey, 1992 and 2005. Data provided by Andrew Harvey, Professor of Economics, Saint Mary's University, and presented in Harvey, Andrew and Ronald Colman, *The Value of Free time in Nova Scotia.* GPI Atlantic. Halifax. September, 2008.
[24] As noted above, "severe time stress," as measured by the 10 GSS questions, increased sharply across Canada for both men and women between 1992 and 1998—increasing from 12% to 16% for men and from 16% to 21% for women.
[25] Statistics Canada. *The Daily*. General Social Survey, Time Use. November 9, 1999. Available from http://www.statcan.ca/Daily/English/991109/d991109a.htm. Accessed July 4, 2008.
[26] Statistics Canada. *The Daily*. General Social Survey, Time Use. November 9, 1999. Available from http://www.statcan.ca/Daily/English/991109/d991109a.htm. Accessed 13 September, 2008.
[27] Phipps, Shelly. Professor, Department of Economics. Dalhousie University. PowerPoint Presentation: *Families, Time and Money in Canada: Historical, Longitudinal and International Perspectives*, presented at Statistics Canada's Socio-Economic Conference, May 6, 2008, Ottawa Congress Centre.

[28] Pannozzo, Linda and Ronald Colman. 2004. *Work Hours and the Future of Work in Canada: A Nova Scotia GPI Case Study*. GPI Atlantic. Halifax, p. 140. Original data are from Statistics Canada's General Social Survey on time use and are for parents between 25–44 years of age.
[29] Statistics Canada. *The Daily*, General Social Survey: Paid and Unpaid work, 2005. July 19, 2006. Available from http://www.statcan.ca/Daily/English/060719/d060719b.htm. Accessed July 7, 2008.
[30] Statistics Canada cites the Canadian Association of Administrators of Labour Legislation, which stated in 2002 that work–life balance has risen in importance because of the "increased recognition of the costs of work–life imbalance in terms of workplace injury rates and the general health of workers, as well as the development and well-being of children and aging parents." Cited in Marshall (2006), p. 16.
[31] Unpaid work includes school work, homework, and household work. Statistics Canada. *The Daily*, "Study: The Busy Lives of Teens." May 23, 2007. Available from http://www.statcan.ca/Daily/English/070523/d070523b.htm. Accessed July 4, 2008.
[32] Ibid.
[33] Based on 48 weeks and a 40-hour workweek.
[34] Nova Scotia 2006 population estimate for population 15 years and older from Department of Finance, Statistical Review 2007. Available from http://www.gov.ns.ca/finance/publish/statsrev/2007/NSSTATS_Review_2007.pdf. Accessed July 3, 2008. Population estimates for 2005 were not available.
[35] Figures are derived by first dividing the total replacement cost value of unpaid work for Nova Scotia in 1992, as given in Statistics Canada, *Households' Unpaid Work: Measurement and Valuation* (Catalogue no. 13-603E, #3. December, 1995),by the total number of household hours from the 1992 General Social Survey on Time Use (Tables B5 and B1, pages 76 and 72) in order to derive an hourly rate for the value of household work, based on market values for similar work. This hourly rate, based on 1992 figures, is then adjusted upward to 2005 dollars using the Consumer Price Index (CPI), and multiplied by the number of unpaid household work and childcare hours for Nova Scotia reported in the 2005 General Social Survey. Original wage rates are cited in Colman, Ronald. 1998. *The Economic Value of Unpaid Housework and Childcare in Nova Scotia*. GPI Atlantic. Halifax, p. 25. To assess the economic value of unpaid household work as a proportion of provincial Gross Domestic Product (GDP), there is a technical change from the method adopted in GPI Atlantic's 1998 study on *The Economic Value of Unpaid Housework and Childcare*. Whereas in the past, Statistics Canada published net domestic product at factor cost, this practice changed in the first quarter of 2001 with the publication of the estimates of the national economic and financial accounts. To bring the Canadian System of National Economic Accounts into line with international standards, the valuation of production is now done according to basic prices. In this update, therefore, the GDP value used for Nova Scotia in 2005 was $28.6 billion (at basic prices). Nova Scotia Department of Finance, Statistical Review 2007. Available from http://www.gov.ns.ca/finance/publish/statsrev/2007/NSSTATS_Review_2007.pdf, p. 136.
[36] Contribution of Accommodation and Food Services industry in 2005 was $643.4 million ($2005). Nova Scotia Department of Finance, Statistical Review 2007. Available from http://www.gov.ns.ca/finance/publish/statsrev/2007/NSSTATS_Review_2007.pdf, p. 135.
[37] Colman, Ronald. 1998. *The Economic Value of Unpaid Housework and Childcare in Nova Scotia*. GPI Atlantic. Halifax, p. 25
[38] The Concise Encyclopedia of Economics. Entry on Simon Kuznets. Available from http://www.econlib.org/LIBRARY/Enc/bios/Kuznets.html. Accessed 13 September, 2008.

Chapter 3: Leisure Time
[1] The half hour difference in 1992 was statistically significant. The 12-minute difference in 2005 was not significant. For an explanation of statistical significance see Harvey, Andrew, and Ronald Colman, *The Value of Free Time in Nova Scotia.* GPI Atlantic. Halifax. September. 2008, footnote 1.
[2] Harvey, Andrew, and Arun K. Mukhopadhyay, "When Twenty-Four Hours is Not Enough: Time Poverty of Working Parents," *Social Indicators Research*, 82 (1). May, 2007. According to Harvey and Mukhopadhyay, the concept of time poverty is based on the following logic: "Individuals can be money poor, time poor or both. While income is the most used indicator of poverty [. . .] our study focuses on the element of deprivation arising from the time deficit of many working people. The usual poverty threshold is calculated as the amount of income to buy the minimum required goods and services from the market. This minimum required purchase is greater for [many time-stressed working people] since they have less time than the average person to produce some goods and services for

themselves at home. So, they need money to buy these in the market in order to maintain the same consumption. The income standard must be supplemented to adequately measure actual poverty. Time use data make it possible to establish time requirements and time availability and provide a measure of time poverty."

[3] Redefining Progress, Genuine Progress Indicator. Available from http://www.rprogress.org/sustainability_indicators/genuine_progress_indicator.htm. Accessed 24 August, 2008.

[4] Talbert, John, Clifford Cobb, and Noah Slattery. *The Genuine Progress Indicator 2006: A Tool for Sustainable Development. Redefining Progress*. 2007. Available from http://www.rprogress.org/publications/2007/GPI%202006.pdf. Accessed 24 August, 2008.

[5] Pannozzo, Linda, and Ronald Colman, *Working Time and the Future of Work in Canada.* GPI Atlantic. Halifax. 2004.

[6] Pennock, Michael, et al. *Kings County GPI Community Profile.* GPI Atlantic. Halifax. May, 2008.

[7] Statistics Canada, Average hourly wages of employees by selected characteristics and profession, unadjusted data, by province (monthly) (Nova Scotia). Available from http://www40.statcan.ca/l01/cst01/labr69d.htm. Accessed 24 August, 2008.

[8] Statistics Canada. Labour force characteristics, population 15 years and older, by economic region, by province (Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick). Available from http://www40.statcan.ca/l01/cst01/labor36a.htm. Accessed 24 August, 2008.

[9] Available respectively at http://www.gpiatlantic.org/releases/pr_landcapacity.htm and http://www.gpiatlantic.org/pdf/health/womens/womensvol1.pdf.

Chapter 4: Paid Work Hours

[1] Sokejima, S. and S. Kagamimori. 1998. "Working hours as a risk factor for acute myocardial infarction in Japan: Case Control Study," *British Medical Journal.* No 317. pp. 775-780.

[2] Statistics Canada, Canadian Centre for Justice Statistics, *A One-Day Snapshot of Inmates in Canada's Adult Correctional Facilities*. Catalogue no. 85-601. p. 120. For Canada, the "Snapshot" shows 55% of provincial prisoners and 43% of federal prisoners unemployed at the time of admission.

[3] Frank Reid study cited in Sykes, Barbara, Peter Faid, and Henry Dembicki. 1985. Counting Costs. A Literature Review of the Social and Psychological costs of unemployment. Edmonton Social Planning Council. Edmonton. Reid and Sykes et al. cited in Pannozzo and Colman. 2004. p. 301.

[4] Ontario Medical Association study cited by Canadian Public Health Association. 1996. Discussion Paper. The Health Impact of Unemployment. CPHA. Ottawa. Cited in Pannozzo and Colman. 2004. p. 301.

[5] Pannozzo, Linda and Ronald Colman. 2004. Working Time and the Future of Work in Canada. A Nova Scotia GPI Case Study. GPI Atlantic. Halifax. Available from http://www.gpiatlantic.org. Cost estimate based on the official Nova Scotia unemployment rate in 2001 of 9.7% (which does not include discouraged workers or the underemployed) and a hypothetical 3.5% unemployment base rate used by the Canadian Centre for Policy Alternatives, which assumes that even in a situation of "full employment" there will always be some people between jobs who are on the unemployment rolls. The $4.4 billion figure includes lost output and fiscal costs such as direct payments to the unemployed and lost tax revenue.

[6] Battle, Ken and Sherri Torjman, eds. 1999. Employment Policy Options. Caledon Institute of Social Policy. Ottawa. Cited in Pannozzo and Colman. 2004. p. 193.

[7] Historical numbers from Nova Scotia Department of Finance, *Nova Scotia Labour Market. December, 2005.* Available from http://www.gov.ns.ca/finance/publish/nslm/lm0512.pdf. Accessed 14 December, 2008.

[8] Canadian Centre for Justice Statistics data indicate that most criminals were unemployed at the time of arrest. Cited in Dodds, Colin and Ronald Colman. 1999. The Cost of Crime in Nova Scotia. GPI Atlantic. Halifax. Paradoxically, imprisonment then removes unemployed criminals from the unemployment rolls.

[9] Calculations are based on a population of 908,007 in 2001. Statistics Canada. 2007. *Census trends for Canada, provinces and territories* (table). 2006 Census. Statistics Canada Catalogue no. 92-596-XWE. Ottawa. Released December 4, 2007. http://www12.statcan.ca/english/census06/data/trends/Index.cfm. Accessed Sep 24, 2008.

[10] At time of writing, only 2006 unemployment data were available, so this costing is based on the 7.9% official unemployment rate and 11.9% supplementary rate prevailing in 2006. Just prior to production of this report, 2007 data were released showing an 8% unemployment rate and 12% supplementary rate for 2007. Therefore the 2007 costs of unemployment would be marginally higher than those calculated here on the 2006 data. The 2007 data have

been included in the indicator trends in this chapter, but—due to the complexity of the costing procedures and the very small difference in the unemployment rate—the costs of unemployment have not been recalculated using the 2007 data.

[11] The following formula (based on Okun's Law) is used for the calculation of lost production attributable to unemployment: Lost production = actual production x [2(actual unemployment rate – 3.5)]/100, where 2 is called the Okun coefficient, and 3.5 represents the base rate of unemployment This formula is based on a series of statistical tests undertaken between l947 and l960 by economist Arthur Okun, who found that each percentage point above 4% in the unemployment rate is related to a 3% reduction in the real GDP, or conversely that that a one percentage point reduction in the unemployment rate would bring about a 3% increase in production and national income. Modifications to Okun's original formula based on more recent evidence are explained in detail in section 9.1.2 of GPI Atlantic's 2004 work hours report. Actual production is here taken as the GDP in 2006—the most recent data available at the time of writing. The population estimate of 913,462 used to estimate per capita losses is also for 2006. GDP data are from the Nova Scotia Department of Finance. Nova Scotia Statistical Review 2007. Economics and Statistics Division. Available from http://www.gov.ns.ca/finance/publish/statsrev/2007/NSSTATS_Review_2007.pdf. Accessed June 17, 2008. Population data are from Statistics Canada. 2007. Census trends for Canada, provinces and territories (table). 2006 Census. Statistics Canada Catalogue no. 92-596-XWE. Ottawa. Released December 4, 2007. http://www12.statcan.ca/english/census06/data/trends/Index.cfm. Accessed Sep 24, 2008. In order to estimate the savings due to the decline in unemployment, figures were converted to 2006 constant dollars using the Bank of Canada's Inflation Calculator.

[12] The 2006 provincial GDP, as reported on the Nova Scotia Department of Finance web site, is $28.6 billion in $2002. For comparison purposes, all figures here have been converted to $2006 using the Bank of Canada's Inflation Calculator.

[13] Department of Finance. Nova Scotia Statistical Review 2004. Available from http://www.gov.ns.ca/finance/publish/statsrev/2004/sr2004.pdf. p. 102. Nova Scotia Statistical Review 2007. Economics and Statistics Division. Available from http://www.gov.ns.ca/finance/publish/statsrev/2007/NSSTATS_Review_2007.pdf. p. 121.

[14] Department of Finance. Nova Scotia Statistical Review 2007. Economics and Statistics Division. Available from http://www.gov.ns.ca/finance/publish/statsrev/2007/NSSTATS_Review_2007.pdf. Accessed June 17, 2008. p. 121.

[15] All calculations in this update use the most recent adjusted Labour Force Survey data available at the time of writing, which may explain why there is a slight discrepancy between the cost estimates reported in GPI Atlantic's 2004 work hours report and what is reported here.

[16] Income tax estimates are kindly provided by Mary MacInnis. Certified General Accountant. Chester, Nova Scotia. Personal communication with Linda Pannozzo, June 19, 2008.

[17] In 2006, 480,000 people were in the labour force and 38,100 (7.9%) were unemployed.

[18] As noted above, this includes both discouraged workers and the difference between the hours currently worked by under-employed (involuntary) part-time workers and the full-time hours they want to work.

[19] Statistics Canada. 2008. Spending Patterns in Canada 2006. Catalogue no. 62-202-X. Minister of Industry. Ottawa.

[20] The term "quintile" simply means "one-fifth," and refers to five income groups ranked from the top 20% of incomes to the bottom 20% of incomes. To assess quintiles, all incomes in a given population are ranked from the lowest to the highest and then divided into five even groups. Thus, the bottom one-fifth of income groups is referred to as the "first quintile," the top one-fifth as the "fifth quintile," and the middle 20% as the "third quintile."

[21] Based on advice from Bruce Hennebury, Executive Director of the Fiscal and Economic Policy Branch, Nova Scotia Department of Finance, GPI Atlantic's 2004 work hours report estimated that HST applied to 50% of all expenditures. This same figure has been used in this update. HST is currently 13%.

[22] Average consumption per person is calculated by dividing the average consumption per household by the household size. The average total current consumption for the lowest quintile is $21,935 ($2006) and the average household size for the bottom quintile is 1.5 persons. The average total current consumption for the second quintile is $32,414 ($2006) and the average household size for that quintile is 2 persons. We use "total current consumption" as opposed to "total expenditure" because the latter includes items that may not be taxable including taxes, pension contributions, and money contributions. Method for calculating average consumption per person from Statistics

Canada. User Guide for the Survey of Household Spending, 2006. Available from http://www.statcan.ca/english/research/62F0026MIE/62F0026MIE2008001.pdf. Accessed June 20, 2008, p. 35.
[23] Statistics Canada. 2007. *Census trends for Canada, provinces and territories* (table). 2006 Census. Statistics Canada Catalogue no. 92-596-XWE. Ottawa. Released December 4, 2007. http://www12.statcan.ca/english/census06/data/trends/Index.cfm. Accessed Sep 24, 2008.
[24] Jahoda, M. 1982. Employment and Unemployment: A Social-Psychological Analysis. Cambridge University Press. London. Cited in Pannozzo and Colman. 2004. pp. 298-299.
[25] Bedard. 1996. p. 11; Canadian Mental Health Association. 1984. Work and Well-being. The Changing Realities of Employment. CMHA. Toronto. p. 1; Jahoda. 1982. pp. 47-73; and other sources cited in Pannozzo and Colman. 2004. p. 299.
[26] Canadian Public Health Association. 1996. p. 4. Cited in Pannozzo and Colman. 2004. p. 309.
[27] D'Arcy and Siddique. 1985. Unemployment and Health: An Analysis of the Canada Health Survey. *International Journal of Health Services.* 15. 4. pp. 609-635. Cited in Pannozzo and Colman. 2004. pp. 309-310.
[28] Health Canada. 2002. Economic Burden of Illness in Canada, 1998. Policy Research Division. Available from http://www.phac-aspc.gc.ca/publicat/ebic-femc98/pdf/ebic1998.pdf. Accessed June 17, 2008.
[29] Bedard, Marcel. 1996. The Economic and Social Costs of Unemployment. Applied Research Branch. Human Resources Development Canada. Ottawa. Cited in Pannozzo and Colman. 2004. p. 317, Table 37.
[30] For a detailed discussion on these methodological and data limitations and on the methodology used for calculating the economic burden of illness in Nova Scotia linked to unemployment, please refer to Pannozzo and Colman. 2004. pp. 311-318.
[31] All estimates are in 2006 constant dollars unless otherwise stated.
[32] Williams, Colin C. and Jan Windebank. l998. "The Unemployed and Paid Informal Sector in Europe's Cities and Regions." In *Unemployment and Social Exclusion. Landscapes of Labour Inequality*. Paul Lawless, Ron Martin, and Sally Hardy (eds). Jessica Kingsley Publishers. London. p. 38.
[33] Pannozzo and Colman. 2004. p. 209 and chapter 9 on "Costs of Unemployment."
[34] For more evidence on the personal and social consequences of unemployment, particularly in relation to family breakdown, please refer to Pannozzo and Colman. 2004. pp. 321-323.
[35] Cobb, Clifford, Mark Glickman, and Craig Cheslog. 2001. The Genuine Progress Indicator, 2000 Update. Redefining Progress. Available from http://www.rprogress.org/publications/2001/2000_gpi_update.pdf. Accessed June 20, 2008. US dollars were first converted to 2006 constant dollars and then converted to Canadian dollars using an exchange rate for June 1, 2006, of 1.1008.
[36] In 2007, Redefining Progress published an update of its 2000 Genuine Progress Indicator, but did not include family breakdown as a cost category nor specify why this cost was excluded in the 2007 update. Talberth, Dr. John, Clifford Cobb, and Noah Slattery. 2007. Genuine Progress Indicator 2006. Redefining Progress. Available from http://www.rprogress.org/publications/2007/GPI2006_ExecSumm.pdf. Accessed June 20, 2008.
[37] For detail regarding the steps involved in the costing analysis used to estimate divorce costs attributable to unemployment in Nova Scotia, please refer to Pannozzo and Colman. 2004. *Work Hours.* pp. 322-324.
[38] In 2006 the population of the US was roughly 298.4 million and that of Nova Scotia was 913,462—or 0.31% of the US population. Extrapolating the total cost of divorce to Nova Scotia from the total cost estimate provided by Redefining Progress for divorce in the US, after adjusting for population alone, the total cost of divorce in Nova Scotia in 2006 would be $265 million ($2006). However, it likely that—on a per case basis—divorce costs are greater in the US than in Nova Scotia, because the evidence indicates that the former is generally a more litigious society. Thus, the cost figure is therefore further adjusted downwards to take into account the ratio of lawyers per capita in Nova Scotia compared to the US—where much more is spent on lawyers on a per capita basis. According to evidence in Dodds and Colman (1999) there is one lawyer for every 300 Americans, compared to one lawyer for every 700 Nova Scotians. Adjusting the total estimated population-based divorce cost in Nova Scotia proportionately, therefore, three-sevenths of $265 million is $113.6 million. This figure is further adjusted downwards to account for the much lower divorce rate in Nova Scotia compared to the US—2.1 per 1,000 versus 4.3 per 1,000. Since roughly half as many divorces take place in Nova Scotia as in the US, it is estimated that the total economic cost of divorce in Nova Scotia may be roughly $56.8 million. The relative risk of getting divorced for those who are unemployed is estimated to be between 2.0 and 3.5 times greater than for those with jobs. To remain on the conservative side, we arbitrarily use 2.5 as the relative risk for the purpose of these cost estimates. The population attributable fraction (PAF) of total divorce costs attributable to unemployment is then calculated using

the same formula used in the previous section on health costs (PAF = P(RR-1)/[P(RR-1)+1], where P is the prevalence of unemployment and RR is the relative risk of divorce attributable to unemployment.) The PAF is 10.6%, which is then applied to the total cost of divorce for Nova Scotia in order to estimate the portion of total divorce costs that may be attributed to joblessness. US population data from National Center of Health Statistics. Available from http://www.cdc.gov/nchs/data/nvsr/nvsr55/nvsr55_05.pdf. Accessed June 20, 2008. Divorce rate data from Statistics Canada. 2000. *The Daily*. Thursday September 28, 2000. NOTE that, since the Nova Scotia results are extrapolated from US results, the magnitude of the cost difference reported in the text between the estimated 2001 and 2006 unemployment-related divorce costs may be partially related to differences in the $CAD-$US exchange rates. Thus, in 2001 the exchange rate was quite high (1.548), whereas in 2006 it was only 1.1008. This difference, coupled with the difference in unemployment rates, likely accounts for the size of the cost difference, as there was no substantial difference in divorce rates during this time period.

[39] Crow Iain, Paul Richardson, Carol Riddington, and Frances Simon. 1989. Unemployment, Crime and Offenders. Routledge. New York. p. 10. Cited in Pannozzo and Colman. 2004. p. 327.

[40] Data provided by Smith, Paul K. Policy, Planning and Research Division. NS Department of Justice. Personal communication, May 1, 2003. Cited in Pannozzo and Colman. 2004. Tables 39 and 40.

[41] Unemployment rates from Statistics Canada, *Estate Database*, and *Canadian Economic Observer, Historical Statistical Supplement*. Catalogue no. 11-210-XPB. Robbery rates from Statistics Canada, *CANSIM Database,* matrix 2200. Reported in Dodds and Colman. 1999. pp. 78-79.

[42] This conservative estimate includes direct costs associated with victim losses in reported crimes; public expenditures on prisons, police, and courts; and private defensive expenditures (alarms, security guards, and theft insurance premiums minus claims). From Dodds and Colman. 1999. p. 34. A more comprehensive estimate in the same report adds estimates for costs associated with unreported crimes, retail losses due to shoplifting and employee theft, insurance fraud losses, and costs attributable to pain and suffering as estimated from court awards and other sources.

[43] Advisory Group on Working Time and Distribution of Work. 1994. Report for the Advisory Group on Working Time and Distribution of Work. Human Resources Development Canada. Hull. p. 15. Cited in Pannozzo and Colman. 2004. p. 5.

[44] Morissette, Rene. l995. *Why has Inequality in Weekly Earnings Increased in Canada?* Business and Labour Market Analysis, Statistics Canada. No. 80. Ottawa. p. 5. Cited in Pannozzo and Colman. 2004. p. 242.

[45] Usalcas, Jeannine. 2008. Hours Polarization Revisited. *Perspectives.* Statistics Canada. Catalogue no. 75-001-X. Minister of Industry. Ottawa. p. 6.

[46] Ibid. p. 14.

[47] Statistics Canada. 1997. Labour Force Update. Cited in Pannozzo and Colman. 2004. p. 465. For more detail on the differences between actual hours and usual hours and how the use of each type of data affects the results, please see Pannozzo and Colman. 2004. pp. 452-468. For example, since actual hours include overtime hours, trend lines constructed using actual hours data are more dramatic than trend lines constructed using usual hours data. In keeping with most of the work done by Statistics Canada on work hours, and unless otherwise stated, usual hours are generally used to create the trend lines for this update. However, actual hours data are used to assess long work hours, since it is important to capture overtime worked in order to assess the actual work burden carried by Canadians and Nova Scotians who work long hours. For a more detailed explanation of the reasoning behind use of usual and actual hours, please refer to the Appendix in the original *Work Hours* report: Pannozzo and Colman. 2004. pp. 452-468.

[48] Incidence of long hours among the full-time employed for Canada and Nova Scotia requires a custom tabulation from Statistics Canada that would cost $300. Financial constraints did not allow the purchase of these data at this time.

[49] Statistics Canada. Study: Understanding regional differences in work hours, 2004. *The Daily*, January 22, 2007. Available from http://www.statcan.ca/Daily/English/070122/d070122a.htm. Accessed June 4, 2008. This study looked at the 25-54 age group, because typically this group is the most engaged in the labour market and may be more likely to share similar preferences in working time.

[50] Ibid. p.3. The study divided working hours into four groups: a "short work year" was defined as working less than 1,500 hours; hours ranging from 1,500 to 1,900 were considered a "low full-time full-year"; 1,900 to 2,300 hours were considered a "standard full-time full-year"; and more than 2,300 hours were defined as a "long work year."

[51] Usalcas, Jeannine. 2008. Hours Polarization Revisited. *Perspectives.* Statistics Canada. Catalogue no. 75-001-X. Minister of Industry. Ottawa, p. 13. The OECD countries that saw a decline in the proportion of workers working 50 hours or more a week between 1997 and 2006 were the United Kingdom, Ireland, Italy, Luxembourg, Canada, New Zealand, Japan, Australia, Netherlands, Germany, and Belgium. Norway, Sweden, and Denmark saw slight increases in the proportion working long hours during this time period.

[52] Shields, Margot. "Long Working Hours and Health". Statistics Canada. *Health Reports.* Volume 11. No. 2. Autumn.1999. pp. 33-48. Cited in Colman, Ronald. 2003. A Profile of Women's Health Indicators in Canada. GPI Atlantic. Prepared for Health Canada. p. 21.

[53] Sokejima, S. and S. Kagamimori. "Working hours as a risk factor for acute myocardial infarction in Japan: Case Control Study". *British Medical Journal.* 1998. pp. 775-780. Cited in Colman, Ronald. 2003. A Profile of Women's Health Indicators in Canada. GPI Atlantic. p. 37.

[54] Pannozzo, Linda and Ronald Colman. 2004. Working Time and the Future of Work in Canada. A Nova Scotia GPI Case Study. GPI Atlantic. Halifax. Available from http://www.gpiatlantic.org. pp. 175-178.

[55] 2007 study by Mercer Human Resource Consulting cited by Mario Cywinski. 2007. "Are Canadians Vacation Deprived?" Canadaone Magazine, and by Jeanne Sahadi. 2007. "Who gets the most (and least) vacation?" CNN Money. Cywinski available from http://www.canadaone.com/ezine/july07/vacation.html. Accessed June 9, 2008. Sahadi available from http://money.cnn.com/2007/06/12/pf/vacation_days_worldwide/. Accessed September 20, 2008. The Mercer study pointed out that many employers provide vacations that exceed the minimum after a certain period of service, but that only the minimum legal vacation entitlement was considered in the study. The number of vacation days also does not include statutory holidays. For example, Finnish workers must get a minimum of 30 days paid vacation plus up to 14 days of paid holidays per year.

[56] A study by the Center for Economic and Policy Research (CEPR) in the US found that the US is the only "advanced economy that does not guarantee its workers any paid vacation or holidays." It estimated that 28 million Americans, or one in four private-sector workers, do not get any paid days off at all, and that the norm for vacations was actually much lower than 15 days when companies of all sizes, and workers of all types, were considered. The US average for all workers and companies, according to CEPR, is 9 days of paid vacation plus 6 days of paid holidays. Rebecca Ray and John Schmitt. 2007. No-Vacation Nation. CEPR. Washington, DC. Available from http://www.cepr.net/index.php/publications/reports/no-vacation-nation/ Accessed June 10, 2008.

[57] Mercer study findings cited by Karen Blotnicky. "Canadians not taking enough vacation: study". Halifax Herald. June 8, 2008.

[58] Mercer study findings cited by Karen Blotnicky. "Canadians not taking enough vacation: study". Halifax Herald. June 8, 2008.

[59] Mario Cywinski. 2007. "Are Canadians Vacation Deprived?" Canadaone Magazine. Available from http://www.canadaone.com/ezine/july07/vacation.html. Accessed June 9, 2008.

[60] Duxbury, Linda and Chris Higgins. 2001. A CPRN Discussion Paper: Work-Life Balance in the New Millennium: Where Do We Need to Go? Canadian Policy Research Networks. Available from http://www.cprn.com/documents/7314_en.PDF. Accessed June, 2008.

[61] Ibid. p. 4.

[62] "Sandwich employees" are working women who experience pressure from both ends of the family dependence scale, and who take care of both young children and elderly parents.

[63] Higgins, Christopher, and Linda Duxbury. 2002. *The 2001 National Work-Life Conflict Study: Report One.* Health Canada. Ottawa. p. 4. Available from http://www.hc-sc.gc.ca/pphb-dgspsp/publicat/work-travail/. Accessed September 3, 2002.

[64] Ibid. p. 9.

[65] The compilation was drawn from the 10,000 comments provided by participants in Health Canada's 2001 National Work-Life Conflict Study, which included workers in the public, private, and not-for-profit sectors in a wide range of large organizations across Canada. Duxbury, Linda and Chris Higgins. 2003. Voices of Canadians: Seeking Work-Life Balance. Human Resources and Social Development Canada. Available from http://www.hrsdc.gc.ca/en/lp/spila/wlb/vcswlb/05table_of_contents.shtml. Accessed June 10, 2008.

[66] Statistics Canada. *The Daily*. Study: Workaholics and time perception. May 15, 2007. Available from http://www.statcan.ca/Daily/English/070515/d070515c.htm. Accessed June 10, 2008.

[67] Statistics Canada. *The Daily*. Study: Workaholics and time perception. May 15, 2007. Available from http://www.statcan.ca/Daily/English/070515/d070515c.htm. Accessed June 10, 2008.

[68] Fudge, Judy. 2006. Control over Working Time and Work-Life Balance: A Detailed Analysis of the Canada Labour Code, Part III. Human Resources and Social Development Canada. Available from http://www.hrsdc.gc.ca/en/labour/employment_standards/fls/research/research17/page01.shtml#exec. Accessed July 9, 2008.
[69] Ibid. p. 1.
[70] Ibid.
[71] Ibid. p. 2.
[72] Ibid. p. 3.
[73] Ibid.
[74] Judy Fudge offers a number of recommendations for new legal rules designed to promote working-time arrangements that are "healthy, family-friendly, foster gender equality, advance productivity, and facilitate worker choice and influence over their hours of work." For more details on these recommendations please refer to her 2006 report. Available from http://www.hrsdc.gc.ca/en/labour/employment_standards/fls/research/research17/page01.shtml#exec
[75] Higgins, Chris and Linda Duxbury. 2002. The 2001 National Work-Life Conflict Study: Report One. Report prepared for the Healthy Communities Division. Health Canada. Ottawa.
[76] Quick, James C., and Jonathan Quick. 1984. Organizational Stress and Preventive Management. McGraw Hill Book Company. New York; Lowe, Graham. 1989. Women, Paid/Unpaid Work, and Stress: New Directions for Research. Canadian Advisory Council on the Status of Women. Ottawa; Health Canada. 1999. Statistical Report on the Health of Canadians. Federal, Provincial, and Territorial Advisory Committee on Population Health. Ottawa.
[77] Health Canada. 1999. Statistical Report on the Health of Canadians. Federal, Provincial, and Territorial Advisory Committee on Population Health. Ottawa. p. 49.
[78] Goetzel, Ron, ed. "The Financial Impact of Health Promotion". *American Journal of Health Promotion.* 15. 5. May/June 2001.
[79] Kemeny, Anna. 2002. Driven to Excel: A Portrait of Canada's Workaholics. *Canadian Social Trends.* Statistics Canada. p. 2. Cited in Pannozzo and Colman. 2004. p. 124.
[80] Adjusted LFS data are used in this update.
[81] According to LFS data, in 2007 the average number of overtime hours worked per week by those Nova Scotians working unpaid overtime was 8.7 hours. To determine the number of hours worked for free in a typical week in Nova Scotia, this number is then multiplied by the number of employees working unpaid overtime (43,800) in 2007.
[82] Duchesne, Doreen. 1997. Working overtime in today's labour market. *Perspectives on Labour and Income.* Statistics Canada. Cited in Pannozzo and Colman. 2004. pp. 116-118.
[83] Communications, Energy, and Paperworkers Union of Canada. 1999. Working less for more jobs. A study of work and job creation in the B.C. pulp and paper industry. CEP. Ottawa. pp. 11-12. Cited in Pannozzo and Colman. 2004. p. 126.
[84] Nova Scotia Department of Environment and Labour. 2003. New Regulations to Clarify Overtime Provision. Press Release. November 28, 2003. Available from http://www.gov.ns.ca/news/details.asp?id=20031128002. Accessed November, 2003. Cited in Pannozzo and Colman. 2004. p. 130.
[85] Nova Scotia Department of Environment and Labour. Overtime. Available from http://www.gov.ns.ca/lwd/employmentrights/overtime.asp. Accessed June, 2008.
[86] Nova Scotia Department of Environment and Labour. Overtime. Available from http://www.gov.ns.ca/lwd/employmentrights/overtime.asp. Accessed June, 2008.
[87] Statistics Canada. 1997. Labour Force Update. Hours of Work. Vol. 1, no. 2. Minister of Industry, Ottawa. Cited in Pannozzo and Colman. 2004. p. 178. Also, Vosko, Leah F., Nancy Zukewich, and Cynthia Cranford. 2003. Precarious jobs: A new typology of employment. *Perspectives on Labour and Income.* Vol. 4. No. 10. Statistics Canada. Available from http://www.statcan.ca/english/freepub/75-001-XIE/01003/ar-ar_200310_02_a.html. Accessed June 11, 2008.
[88] Vosko et al. p. 6.
[89] Ibid.
[90] Labour Force Historical Review, 2001. Cited in Pannozzo and Colman (2004). These data are for employed persons aged 15 and over.
[91] 1989 data cited in Pannozzo and Colman (2004) from Advisory Group on Working Time and the Distribution of Work. Also from Vosko, Leah F., Nancy Zukewich, and Cynthia Cranford. 2003. Precarious jobs: A new typology

of employment. *Perspectives on Labour and Income.* Vol. 4. No. 10. Statistics Canada. Available from http://www.statcan.ca/english/freepub/75-001-XIE/01003/ar-ar_200310_02_a.html. Accessed June 11, 2008. Provincial data for 1989 are unavailable. Canadian data for 1989 are from the 1989 General Social Survey and include all employees over the age of 15. The incidence of temporary work in 1989 was 6% among men and 8% among women.

92 Morissette, Rene and Anick Johnson. 2005. Are Good Jobs Disappearing in Canada? Analytical Studies Branch Research Paper Series. Statistics Canada. Ottawa. p. 18. Available from http://www.statcan.ca/english/research/11F0019MIE/11F0019MIE2005239.pdf. Accessed June 13, 2008. Newly hired employees are defined as those who have one year of seniority or less.

93 Ibid. p. 19.

94 Statistics Canada. Study: Earnings of temporary versus permanent employees. *The Daily*. January 26, 2005. Available from http://www.statcan.ca/Daily/English/050126/d050126b.htm. Accessed June 4, 2008.

95 Ibid.

96 Advisory Group on Working Time and the Distribution of Work (1994), pp. 32-33.

97 Heisz, Andrew and Sebastien LaRochelle-Cote. 2006. Work Hours Instability. *Perspectives on Labour and Income.* Vol. 7, no. 12. Statistics Canada. p. 3.

98 Human Resources and Social Development Canada. 2008. Federal Labour Standards Review Commission. History. Available from http://www.hrsdc.gc.ca/en/labour/employment_standards/fls/history.shtml. Accessed June 4, 2008.

99 Federal Labour Standards Review Commission. 2006. Fairness at Work: Federal Labour Standards for the 21st Century. HRSDC. Available from http://www.hrsdc.gc.ca/en/labour/employment_standards/fls/final/page55.shtml. Accessed June 4, 2008.

100 Ibid. p. 56.

101 Ibid. pp. 56-57.

102 2006 data for part-time work among women from OECD. Cited in Usalcas, Jeannine. 2008. Hours polarization revisited. *Perspectives.* Statistics Canada. Table 4.

103 Pannozzo and Colman. 2004. p. 178. The Netherlands has legislation and labour agreements that prohibit discrimination against part-timers in terms of promotion, pay, and fringe benefits.

104 Statistics Canada. 2008. Labour Force Historical Review. Minister of Industry, Ottawa.

105 Statistics Canada. 1997. Labour Force Update. Hours of Work. Vol. 1 no. 2. Minister of Industry. Ottawa. p. 17. Cited in Pannozzo and Colman. 2004. p. 172.

106 1976-2001 data from Statistics Canada. 2002. Labour Force Historical Review 2001; 1953-1976 data from Benimdhu, Prem. 1987. Hours of Work: Trends and Attitudes in Canada. Conference Board of Canada. Cited in Pannozzo and Colman. 2004. Table 35.

107 Statistics Canada. Labour Force Historical Review. Minister of Industry, Ottawa.

108 Harvey, Andrew, and Arun K. Mukhopadhyay. 2007. "When Twenty-Four Hours is not Enough: Time Poverty of Working Parents," *Social Indicators Research,* volume 82, no. 1. May. According to the authors, the concept of time poverty is based on the following logic: "Individuals can be money poor, time poor or both. While income is the most used indicator of poverty…our study focuses on the element of deprivation arising from the time deficit of many working people. The usual poverty threshold is calculated as the amount of income to buy the minimum required goods and services from the market. This minimum required purchase is greater for [many time-stressed working people] since they have less time than the average person to produce some goods and services for themselves at home. So, they need money to buy these in the market in order to maintain the same consumption. The income standard must be supplemented to adequately measure actual poverty. Time use data make it possible to establish time requirements and time availability and provide a measure of time poverty."

109 Dual-earner couples include both full-time and part-time employed, and all age groups between the ages of 18 and 64.

110 For the original GPI Work Hours report, nearly $400 was spent to obtain a custom tabulation by Statistics Canada for the actual work hours of dual earner couples with children. Due to financial constraints, it was not possible at this time to update this indicator.

111 CCHS definition of workplace stress cited in Williams, Cara. 2003. Stress at Work. *Canadian Social Trends.* Autumn. Statistics Canada. Catalogue no. 11-008. p. 7.

[112] Global Business and Economic Roundtable on Mental Health. 2000. Top 10 sources of workplace stress. *Unheralded Business Crisis in Canada: Depression at Work. An Information Paper for Business.* GPC Canada. Toronto. p. 37. Available from http://www.mentalhealthroundtable.ca/aug_round_pdfs/Roundtable%20report_Jul20.pdf. Accessed June 13, 2008; Menzies, Heather. 1996. Whose Brave New World? The Information Highway and the New Economy. *Between the Lines*. Toronto. Cited in Pannozzo and Colman. 2004. pp. 217-218; and Williams, Cara. 2003. Stress at Work. *Canadian Social Trends.* Autumn. Statistics Canada. Catalogue no. 11-008. pp. 7-8.
[113] Wilkins, Kathryn and Marie P. Beaudet. l998. "Work Stress and Health." *Health Report*s. Statistics Canada. Catalogue no. 82-003. Minister of Industry. Ottawa. p. 47.
[114] Pannozzo, Linda and Ronald Colman. 2004. Work Hours and the Future of Work in Canada: A Nova Scotia GPI Case Study. GPI Atlantic. Halifax. p. 195.
[115] Higgins, Chris and Linda Duxbury. 2002. The 2001 National Work-Life Conflict Study: Report One. Report prepared for the Healthy Communities Division, Health Canada. Ottawa.
[116] Williams. 2003. p. 8. Based on GSS 2000 data.
[117] Quick, James C., and Jonathan Quick. 1984. Organizational Stress and Preventive Management. McGraw Hill Book Company. New York; Lowe, Graham. 1989. Women, Paid/Unpaid Work, and Stress: New Directions for Research. Canadian Advisory Council on the Status of Women. Ottawa; Health Canada. 1999. Statistical Report on the Health of Canadians. Federal, Provincial, and Territorial Advisory Committee on Population Health. Ottawa.
[118] Health Canada. 1999. Statistical Report on the Health of Canadians. Federal, Provincial, and Territorial Advisory Committee on Population Health. Ottawa. p. 49.
[119] Quick and Quick. 1984. pp. 59-63.
[120] Lowe, Graham S., and Herbert C. Northcott. 1986. Under Pressure: A Study of Job Stress. Garamond Press. Toronto. p. 47. Cited in Pannozzo and Colman. 2004. p. 222.
[121] Shields, Margot. 2006. Unhappy on the Job. *Health Reports.* Vol. 17. No. 4. Statistics Canada. Ottawa. p. 33.
[122] Ibid. pp. 33-34.
[123] Park, Jungwee. 2007. Work stress and job performance. *Perspectives.* Statistics Canada. December. Available from http://www.statcan.ca/english/freepub/75-001-XIE/2007112/articles/10466-en.pdf. Accessed June 13, 2008. p. 7.
[124] Active jobs are defined as those which are both above median in terms of demands but also above median in terms of control. Low job strain jobs are below median on demands and above median on control. Passive jobs are below median on both demands and control. Ibid, p. 6.
[125] Ibid. p. 14.
[126] Ibid. p. 15. Job strain is defined as the "measure of the balance between the psychological demands of a job and the amount of control or decision-making power it affords."
[127] Wilkins, Kathryn and Marie P. Beaudet. l998. "Work Stress and Health." *Health Report*s. Statistics Canada. Catalogue. No. 82-003. Minister of Industry. Ottawa. pp. 47-52.
[128] Ibid. pp. 50-51.
[129] Boudreau, Marcel. Statistics Canada. Personal communication. August 28, 2008.

Chapter 6: Income Distribution
[1] Osberg, Lars. 2007. *Reality Check: Economic Inequality in Canada.* In "Why inequality matters, in 1,000 words or less." Canadian Centre for Policy Alternatives. Ottawa. December. pp. 25-27.
[2] Aristotle. *The Politics.* Book Four. Ch. XI.
[3] Statistics Canada. 1999. Income inequality and mortality among working-age people in Canada and the US *Health Reports.* p. 77. Cited in Pannozzo, Linda and Ronald Colman. 2004. Working Time and the Future of Work in Canada. A Nova Scotia GPI Case Study. GPI Atlantic. Halifax. p. 274.
[4] Marmot, Michael and Richard Wilkinson. eds. 1998. Social Determinants of Health: The Solid Facts. World Health Organization. p. 10. Cited in Pannozzo and Colman. 2004. p. 275.
[5] Almer, Robert and Donald Eddins. 1987. Cross-sectional analysis: Precursors of premature death in the United States. In Almer, Robert and Bruce Hull. eds. *Closing the Gap: The Burden of Unnecessary Illness.* Oxford University Press. New York and Oxford. Table 1. p. 183. Cited in Colman, Ronald. 2002. The Cost of Chronic Disease in Nova Scotia. GPI Atlantic. Halifax. p. 53.

[6] "Stunning Statistics Reveal Toll of Poverty on Children," *Vancouver Sun,* December, 28, 1990; cited in Province of British Columbia. 1996. *Cost Effectiveness/Value of Nutrition Services: An Annotated Bibliography.* Prevention and Health Promotion Branch. Ministry of Health. B.C. July, 1996. p. 5.
[7] Health Canada. 1999. *Toward a Healthy Future: Second Report on the Health of Canadians,* Health Canada and Statistics Canada. September. p. 85 and chapter 3.
[8] Barbara Morrongiello. 1998. "Preventing Unintentional Injuries Among Children." *Determinants of Health: Children and Youth.* Canada's Health Action: Building on the Legacy. Volume 1. National Forum on Health.
[9] Scott, Elizabeth. 2007. "How the Stress of Poverty Impacts Children's Health." November. Available from http://stress.about.com/od/financialstress/a/poverty.htm. Accessed September 7, 2008.
[10] Ross, David, and Paul Roberts. 1999. "Income and Child Well-being: A new perspective on the poverty debate." Canadian Council on Social Development. Available from http://www.ccsd.ca/pubs/inckids/index.htm. Accessed September 7, 2008.
[11] Ross, David. 1998. "Rethinking Child Poverty," *Insight, Perception*. Canadian Council on Social Development. Ottawa. , 22:1. pp. 9-11.
[12] Kennedy, Bruce P., Ichiro Kawachi, Roberta Glass, and Deborah Prothrow-Stith. 1996. Income Distribution, Socioeconomic Status, and Self-Rated Health: A US Multi-Level Analysis. *British Medical Journal.* Vol. 317. pp. 917-921. Available from http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=28675. Accessed July 15, 2008.
[13] Ibid.
[14] Kahn, Henry S., Lilith M. Tatham, Elsie R. Pamuk and Clark W. Heath Jr. 1998. Are Geographic Regions with High Income Inequality Associated with Risk of Abdominal Weight Gain? *Social Science and Medicine.* Vol. 47. pp. 1-6.
[15] British Medical Journal. 1998. "Editorial: The Big Idea." April 20. Cited in Pannozzo and Colman. 2004. p. 276.
[16] Pickett, Kate, and Richard Wilkinson, "Child wellbeing and income inequality in rich societies: ecological cross sectional study." *British Medical Journal.* 335. 7629. 1080. November 24, 2007.
[17] Statistics Canada. 1999. pp. 78-79. Cited in Pannozzo and Colman. 2004. p. 277.
[18] Marmot and Wilkinson. 1998. pp. 16-17. Cited in Pannozzo and Colman. 2004. p. 277.
[19] Statistics Canada. 1999. p. 82. Cited in Pannozzo and Colman. 2004. p. 277.
[20] In 2001, GPI Atlantic reported that 30% of Canada's health care spending was in the private sector. Dodds, Colin and Ronald Colman. 2001. Income Distribution in Nova Scotia. GPI Atlantic. Halifax. p. vi. Direct private health spending as a proportion of disposable income reported in Osberg, Lars, and Andrew Sharpe. 2008. *Economic Security in Nova Scotia.* GPI Atlantic. Halifax.
[21] Dodds, Colin and Ronald Colman. 2001. Income Distribution in Nova Scotia. GPI Atlantic. Halifax,
[22] Council of Ministers of Education Canada (CMEC). 2005. *Education Indicators in Canada: Report of the Pan-Canadian Education Indicators Program.* Table C4.6. p. 208.
[23] Organisation for Economic Co-operation and Development (OECD). 2005. *School Factors Related to Quality and Equity. Results from PISA 2000.* Paris. OECD.
[24] See, for example, Leadbeater, Charlesm. 2000. *The Weightless Society.* Texere.
[25] See for example, Savoie, Donald, 1997. *Rethinking Canada*'s *Regional Development Policy*. Moncton. Canadian Institute for Research on Regional Development; Osberg, Lars. ed. 2003. *The Economic Implications of Social Cohesion.* Toronto. University of Toronto Press.; Osberg, Lars, 1995. "The Equity/Efficiency Tradeoff in Retrospect." *Canadian Business Economics*. Vol. 3. No. 3. Spring. pp. 5-20; Sharpe, Andrew. 2001. Opening address to IRPP-CSLS Conference on the Linkages Between Economic Growth and Inequality. Ottawa. January.
[26] Definitions:

- "Rich" and "poor" are used colloquially here to refer to income groups. In the chapter on financial security, "rich" and "poor" are used colloquially to refer to wealth (defined as assets minus debts).
- "Quintile" simply means "one-fifth" and refers to five income groups from the wealthiest 20% to the poorest 20%. For example, the "third quintile" is the middle 20% of income earners.
- "Disposable income" refers to market income plus government transfers, minus taxes, and therefore represents the money actually available for household expenditures.
- "Market income" includes both earned (wage and salary) income and income from interest and investments. Government transfers are federal, provincial and local, and include Canada Pension Plan

payments, Old Age Security, Employment Insurance, Child Tax Benefit, Social Assistance, and other payments.
- Values are given for households, including "economic families" (consisting of two or more persons) and "unattached individuals".
- Values are given in constant or "real dollars" (generally $2006) to eliminate the effects of inflation and to translate disposable income into actual spending power.

[27] Statistics Canada. 2008. *Income in Canada 2006*. Catalogue no. 75-202-XIE. Minister of Industry. Ottawa. p. 7.
[28] Statistics Canada. 2008. *Income in Canada 2006*. Catalogue no. 75-202-XIE. Minister of Industry. Ottawa. p. 15.
[29] Due to financial constraints, GPI Atlantic here only reports the publicly available provincial data to 2004. However, the most recent 2006 data were purchased from Statistics Canada for Canada, Nova Scotia, and Ontario.
[30] 2006 data for Nova Scotia from Statistics Canada, CANSIM Table 202-0706.
[31] Statistics Canada. 2008. *Income in Canada 2006*. Catalogue no. 75-202-XIE. Minister of Industry. Ottawa. Table 6-1.
[32] Note that the data in Table 8-29 above have been adjusted for family size, whereas the data in Figure 8-39 have not.
[33] Statistics Canada. 2008. 2006 Census: Earnings, income and shelter costs. May 1. Available from http://www.statcan.ca/Daily/English/080501/d080501a.htm. Accessed July 15, 2008. Comparable data for Nova Scotia were not publicly available but could be purchased from Statistics Canada for $1,500 per census year – a cost that is not feasible for GPI Atlantic to incur at this time.
[34] Statistics Canada. 2008. Earnings and Incomes of Canadians Over the Past Quarter Century, 2006 Census. Available from http://www12.statcan.ca/english/census06/analysis/income/tables/table3.htm. Accessed September 9, 2008.
[35] Osberg, Lars. 2008. A Quarter Century of Economic Inequality in Canada: 1981-2006. Canadian Centre for Policy Alternatives. Ottawa. Available from http://www.policyalternatives.ca/News/2008/04/PressRelease1882/. Available from http://www.policyalternatives.ca/documents/National_Office_Pubs/2008/Quarter_Century_of_Inequality.pdf. Accessed July 14, 2008.
[36] Fellegi, Ivan P. 1997. On Poverty and Low Income. Statistics Canada. Catalogue no. 13F0027XIE. Available from http://www.statcan.ca/english/research/13F0027XIE/13F0027XIE1999001.htm. Accessed July 21, 2008.
[37] Statistics Canada. 2007. Low Income Cut-Offs for 2006 and Low Income Measures for 2005. Available from http://www.statcan.ca/english/research/75F0002MIE/75F0002MIE2007004.pdf. Accessed July 21, 2008.
[38] According to Statistics Canada, the Nova Scotia incidence of low income among children should be used with caution due to sampling issues.
[39] Statistics Canada. 2008. Income in Canada, 2006. Catalogue no. 75-202-XIE. Tables 11-1 and 11-4. Original data from the Survey of Consumer Finances and Survey of Labour and Income Dynamics.
[40] Children aged 17 and under living in low-income economic families as a proportion of all children aged 17 and under living in economic families.
[41] Statistics Canada. 2001 Census. Available from http://www.statcan.ca/english/freepub/82-221-XIE/2008001/tblstructure/2nonmed/2lw/lw2lir-en.htm and http://www.statcan.ca/english/freepub/82-221-XIE/2008001/tblmaps/dt_maps/lw2cil-en.htm. Accessed July 14, 2008.
[42] Statistics Canada. 2008. Income in Canada, 2006. Catalogue no. 75-202-XIE. Tables 11-1, 11-4, and 31-1
[43] The 2006 Census has a much larger sample size than the Survey of Labour and Income Dynamics, which is used for the results reported in *Income in Canada*, and which uses a sample composed of two panels. Each panel consists of two Labour Force Survey rotation groups and includes roughly 15,000 households. A panel is surveyed for a period of six consecutive years. A new panel is introduced every three years, so two panels always overlap. Because the sample size for the census is much larger (20% of 12.5 million Canadian households) than the SLID sample, the census data provide—in the words of a Statistics Canada representative—a "more accurate portrait" of the incidence of low income. Statistics Canada. Daniel Genest. Data dissemination officer. Personal communications. September 11 and 12, 2008.
[44] Statistics Canada. 2008. Income in Canada, 2006. Catalogue no. 75-202-XIE. Minister of Industry. Ottawa. Tables 11-1 and 11-4.
[45] Ibid. Table 13-1. Data were not publicly available for Nova Scotia.

[46] Original data from Statistics Canada. Income in Canada. 2000. Cited in Colman, Ronald. 2003. A Profile of Women's Health Indicators in Canada. GPI Atlantic. Halifax. p. 19.
[47] Colman, Ronald. 2003. A Profile of Women's Health Indicators in Canada. GPI Atlantic. Halifax. p. 20.
[48] Harvey, Andrew, and Arun K. Mukhopadhyay. 2007. "When Twenty-Four Hours is not Enough: Time Poverty of Working Parents." *Social Indicators Research.* Volume 82. No. 1. May. According to the authors, the concept of "time poverty" is based on the following logic: "Individuals can be money poor, time poor or both. While income is the most used indicator of poverty…our study focuses on the element of deprivation arising from the time deficit of many working people. The usual poverty threshold is calculated as the amount of income to buy the minimum required goods and services from the market. This minimum required purchase is greater for [many time-stressed working people] since they have less time than the average person to produce some goods and services for themselves at home. So, they need money to buy these in the market in order to maintain the same consumption. The income standard must be supplemented to adequately measure actual poverty. Time use data make it possible to establish time requirements and time availability and provide a measure of time poverty."
[49] Life stress rates from Statistics Canada's Canadian Community Health Survey. Available from http://www.statcan.ca/english/freepub/82-221-XIE/2008001/tblstructure/2nonmed/2pr/pr2pls-en.htm. Accessed July 21, 2008.
[50] Harvey, Andrew, and Ronald Colman. 2008. *The Value of Free Time in Nova Scotia.* GPI Atlantic, Halifax. Citing special provincial tabulations of the 1998 and 2005 Statistics Canada General Social Survey time stress questionnaire, which collected responses to ten questions designed to capture perceptions of several dimensions of time stress. Those responding "yes" to seven or more of the items were deemed to experience high levels of time stress. A summary of Canadian time stress results from the 1998 General Social survey is available in Statistics Canada. 1999. *The Daily*. General Social Survey, Time Use. November 9. Available from http://www.statcan.ca/Daily/English/991109/d991109a.htm. Accessed July 4, 2008.
[51] Statistics Canada. *Women in the Workplace.* Catalogue no. 71-534. pp. 50 and 55. Cited in Colman. 2003. p. 20.
[52] Goetzel, Ron. ed. 2001. "The Financial Impact of Health Promotion." *American Journal of Health Promotion.* 15. 5. May / June. Cited in Colman. 2003. p. 21.
[53] Shields, Margot. 1999. "Long Working Hours and Health." Statistics Canada. *Health Reports.* 11. 2. pp. 33-48.
[54] Battle, Ken and Sherri Torjman. 2008. Make Work Pay. Caledon Institute of Social Policy. Ottawa. Available from http://www.caledoninst.org/Publications/PDF/707ENG.pdf. Accessed September 2, 2008.
[55] Ibid.
[56] Ibid.
[57] Kawachi, Ichiro. 2000. Income Inequality. John D. and Catherine T. MacArthur Research Network on Socioeconomic Status and Health. Available from http://www.macses.ucsf.edu/Research/Social%20Environment/notebook/inequality.html. Accessed July 14, 2008.
[58] Messinger, Hans. Statistics Canada. Personal communication. December 12, 2003.

[59] Statistics Canada. 1996 Census: The Nation Series, catalogue no. 93F0028SDB96001.
[60] Statistics Canada. Women in Canada 2000: A gender-based statistical report, catalogue no. 89-503-XPE.
[61] Drolet, Marie. 2001. *The Persistent Gap: New Evidence on the Canadian Gender Wage Gap.* Statistics Canada. Catalogue no 11F0019-MPE. No. 157. January. p. 9.
[62] Marie Drolet. 1999. *The Persistent Gap; New Evidence on the Canadian Gender Wage Gap*. Income Statistics Division, Statistics Canada. Catalogue no. 75F0002MIE-99008. December. p. 13. See Table 3 of this study for the 14 factors examined and for the fraction of the gender wage gap explained by each factor.
[63] Statistics Canada. CANSIM Table 282-0073 – Labour force survey estimates (LFS), wages of employees by job permanence, union coverage, sex and age group, unadjusted for seasonality, monthly. CANSIM database. Accessed October 13, 2008.
[64] Ibid.

Chapter 7: Fnancial Security and Debt
[1] Jon, Serena Ng, and Damian Paletta. 2008. "Worst Crisis Since '30s With No End Yet in Sight."*The Wall Street Journal.* 18 September. Citing Mark Gertler, New York University Economist. Available from http://online.wsj.com/article/SB122169431617549947.html. Accessed 14 October, 2008.

[2] 'Subprime' lending refers to the lending of money to those who have a heightened perceived risk of default, such as those who have a history of loan delinquency or default, those with a recorded bankruptcy, or those with limited debt experience. A subprime mortgage is a mortgage offered to a subprime borrower, usually at a low introductory (or teaser) interest rate. However, because of the borrower's lower credit rating, and lenders' attempts to compensate themselves for carrying more risk, these mortgages tend to increase to much higher rates of interest than conventional mortgages after the introductory period has expired. While the mortgage and banking crisis in Canada may not be as dire as in the US, due to a very much smaller subprime market and more restrictive lending practices, the now broadened financial crisis has crossed the border and caused a parallel collapse on the Toronto Stock Exchange, which will directly affect Canadians' wealth and financial security. It is also noteworthy that there have been significant changes in bank lending policies in this country as well in recent years, the long-term effects of which remain unknown. For example, banks have substantially broadened access to lines of credit, thereby encouraging households to shift towards this debt source, which is typically available at lower borrowing charges than conventional bank loans.

[3] According to Statistics Canada's National Balance Sheet Accounts (NBSA), the largest contributors to asset growth in Canada since the early 1980s have been financial assets (such as stocks and mutual funds) followed by housing. Financial assets now represent nearly one-third of the total value of household sector assets. Though financial assets remain the largest component of asset ownership, growth has slowed in recent years—even declining in 2003 and 2004—so that their current share of total assets is somewhat lower than during the late 1990s, when it was nearly 40%.

[4] Residential properties account for 22–23% of the total value of household assets in Canada, and accounted for the same percentage of real asset growth during the 1982 to 2005 period. On the debt side, however, the largest factor fuelling the growth in household debt has been mortgages, which represent 60% of household debt and accounted for over 60% of the real increase in debt between 1982 and 2005.

[5] Tran, Kimberley and Ronald Colman. 2008. *Financial Security and Debt in Atlantic Canada*. GPI Atlantic. Halifax. Available from http://www.gpiatlantic.org.

[6] See, for example, Savoie, Donald. 1997. *Rethinking Canada's Regional Development Policy*. Canadian Institute for Research on Regional Development; Osberg, Lars. 1995. "Rethinking the Equity/Efficiency Tradeoff". *Canadian Association of Business Economists (CABE) Journal*; Sharpe, Andrew. 2001. Opening Talk. IRPP-CSLS Conference on the Linkages between Economic Growth and Inequality. Ottawa.

[7] Maritime Provinces Higher Education Commission. 2008. Intentions of Maritime University Students Following Graduation: A Survey of the Class of 2007. Executive Summary. Available from http://www2.mphec.ca/english/pdfs/Intentions2007En.pdf

[8] Canadian Education Statistics Council, *Education Indicators in Canada: Report of the Pan-Canadian Education Indicators Program, 2005*. Canadian Education Statistics Council, *Education Indicators in Canada: Report of the Pan-Canadian Education Indicators Program, 2003*.

[9] Wealth is defined as assets minus debts. It is also referred to as net worth.

[10] Tran, Kimberley and Ronald Colman. 2008. Financial Security and Debt in Atlantic Canada. GPI Atlantic. Halifax. Available from http://www.gpiatlantic.org/. Original data source: Statistics Canada. 2005. Summary Tables Online: Income, Pensions, Spending and Wealth. "Assets and debts held by family units, total amounts." Survey of Financial Security. It can be surmised that the student debt load of the top wealth quintile is substantially smaller than the $1.28 billion in student debt owed by the fourth quintile in 2005 and may have declined from the $1.3 billion estimate for the top quintile in 1999.

[11] Unfortunately, recent Nova Scotia data by quintile are unavailable, as the 2005 Survey of Financial Security sample size was too small to provide provincial breakdowns for this region. Therefore, only Canadian data are presented here.

[12] Unless otherwise stated, results in this chapter are from Statistics Canada, Income Statistics Division. 1999 and 2005. Surveys of Financial Security (SFS). Results include unpublished SFS data provided to GPI Atlantic by Statistics Canada. Published SFS data are largely available from Statistics Canada, Summary Tables Online. Income, Pensions, Spending and Wealth: Assets and Debts Held by Family Units, Total Amounts, by Net Worth Quintile. Available from http://www40.statcan.ca/l01/cst01/famil115f.htm. Accessed May, 2007.

[13] Davies, J.B. 1993. "The Distribution of Wealth in Canada." In Edward Wolff, ed, *Research in Economic Inequality, 4*. Greenwich, CT. JAI Press. pp. 159–180. Cited in Morisette, Rene, Xuelin Zhang, and Marie Drolet. 2002. *The Evolution of Wealth Inequality in Canada, 1984–1999.* Ottawa. Statistics Canada. Catalogue 11F0019.

No. 187. February 22. Available from http://www.statcan.ca/english/research/11F0019MIE/11F0019MIE2002187.pdf. Accessed June 22, 2008.
[14] Kerstetter, Steve. 2002. *Rags and Riches: Wealth Inequality in Canada.* Ottawa and Vancouver. Canadian Centre for Policy Alternatives. December. Table II-1. p. 17 and Appendix A.
[15] Unfortunately, Nova Scotia data by quintile are unavailable for 2005, as the 2005 Survey of Financial Security sample size was too small to provide provincial breakdowns for this region. The 2005 SFS sample size was sufficient to provide aggregate regional data on debt and asset growth between 1999 and 2005, as presented below, but not provincial data or breakdowns by quintile. Therefore, Canadian quintile data are presented here. Because debt growth outpaced asset growth more dramatically in this region than in the rest of the country between 1999 and 2005, it can be assumed that the debt to asset ratios of the bottom quintiles in the four Atlantic Canadian provinces in 2005 were even less favourable than in the rest of the country. See Figure 6-31 below showing that the rate of consumer bankruptcy is considerably higher in this region than in the rest of the country.
[16] This 2005 estimate is based on Nova Scotia's share of the total value of assets in Atlantic Canada in 1999, and assumes that this share remained constant. As noted earlier, the 2005 SFS sample size was much smaller than that of the 1999 SFS, which therefore provides the most recent provincial breakdowns.
[17] As noted earlier, these and other data in this chapter, unless otherwise indicated, are primarily from the 1999 and 2005 SFS, with special, unpublished data sets provided to GPI Atlantic by Statistics Canada's Income Statistics Division.
[18] Calculations used in this section are based on data from Statistics Canada. CANSIM Table 177-0001 – Consumer Bankruptcies, Annual. Additional data are drawn from the Centre for the Study of Living Standards (CSLS). Living Standards Domain of the Canadian Index of Wellbeing. Prepared for the Canadian Index of Wellbeing. Forthcoming.
[19] Industry Canada. Office of Consumer Affairs. 1997. "What Are Current Attitudes Toward Bankruptcy?" *Consumer Quarterly*. Industry Canada. Vol. 2. No. 4. October. Ottawa. Based on Schwartz, Saul, and Leigh Anderson. 1998. *An Empirical Study of Canadians Seeking Personal Bankruptcy Protection*. Unpublished research. Carleton University. School of Public Administration.
[20] Office of the Superintendent of Bankruptcy. 2006. *An Overview of Canadian Insolvency Statistics up to 2004*. Industry Canada. Ottawa. p. 11.
[21] Centre for the Study of Living Standards (CSLS). *Living Standards Domain of the Canadian Index of Wellbeing*. Prepared for the Canadian Index of Wellbeing. Forthcoming. Table 21.
[22] Statistics Canada's National Balance Sheet Accounts define personal liabilities as including total consumer credit, bank loans, mortgages, and other loans. The National Balance Sheet Accounts estimate the value of Canadian assets and liabilities at the national level only from 1981 to the present.
[23] Statistics Canada. CANSIM Table 378-0004 – National Balance Sheet Accounts, by Sector, Annual; Statistics Canada. CANSIM Table 380-0019 – Sector Accounts, Persons and Unincorporated Businesses, Annual. Conversions to 2005 constant dollars by GPI Atlantic using CPI deflator data provided by Statistics Canada, Income Statistics Division.
[24] Ibid.
[25] Income data from Survey of Labour and Income Dynamics (SLID) provided by the Centre for the Study of Living Standards (CSLS). Living Standards Domain of the Canadian Index of Wellbeing. Prepared for the Canadian Index of Wellbeing. Forthcoming. Table 12B; Statistics Canada. CANSIM Table 202-0401 – Distribution of Total Income, by Economic Family Type; Median household debt data are from Statistics Canada. Income Statistics Division, 2005. Survey of Financial Security. Ottawa.
[26] Ibid.
[27] Income trends by income quintile used in this section draw on SLID data of economic families, adjusted for family size. An economic family is defined as a group of two or more persons who live in the same dwelling and are related to each other by blood, marriage, common law, or adoption.
[28] For a more detailed discussion regarding the differences between income and wealth quintiles and the consequent caveats relating to this indicator, please refer to Tran and Colman. 2008. pp. 60-62.
[29] Income data from Survey of Labour and Income Dynamics (SLID) provided by the Centre for the Study of Living Standards (CSLS). Living Standards Domain of the Canadian Index of Wellbeing. Prepared for the Canadian Index of Wellbeing. Publication forthcoming. Table 24C.

[30] Financial constraints did not permit the purchase of more recent SLID data from Statistics Canada. Because data to 2004 were available to GPI Atlantic for free by courtesy of CSLS, the comparison here is confined to those years.
[31] Real family income growth rates are from the Survey of Labour and Income Dynamics, provided by the Centre for the Study of Living Standards (CSLS). Living Standards Domain of the Canadian Index of Wellbeing. Prepared for the Canadian Index of Wellbeing. Forthcoming. Table 24C.
[32] Data on debt types are available from the 1999 and 2005 Surveys of Financial Security, which again are the source of the information reported in this chapter unless otherwise noted.

Chapter 8: Economic Security
[1] The Index of Economic Security, which is used here as a key indicator for the Nova Scotia Genuine Progress Index, was developed by Drs Osberg and Sharpe as part of the Centre for the Study of Living Standards' Index of Economic Wellbeing (IEW). We are grateful to Drs Osberg and Sharpe for authoring the 2008 Economic Security in Nova Scotia report on which the results in this chapter based.
[2] Smith, Jeremy. 2003. Guide to the Construction and Methodology of the Index of Economic Well-Being. Available online at www.csls.ca/iwb/iewb-guide.pdf. Cited in Osberg, Lars and Andrew Sharpe. 2008. Economic Security in Nova Scotia. GPI Atlantic. Halifax. p. 2.
[3] Osberg, Lars. 1998. Economic Insecurity. Discussion paper No. 88. Social Policy Research Center, University of New South Wales, Australia. Cited in Ibid.
[4] In each case, the risk of an economic loss associated with the event is modelled as a conditional probability, which itself is the product of a number of underlying probabilities. The prevalence of economic risk is then weighted by the proportion of the population that it affects. The core hypothesis underlying this proposed measure of economic security and insecurity is that changes in the subjective level of anxiety about a lack of economic safety are proportionate to changes in objective risk. For further details on how the CSLS index of economic security is constructed and on the methodology used for calculating the Index of Economic Security, please refer to Osberg and Sharpe. 2008. pp. 2-7.
[5] For detailed data tables please refer to the Appendix in Osberg and Sharpe. 2008.
[6] Health Council of Canada. 2008. Rekindling Reform: Health Care Renewal in Canada, 2003-2008. Health Council. Toronto. Available from http://www.healthcouncilcanada.ca./en/. Accessed October 9, 2008. Cited in Osberg and Sharpe. 2008. p. 17.
[7] Health Council of Canada. 2008. p. 35. Cited in Osberg and Sharpe. 2008. p. 17.
[8] Due to small sample sizes, the data on low-income rates among single parents showed large year-to-year variability. For this reason, the authors used three-year averages as the start and end points of the period. Also, due to lack of available data on low income after 2005 at time of writing, the values for 2006 and 2007 were imputed from the average of 2003 to 2005. Because both the low-income rate and the poverty gap for single-parent families have been falling since 2002, 2007 data would likely produce even more positive results than those indicated here.
[9] GPI Atlantic has examined the issue of time poverty among lone-parent mothers and found that the "struggle to juggle" paid and unpaid work responsibilities and to balance work and family life is typically most difficult for full-time employed dual-earner parents and for working single mothers. Working single mothers—who put in an average of 75 hours a week of paid and unpaid work when employed full-time—have a particularly daunting challenge, as they shoulder the entire burden of unpaid household work alone, coming home from their paid jobs to face the full demands of childcare, cooking, cleaning, shopping, and laundry largely by themselves. It is noteworthy that the percentage of lone-parent mothers in the paid work force increased sharply between 1971 and 2004 from 35% to nearly 80%. As well, in 1971 only 4.9% of lone mothers worked 40 hours or more per week, compared to 23.2% in 2004. This probability of long hours is almost the same for the average two-parent family (24%). As well, working single mothers spend about three times as a high a proportion of their incomes on childcare expenditures as their married counterparts. For more information on work hours, time poverty, and time stress among single mothers, please refer to the accompanying chapter on unpaid household work and childcare, as well as to Colman, Ronald. 1998. The Economic Value of Unpaid Housework and Childcare in Nova Scotia. GPI Atlantic. Halifax. Available from http://www.gpiatlantic.org/pdf/housework/housework.pdf.
[10] The reason this sub-index shows a 12.9% improvement for Nova Scotia and a 41.2% improvement for Canada since 1981 is that the 1981 level was the second lowest on record for Nova Scotia and by far the lowest on record for Canada in the period. The 1981 level was even 9% lower in Nova Scotia and 18.6% lower in Canada than the

following year (1982). It is therefore questionable whether the apparent magnitude of improvement in the index presented in Table 7-23 provides an accurate characterization of the actual trend during this period.

[11] Note that, even though Statistics Canada's low income cut-offs (LICO) are widely used as a poverty line, Statistics Canada does not make this equation. See Statistics Canada's website for an official statement on this issue by the Chief Statistician, Ivan Fellegi. Available from http://www.statcan.ca/english/research/13F0027XIE/13F0027XIE.htm. Accessed October 9, 2008.

[12] Deductions for taxes, employment insurance or other reasons were not accounted for. As the minimum wage calculation is before tax, we compare here to the before tax Low Income Cut Off.

[13] Harvey, Andrew, and Ronald Colman. 2008. The Value of Free Time in Nova Scotia. GPI Atlantic. Halifax. Available from http://www.gpiatlantic.org/pdf/timeuse/freetime.pdf. Accessed October, 13, 2008.

[14] Though Statistics Canada's low income cut-offs (LICO) are widely used as a "poverty line," Statistics Canada, as noted above, does not make this equation. See Statistics Canada's website for an official statement on this issue by the Chief Statistician, Ivan Fellegi. Available from http://www.statcan.ca/english/research/13F0027XIE/13F0027XIE.htm. Accessed October 9, 2008.

[15] Unlike the previous indicators presented in this chapter, data on social assistance benefits are only available for the years 1986-2006 for single persons, single parents with one child, and couples with two children. For persons with a disability, data are only available from 1989-2006.

[16] The Canadian average was calculated by the Centre for the Study of Living Standards by taking the average of welfare incomes in each province weighted by their respective population.

[17] Canada Revenue Agency. *National Child Benefits.* Available from http://www.cra-arc.gc.ca/benefits/ncb-e.html. Accessed May, 25, 2008.

[18] The totals exclude Quebec, which decided not to participate in the federal Child Benefits program and instead created its own program.

Chapter 9: Population Health

[1] Statistics Canada. 1999. Income inequality and mortality among working-age people in Canada and the U.S. *Health Reports,* p. 77. Cited in Pannozzo, Linda and Ronald Colman. 2004. Working Time and the Future of Work in Canada. A Nova Scotia GPI Case Study. GPI Atlantic. Halifax, p. 274.

[2] Almer, Robert and Donald Eddins. 1987. Cross-sectional analysis: Precursors of premature death in the United States. In *Closing the Gap: The Burden of Unnecessary Illness.* Almer, Robert and Bruce Hull (eds). Oxford University Press. New York and Oxford. Table 1, p. 183. Cited in Colman, Ronald. 2002. The Cost of Chronic Disease in Nova Scotia. GPI Atlantic. Halifax, p. 53.

[3] Marmot, Michael and Richard Wilkinson (eds). 1998. Social Determinants of Health: The Solid Facts. World Health Organization, p. 10. Cited in Pannozzo and Colman (2004), p. 275.

[4] "Stunning Statistics Reveal Toll of Poverty on Children," *Vancouver Sun,* 28 December, 1990, cited in Province of British Columbia (1996), *Cost Effectiveness/Value of Nutrition Services: An Annotated Bibliography,* Prevention and Health Promotion Branch, Ministry of Health, B.C., July, 1996, page 5.

[5] Health Canada, *Toward a Healthy Future: Second Report on the Health of Canadians,* Health Canada and Statistics Canada, September, 1999, page 85, and chapter 3.

[6] Barbara Morrongiello, "Preventing Unintentional Injuries Among Children," *Determinants of Health: Children and Youth,* Canada's Health Action: Building on the Legacy, Volume 1, National Forum on Health, 1998.

[7] Scott, Elizabeth, "How the Stress of Poverty Impacts Children's Health." Cited at: http://stress.about.com/od/financialstress/a/poverty.htm. November. 2007. Accessed 7 September, 2008.

[8] Ross, David, and Paul Roberts, "Income and Child Well-being: A new perspective on the poverty debate." Canadian Council on Social Development. 1999. Available at http://www.ccsd.ca/pubs/inckids/index.htm. Accessed 7 September, 2008.

[9] David Ross, "Rethinking Child Poverty," Insight, Perception, 22:1, Canadian Council on Social Development, Ottawa, 1998, pages 9–11.

[10] Kennedy, Bruce P., Ichiro Kawachi, Roberta Glass, and Deborah Prothrow-Stith. 1996. Income Distribution, Socioeconomic Status, and Self-Rated Health: A U.S. Multi-Level Analysis. British Medical Journal. Vol. 317: 917-921. Available from http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=28675. Accessed July 15, 2008.

[11] Ibid.

[12] Kahn, Henry S., Lilith M. Tatham, Elsie R. Pamuk and Clark W. Heath Jr. 1998. Are Geographic Regions with High Income Inequality Associated with Risk of Abdominal Weight Gain? Social Science and Medicine. Vol. 47: 1-6.
[13] British Medical Journal. "Editorial: The Big Idea." April 20, 1998. Cited in Pannozzo and Colman (2004), p. 276.
[14] Pickett, Kate, and Richard Wilkinson, "Child wellbeing and income inequality in rich societies: ecological cross sectional study." British Medical Journal. 335 (7629):1080. 24 November. 2007.
[15] Statistics Canada (1999), pp. 78-79. Cited in Pannozzo and Colman (2004), p. 277.
[16] Marmot and Wilkinson (1998), pp. 16-17. Cited in Pannozzo and Colman (2004), p. 277.
[17] Statistics Canada (1999), p. 82. Cited in Pannozzo and Colman (2004), p. 277.
[18] Health Canada, *Toward a Healthy Future: Second Report on the Health of Canadians,* Ottawa, 1999, page 96.
[19] Health Canada, *Toward a Healthy Future,* pages 96-97, citing World Health Organization, *Health and Environment in Sustainable Development: Five years after the Earth Summit,* Geneva, 1997.
[20] Health Canada, *Toward a Healthy Future,* page 95.
[21] Environmental Illness Society of Canada, http://www.eisc.ca/news_release_Oct1.htm; U.S. Department of Labour, Occupational Health and Safety Administration, "Multiple Chemical Sensitivities," available at: http://www.osha.gov/SLTC/multiplechemicalsensitivities/.
[22] Jin, R.L, Shah, C.P, Svoboda, T.J. l994. *The Health Impact of Unemployment: A Review and Application of Research Evidence*. Working Paper for the Population Health Committee. Ontario Medical Association. Toronto. Cited in Bedard, Marcel. l996. *The Economic and Social Costs of Unemployment.* Applied Research Branch. Human Resources Development Canada. Ottawa.
[23] Williams, Colin C. and Jan Windebank. l998. "The Unemployed and Paid Informal Sector in Europe's Cities and Regions." In *Unemployment and Social Exclusion. Landscapes of Labour Inequality*. Paul Lawless, Ron Martin, and Sally Hardy (eds). Jessica Kingsley Publishers. London. p. 38. Cited in Pannozzo and Colman (2004), p. 209, and chapter 9 on "Costs of Unemployment."
[24] Kirsh, Sharon. l983. *Unemployment: Its Impact on Body and Soul.* Canadian Mental Health Association. Toronto. p. 54.
[25] World Health Organization cited in Junankar, P.N. l986. *Programme of Research and Actions on the Development of the Labour Market. Costs of Unemployment. Main Report.* Commission of the European Communities. Luxembourg. p. 67.
[26] Sokejima, S. and S. Kagamimori, "Working hours as a risk factor for acute myocardial infarction in Japan: Case Control Study," *British Medical Journal* 317, 1998, pages 775-780.
[27] Shields, Margot. 1999. "Long Working Hours and Health." Health Reports. Autumn l999. Vol. 11, no. 2. Statistics Canada. Ottawa. p. 44.

[28] Iso-Alsola, S. E., and Park, C. J. (1996). "Leisure-Related Social Support and Self-Determination as Buffers of Stress-Illness Relationship." Journal of Leisure Research, 28, 169–87; Iwasaki, Y., and Schneider, I. E. (2003). "Leisure, Stress, and Coping: An Evolving Area of Inquiry" Leisure Sciences, 25, 107–113.

[29] Coleman, D. (1993). "Leisure Based Social Support, Leisure Dispositions and Health," Journal of Leisure Research, 25, 350–61; Mannell, R.C. (1999). "Older Adults, Leisure, and Wellness," Journal of Leisurability, 26 (2).
[30] Health Canada (1999), Toward a Healthy Future: Second Report on the Health of Canadians, Ottawa, p. 60.
[31] Health Canada (1999), op. cit., pp. 60-62.
[32] Mustard, J.F., and Frank, J. (1991). The Determinants of Health, (CIAR Publication No. 5) Canadian Institute for Advanced Research, Toronto.
[33] Colman, Ronald. The Economic Value of Civic and Voluntary Work in Atlantic Canada. 2003 Update. GPI Atlantic. Halifax. Available from http://www.gpiatlantic.org/pdf/volunteer/volunteerupdate03.pdf.
[34] Health Canada, *Towards a Healthy Future: Second Report on the Health of Canadians,* Ottawa, 1999, page 51; Health Canada. l999. *Statistical Report on the Health of Canadians.* Federal, Provincial and Territorial Advisory Committee on Population Health for Meeting of Ministers of Health. Ottawa. page 30.
[35] Health Canada, *Statistical Report on the Health of Canadians,* Ottawa, 1999, page 267.
[36] Kephart, George, Vince Salazar Thomas, and David MacLean, "Socioeconomic Differences in the Use of Physician Services in Nova Scotia," *American Journal of Public Health,* 88 (5): 800-803, May, 1998.

[37] *National Consensus Conference on Population Health Indicators: Final Report,* Canadian Institute for Health Information, Ottawa, 1999, pages 5 and B8.
[38] Health Canada, *Health Canada's Women's Health Strategy,* Ottawa. March 1999, page 7.
[39] Health Canada, *Health Canada's Women's Health Strategy,* March 1999, page 1: Introductory "Message from the Minister"; available at http://www.hc-sc.gc.ca/datawhb/womenstr2.htm
[40] National Forum on Health, *Canada Health Action: Building on the Legacy: The Final Report of the National Forum on Health,* 1997; available at http://www.nfh.hwc.ca
[41] Health Canada, *Health Canada's Gender-based Analysis Policy,* Ottawa, 2000, page 6.
[42] Health Canada, *Toward a Healthy Future: Second Report on the Health of Canadians,* Ottawa, 1999, p. 14. Cited in Colman, Ronald. 2003. A Profile of Women's Health Indicators in Canada. Prepared for Health Canada by GPI Atlantic. Halifax, p. 188.
[43] At the time data were retrieved for this chapter, there had been a change in the CCHS reporting format starting in 2005, and so data for 2005 and 2007 are reported separately in Table 2. Just as this report went to press, it was found that Statistics Canada has now adjusted the 1994/95–2007 data to be comparable, as now reflected in Statistics Canada, CANSIM Table 105-4022. Available at http://cansim2.statcan.gc.ca/cgi-win/cnsmcgi.pgm. Accessed 7 December, 2008. However, time did not allow a reformatting of Tables 1-1 and 1-2 into a single comparable table before publication. Nonetheless, table adjustments were made at press time to allow for consistent comparison.
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[45] National Cancer Institute of Canada, *Canadian Cancer Statistics 1999,* March, 1999, pages 9 and 24.
[46] Canadian Cancer Society and National Cancer Institute (2008), p. 24
[47] Female susceptibility to lung cancer, from a Pennsylvania State University study published in the *Journal of the U.S. National Cancer Institute,* reported in *The Chronicle-Herald,* Halifax, 5 January, 2000, pages 1-2.
[48] Canadian Cancer Society and National Cancer Institute. 2008. Canadian Cancer Statistics, pp. 24-25. Table 9. Available from http://www.cancer.ca/Canada-wide/About%20cancer/Cancer%20statistics/Canadian%20Cancer%20Statistics.aspx?sc_lang=en. Accessed October 14, 2008. Percent changes are averaged annual percent changes.
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[56] Health Canada. 2001. Respiratory Disease in Canada. p. 18. Available at http://www.phac-aspc.gc.ca/publicat/rdc-mrc01/pdf/rdc0901e.pdf. Accessed April 15, 2008,
[57] Childhood asthma rates for Canada and regions are for 2000/2001 and are from Garner, Rochelle and Dafna Kohen. 2008. Changes in the prevalence of asthma among Canadian children. *Health Reports.* Volume 19, no. 2. Catalogue no. 82-003-X. Statistics Canada. Available from http://www.statcan.ca/english/freepub/82-003-XIE/2008002/article/10551-en.pdf. Accessed October 22, 2008. 2001 rates for Nova Scotia (total and by gender) provided by Rochelle Garner, Statistics Canada Health Information and Research Division, personal communication

with Linda Pannozzo, April 18, 2008. Findings are based on the 2000/2001 National Longitudinal Survey of Children and Youth (NLSCY).

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[64] Manson, Joann, and Angela Spelsberg, "Primary Prevention of Non-Insulin-Dependent Diabetes Mellitus," *American Journal of Preventive Medicine,* 10 (3), 1994.

[65] Carter Center study cited in Almer, Robert, and Donald Eddins, "Cross-Sectional Analysis: Precursors of Premature Death in the United States," in Amler, Robert, and Bruce Hull (eds.), *Closing the Gap: The Burden of Unnecessary Illness,* Oxford University Press, New York and Oxford, 1987, table 1, page 183.

[66] The six regions described here actually correspond to Statistics Canada's six designated Health Zones for Nova Scotia, which are aggregations of the nine District Health Authorities in the Province. The Zones roughly correspond to the District Health Authorities (DHA), though two DHAs are combined in three of Statistics Canada's 6 Health Zones (1, 3, and 4). By contrast, Zones 2 (Annapolis Valley), 5 (Cape Breton), and 6 (Halifax) correspond to the existing DHAs in those regions. Accordingly: Zone 1 represents South Shore Health (DHA1) and South West Health (DHA2); Zone 2 is Annapolis Valley Health (DHA3); Zone 3 is Colchester East Hants Health Authority (DHA4) and Cumberland Health Authority (DHA5); Zone 4 is Pictou County Health Authority (DHA6) and Guysborough Antigonish Strait Health Authority (DHA7); Zone 5 is Cape Breton Health Authority (DHA8); and Zone 6 is Capital Health (DHA9).

[67] Almer, Robert, and Donald Eddins, "Cross-Sectional Analysis: Precursors of Premature Death in the United States," in Amler, Robert, and Bruce Hull (eds.), *Closing the Gap: The Burden of Unnecessary Illness,* Oxford University Press, New York and Oxford, 1987, p. 185. Cited in Mirolla (2004), p. 56.

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[70] Statistics Canada. The Daily. Deaths, 2003. December 21, 2005. Available from http://www.statcan.ca/Daily/English/051221/d051221b.htm Accessed October 16, 2008.

[71] Canadian Cancer Society and National Cancer Institute (2008), pp. 1-2.

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[73] U.S. Centers for Disease Control and Prevention (CDC) and U.S. Department of Health and Human Services. 1999. Chronic Diseases and Their Risk Factors: The Nation's Leading Causes of Death. Atlanta. Cited in Colman (2002), p. 11.

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[85] Kabat-Zinn, Jon, "Psychosocial Factors: Their Importance and Management," in Ockene, Ira, and Judith Ockene, *Prevention of Coronary Heart Disease,* Little, Brown, and Company, Boston, 1992, pages 312-313; and Goldberg, Robert, "Coronary Heart Disease: Epidemiology and Risk Factors," in Ockene, Ira, and Judith Ockene, *Prevention of Coronary Heart Disease,* page 27. Cited in Colman (2002), Chapter 7.
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[88] Reasoner, Robert. "The true meaning of self-esteem." National Association for Self-Esteem, available at: http://www.self-esteem-nase.org/whatisselfesteem.shtml. Cited in Colman (2003), p. 190.
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Zone 2 Annapolis and Kings Counties
Zone 3 Cumberland, Colchester, and East Hants Counties.
Zone 4 Pictou, Antigonish, Guysborough, and Richmond Counties
Zone 5 Cape Breton Island—counties of Cape Breton, Victoria, and Inverness.
Zone 6 Halifax Regional Municipality, including eastern shore and West Hants County
[90] Health Canada, "Deaths in Canada due to Smoking," *Information Sheet,* Ottawa, 18 January, 1999; Health Canada, *Toward a Healthy Future: Second Report on the Health of Canadians,* Ottawa, 1999.
[91] Health Canada, *Toward a Healthy Future,* page 25; Health Canada, *Statistical Report on the Health of Canadians,* Ottawa, 1999, page 308; National Cancer Institute of Canada, *Canadian Cancer Statistics 2000,* Toronto 2000.
[92] Statistics Canada, Canadian Community Health Survey, 2000-01 and 2003; Statistics Canada, National Population Health Survey, 1994-95, 1996-97, 1998-99.
[93] The body mass index (BMI) is a person's weight in kilograms (kg) divided by their height in meters (m) squared.
[94] Studies have shown that both men and women who respond to health surveys tend to underestimate their weight and overestimate their height. This tends to underestimate the actual rate of obesity and overweight based on self-

reported data. In 2004, Statistics Canada did its own direct (and therefore far more accurate) measurements of obesity, and these are the main reference point for a new GPI Atlantic study on the Cost of Obesity in Alberta, undertaken for the Alberta Cancer Board—to be released in 2009. However, time series are not available for the measured data, since they were only collected for this single point in time, and so self-reported CCHS and NPHS data on BMI are used here to assess trends. In short, the statistics used here can reasonably be used to assess relative trends over time—i.e., whether rates of overweight and obesity are increasing or not—assuming that rates of overestimation of height and underestimation of weight remain at least relatively stable over the time period under consideration—but they are not accurate measures of actual BMI. For a detailed discussion of this issue, please see the forthcoming GPI report on Cost of Obesity in Alberta. See also Statistics Canada. The Daily. National Population Health Survey—Obesity: A growing issue. Thursday April 7, 2005. Available from http://www.statcan.ca/Daily/English/050407/d050407a.htm. Accessed October 21, 2008.

[95] Statistics Canada's six designated Health Zones for Nova Scotia are aggregations of the nine District Health Authorities in the Province. The Zones roughly correspond to the District Health Authorities (DHA), though two DHAs are combined in three of Statistics Canada's 6 Health Zones (1, 3, and 4). Zones 2 (Annapolis Valley), 5 (Cape Breton), and 6 (Halifax) correspond to the existing DHAs in those regions. Accordingly: Zone 1 represents South Shore Health (DHA1) and South West Health (DHA2); Zone 2 is Annapolis Valley Health (DHA3); Zone 3 is Colchester East Hants Health Authority (DHA4) and Cumberland Health Authority (DHA5); Zone 4 is Pictou County Health Authority (DHA6) and Guysborough Antigonish Strait Health Authority (DHA7); Zone 5 is Cape Breton Health Authority (DHA8); and Zone 6 is Capital Health (DHA9).

[96] Statistics Canada. The Daily. National Population Health Survey—Obesity: A growing issue. Thursday April 7, 2005. Available from http://www.statcan.ca/Daily/English/050407/d050407a.htm. Accessed October 21, 2008.

[97] Canadian Fitness and Lifestyle Research Institute, *The Research File,* 2000, Reference No. 00-01. Cited in Colman, Ronald. 2003. A Profile of Women's Health Indicators in Canada. Prepared for Health Canada by GPI Atlantic. Halifax, p. 150.

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[99] Fries, James. 1996. "Physical Activity, the Compression of Morbidity, and the Health of the Elderly," *Journal of the Royal Society of Medicine* 89, pp. 64 and 67. Cited in Colman, (2003), p. 151.

[100] Colman, Ronald. 2002. The Cost of Physical Inactivity in Nova Scotia. GPI Atlantic. Halifax. Available from http://www.gpiatlantic.org/pdf/health/inactivity.pdf. Accessed October 17, 2008. p. 3.

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[112] Statistics Canada. *Health Indicators 2008*, Health Statistics Division, Statistics Canada, Catalogue no. 82-221-X, 2008; accessed June 2008; available from http://www.statcan.ca/english/freepub/82-221-XIE/82-221-XIE2008001.pdf. p. 21.
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[117] Ibid.
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[121] Ibid. p. 16.
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[125] Colman, Ronald and Janet Rhymes. 2007. The Cost of Tobacco Use in Nova Scotia. GPI Atlantic. Halifax. Available from http://www.gpiatlantic.org/pdf/health/tobacco/costoftobacco-ns-2007.pdf. Accessed October 16, 2008. pp. ii-iii.
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[127] Nova Scotia Department of Finance. 2007. Nova Scotia Budget Bulletin for the fiscal year 2007-08. Available from http://www.gov.ns.ca/finance/site-finance/media/finance/2007_healthycommunities.pdf. Accessed October 22, 2008. According to the budget bulletin, "healthcare spending has been increasing by over 8% each year for the past ten years, or about 48% of the provincial budget. We cannot sustain this growth rate."
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[133] Colman, Ronald. 2002. The Cost of Physical Inactivity in Nova Scotia. GPI Atlantic. Halifax. Available from http://www.gpiatlantic.org/pdf/health/inactivity.pdf. Accessed October 16, 2008. p. 3.
[134] The seven chronic diseases reliably linked to physical inactivity in the epidemiological literature available at the time of GPI Atlantic's original Cost of Physical Inactivity in Nova Scotia study, are heart disease, stroke, hypertension, colon cancer, breast cancer, Type 2 diabetes, and osteoporosis.
[135] Ibid. For a detailed description of the methodology used to calculate direct and indirect costs attributable to physical inactivity please refer to Colman, Ronald. 2002. The Cost of Physical Inactivity in Nova Scotia. GPI Atlantic. Halifax. pp. 14-25, Available from http://www.gpiatlantic.org/pdf/health/inactivity.pdf. Direct costs include direct health expenditures on hospital, doctor, drug, and research associated with seven chronic diseases linked to physical inactivity plus estimated direct mental health costs attributable to physical inactivity. Indirect costs are productivity losses due to premature mortality and disability for each of the seven diseases related to physical inactivity.
[136] Goetzel, Ron, (ed.), "The Financial Impact of Health Promotion," *American Journal of Health Promotion* 15 (5), May/June, 2001. Cited in Colman, Ronald. 2002. The Cost of Chronic Disease in Nova Scotia. GPI Atlantic. Halifax. Available from http://www.gpiatlantic.org/pdf/health/chronic.pdf. Accessed October 16, 2008, p. iii.
[137] For details on the methodology used here to calculate the original cost estimates please refer to Colman, Ronald. 2002. Cost of Chronic Disease in Nova Scotia. GPI Atlantic. Halifax. Available from http://www.gpiatlantic.org. All original cost estimates have been updated to 2007 constant dollars using the Consumer Price Index (CPI), and are therefore described here as 2007 cost estimates, even though direct cost estimates for 2007 have not been developed here.
[138] Kephart, George, Vince Salazar Thomas, and David MacLean, "Socioeconomic Differences in the Use of Physician Services in Nova Scotia," *American Journal of Public Health,* 88 (5): 800-803, May, 1998. Cited in Colman (2002), p. 59.

Chapter 10: Safety and Security

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[2] Statistics Canada, Canadian Centre for Justice Statistics, *Criminal Justice Trends in Canada from 1962: Corrections Program,* p. 21. Cited in Dodds and Colman (1999), p. 100.
[3] Statistics Canada, Canadian Centre for Justice Statistics, *A One-Day Snapshot of Inmates in Canada's Adult Correctional Facilities,* Catalogue no. 85-601, p. 120. Cited in Dodds and Colman (1999), p. 100.
[4] Statistics Canada has analyzed four decades of data on alcohol consumption and unemployment and found that years with higher rates of per capita alcohol consumption and unemployment tended to be associated with higher rates of homicide. According to Statistics Canada: "Alcohol use has previously been associated more often with violent crime than property crime because of the disinhibiting effect it has on cognition and perceptions. Likewise, unemployment has been associated with stress, exclusion and social withdrawal." The same Statistics Canada study also suggests that periods of inflation are associated with financially-motivated crimes. From Bunge, Valerie Pottie, Holly Johnson, and Thierno A. Balde. 2005. Exploring crime patterns in Canada, 1962-2003. Crime and Justice Research Paper Series. Statistics Canada. Available from http://www.statcan.ca/english/research/85-561-MIE/85-561-MIE2005005.pdf. Accessed September 5, 2008.
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[6] Statistics Canada, Canadian Centre for Justice Statistics. 1996. "Criminal Victimization: An International Perspective", *Juristat,* catalogue no. 85-002-XPE, volume 18, no. 6. Cited in Dodds and Colman (1999), p.51.
[7] Statistics Canada. The Daily. General Social Survey: Criminal Victimization, 2004. November 24, 2005. Available from http://www.statcan.ca/Daily/English/051124/d051124b.htm. Accessed August 27, 2008.
[8] Ibid. The 2004 GSS found that 88% of sexual assaults and 60% of assaults were not reported to the police, while, by comparison, only 44% of break and enters went unreported. The percentage of respondents in the "don't know / not stated" categories accounts for the difference between 100% and the percentages of reported and unreported

crimes in each category. For example, 54% of break and enters were reported, 44% were unreported, and 2% of break and enter victims either said they did not know or did not respond.
[9] Canadian Centre for Justice Statistics. 2006. Uniform Crime Reporting. Statistics Canada. Available from http://ivt.crepuq.qc.ca/juridique/documentation2006/2005-canada-province-cma.pdf. Accessed September 5, 2008.
[10] For greater detail regarding GPI*Atlantic*'s analysis of changing reporting rates, please refer to Dodds and Colman (1999) pp. 51-54.
[11] Personal communication with Dr. Don Clairmont, Criminologist with the Sociology Department at Dalhousie University, Halifax, March 18, 1999. Cited in Dodds and Colman (1999), p. 54.
[12] The Pew Center on the States, Press release. Pew report finds more than one in 100 adults are behind bars." Available from http://www.pewcenteronthestates.org/news_room_detail.aspx?id=35912. Full report titled: One in 100: Behind Bars in America 2008. The Pew Charitable Trusts. February, 2008. Available from http://www.pewcenteronthestates.org/uploadedFiles/8015PCTS_Prison08_FINAL_2-1-1_FORWEB.pdf. Accessed 5 October, 2008.
[13] Hackler, Jim and Kim Don. "Estimating System Biases: Crime Indices that Permit Comparisons across Provinces," *Canadian Journal of Criminology*, April 1990, Vol. 32, No. 2, p. 244 and 247. Cited in Dodds and Colman (1999), p. 64.
[14] Official statistics for total criminal incidents for Canada are from Statistics Canada CANSIM Table # 252-0013 titled Crime statistics by detailed offences, annual. GSS 2004 survey data from Statistics Canada. The Daily. General Social Survey: Criminal Victimization, 2004. November 24, 2005. Available from http://www.statcan.ca/Daily/English/051124/d051124b.htm. Accessed August 27, 2008.
[15] Violent crimes include homicide, attempted murder, robbery, sexual assault (levels 1,2,and 3), other sexual offences, physical assault (assault level 1, assault level 2, weapon/causing bodily harm, aggravated assault, and other assaults), and abduction. Property crimes include breaking and entering, motor vehicle theft, theft over $5,000, theft $5,000 and under, possession of stolen goods, and fraud. Other criminal code incidents include mischief, counterfeiting currency, bail violations, disturbing the peace, offensive weapons, prostitution, arson, and forcible confinement/kidnapping. Criminal code violations also include certain traffic offences, such as impaired driving. However, traffic offences, including those (like impaired or negligent driving) that are classified as criminal offences, are not included in the data presented in this update.
[16] For more information on trends in crime statistics by province please refer to Statistics Canada. The Daily. Crime Statistics, 2007. July 17, 2008. Available from http://www.statcan.ca/Daily/English/080717/d080717b.htm. Accessed September 5, 2008.
[17] Statistics Canada. Aboriginal people as victims and offenders, 2004. The Daily, June 6, 2006. Available from http://www.statcan.ca/Daily/English/060606/d060606b.htm. Accessed 11 October, 2008.
[18] Based on the 2006 Census of Population, the Aboriginal population (1,172,790) comprised 3.7% of the total Canadian population (31,612,895). Aboriginal population from Statistics Canada. Population reporting an Aboriginal identity. Available from http://www40.statcan.ca/l01/cst01/demo40a.htm. Accessed October 13, 2008. Canadian data from Statistics Canada. 2007. *Census trends for Canada, provinces and territories* (table). 2006 Census. Statistics Canada Catalogue no. 92-596-XWE. Ottawa. Released December 4, 2007. http://www12.statcan.ca/english/census06/data/trends/Index.cfm. Accessed October 13, 2008.
[19] Statistics Canada. Aboriginal people as victims and offenders, 2004. The Daily, June 6, 2006. Available from http://www.statcan.ca/Daily/English/060606/d060606b.htm. Accessed October 11, 2008.
[20] Taylor-Butts, Andrea and Angela Bressan. 2007. Youth Crime in Canada, 2006. *Juristat.* Vol. 28, no. 3. Statistics Canada. Canadian Centre for Justice Statistics. Minister of Industry. Ottawa. Trend lines from 1997-2006 for NS were not publicly available.
[21] The chance of being a victim of violent crime is derived by dividing the number of incidents by 100,000 population. This does not necessarily mean that one in 94 people is a victim of violent crime, since one person may be victimized several times in a year.
[22] Statistics Canada. The Daily. Victimization and offending in the North, 2004 and 2005. October 30, 2006. Available from http://www.statcan.ca/Daily/English/061030/d061030b.htm. Accessed September 5, 2008.
[23] Statistics Canada. The Daily. Crime Statistics, 2007. July 17, 2008. Available from http://www.statcan.ca/Daily/English/080717/d080717b.htm. Accessed September 5, 2008.
[24] Dodds and Colman (1999), p. 76. Statistics Canada sells the more detailed current breakdowns by category of violent crime for $150 for Canada and Nova Scotia. Unfortunately resources did not permit purchase of these

additional data at this time. However, in light of the important distinctions among categories of violent crime uncovered in the 1999 GPI crime study, as well as the need to track changes in these particular trends and ratios, it is recommended that this more detailed analysis by category of violent crime be included in future updates of the GPI crime indicators as resources become available.

[25] Eight types of offences are included in the GSS including sexual assault, robbery, physical assault, theft of personal property, breaking and entering, motor vehicle/parts theft, theft of household property, and vandalism. Thus, the rate of victimization cited in the text (28%) for 2004 includes all these eight types of offences.

[26] According to the 2004 GSS on Victimization, Nova Scotia reported one of the highest rates of violent incidents per 1,000 population aged 15 and older of any province in Canada (157 per 1,000). However, according to the Uniform Crime Reporting Survey, the violent crime rate in Nova Scotia in 2004 was 1,202.3 per 100,000 population. If the GSS data were expressed per 100,000 population, that would translate to 15,700 violent incidents per 100,000. When the fact that 66% of violent crimes are NOT reported to police is taken into account, this still leaves 5,338 violent crimes per 100,000 population, which is more than four times higher than the police-reported UCR survey data for that year. Inquiries were made to Statistics Canada in order to investigate the reasons for this apparent discrepancy. However, an explanation was not received in time for publication. It is likely that the reasons lie in the significant differences between the UCR and GSS described in the accompanying text. Future updates of this summary should pursue this issue further.

[27] Statistics Canada. The Daily. General Social Survey: Criminal Victimization (2004). November 24, 2005. Available from http://www.statcan.ca/Daily/English/051124/d051124b.htm. Accessed August 27, 2008.

[28] Canadian Centre for Justice Statistics. 2006. Uniform Crime Reporting. Statistics Canada. Available from http://ivt.crepuq.qc.ca/juridique/documentation2006/2005-canada-province-cma.pdf. Accessed September 5, 2008.

[29] Statistics Canada. 1997. An Overview of the Differences between Police-Reported and Victim-Reported Crime, 1997. Catalogue no. 85-542-XIE. Minister of Industry, Ottawa, p. 2.

[30] Ibid, pp. 3-5.

[31] Ibid, p. 5.

[32] Ibid, p. 7.

[33] Statistics Canada. Aboriginal people as victims and offenders, 2004. The Daily, June 6, 2006. Available from http://www.statcan.ca/Daily/English/060606/d060606b.htm. Accessed October 11, 2008.

[34] The total for property crime here does not include offences categorized as "mischief", which falls under the category of "other criminal code" violations, but which in fact accounts for a large number of crimes against property in Nova Scotia: Thus, there were 13,460 incidents of mischief under $5,000 and 367 incidents of mischief over $5,000 reported in 2007.

[35] Statistics Canada. The Daily. General Social Survey: Criminal Victimization (2004). November 24, 2005. Available from http://www.statcan.ca/Daily/English/051124/d051124b.htm. Accessed September 7, 2008.

[36] Statistics Canada. The Daily. General Social Survey: Criminal Victimization (2004). November 24, 2005. Available from http://www.statcan.ca/Daily/English/051124/d051124b.htm. Accessed September 7, 2008.

[37] Statistics Canada. General Social Survey on Victimization, Cycle 18: An Overview of Findings. 2004. Available from http://www.statcan.ca/english/freepub/85-565-XIE/85-565-XIE2005001.htm. Accessed September 9, 2008. Tables 3 and 4.

[38] Due to financial constraints it was not possible to purchase data from Statistics Canada to allow a breakdown by province between those who were "very" and "somewhat" satisfied with their safety. Statistics Canada only publicly released those data, by way of illustration, for Newfoundland and Labrador, Quebec, and Manitoba.

[39] Ibid. Table 4b. Based on responses of people who engage in the activity of walking alone at night.

[40] Statistics Canada. General Social Survey on Victimization, Cycle 18: An Overview of Findings. 2004. Available from http://www.statcan.ca/english/freepub/85-565-XIE/85-565-XIE2005001.htm. Accessed September 9, 2008.

[41] Statistics Canada, General Social Survey, cycle 18 overview: personal safety and perceptions of the criminal justice system 2004. Catalogue no. 86-566-XIE. July, 2005. Table 1A. Available from http://www.statcan.ca/english/freepub/85-566-XIE/85-566-XIE2005001.pdf. Accessed 11 October, 2008.

[42] According to the 2004 General Social Survey, almost 4 in 10 residents of the territories reported they were victimized at least once in the twelve months prior to being interviewed, compared to 28% for the rest of Canada. Police-reported crime rates in the North were more than four times higher than the rates in the rest of Canada.

[43] Statistics Canada. The Daily. Victimization and offending in the North, 2004 and 2005. Monday October 30, 2006. Available from http://www.statcan.ca/Daily/English/061030/d061030b.htm. Accessed September 5, 2008.

[44] Statistics Canada. Aboriginal people as victims and offenders, 2004. The Daily, June 6, 2006. Available from http://www.statcan.ca/Daily/English/060606/d060606b.htm. Accessed October 11, 2008.
[45] Latimer, Jeff and Norm Desjardins. 2007. The 2007 National Justice Survey. Tackling Crime and Public Confidence. Department of Justice Canada. Available from http://www.justice.gc.ca/eng/pi/rs/rep-rap/2007/rr07_4/index.html. Accessed September 8, 2008.
[46] Ibid. Figure 4, p. 14.
[47] Keown, Leslie-Anne. 2008. Life in metropolitan areas. A profile of perceptions of incivility in the metropolitan landscape. *Canadian Social Trends.* Statistics Canada. Minister of Industry. Ottawa. p. 2.
[48] There are two types of *incivility* explored in the study:*Physical incivility* is defined to exist when people believe that conditions such as excessive litter, abandoned buildings, vandalism, and vacant lots constitute a problem in the area where they live. *Social incivility* includes the perception that disruptive behaviour such as inconsiderate and noisy neighbours, drunks, drug use and drug dealing, and homelessness are a problem in one's neighbourhood.
[49] Keown (2008), p. 5.
[50] Human Resources and Social Development Canada, Indicators of Well-being in Canada, Security—Perceptions of Local Police. Available from http://www4.hrsdc.gc.ca/indicator.jsp?lang=eng&indicatorid=58#MOREON_4. Accessed 11 October, 2008.
[51] In 2004, a total of 98,168 men in Canada were charged with violent offences, compared with 18,989 women. In total, 300,000 violent offences were reported in 2004, but not all resulted in a charge being laid. Statistics Canada. 2006. *Women in Canada. Fifth Edition: A gender-based statistical report,* Catalogue no. 89-503-XIE. Table 7.5. Available from http://www.statcan.ca/english/freepub/89-503-XIE/0010589-503-XIE.pdf. Accessed September 11, 2008.
[52] Ibid. Due to time and financial constraints, it was not possible to update crime rates and violent crime rates by gender for Canada and the provinces for 2007.
[53] Spousal violence is defined as all violent incidents committed by legally married, separated, and divorced partners. This includes same-sex partners and ex-partners. Ex-spouse includes separated and divorced partners. The Criminal Code does not have a specific category for spousal violent offences. Thus, all spousal violent offences are included under the broad category of "violent offences" in the Criminal Code.
[54] Ibid. Chart 7.2, p. 161.
[55] 1993 data for spousal violence against men were not available. The percentages for spousal violence against women in 1993 and 1999 are for the five-year period preceding the survey—with respondents asked whether they had experience such violence in the previous five years. In 1993, a dedicated survey was conducted titled "Violence Against Women," and in 1999 the "Victimization" survey that gathered these spousal violence data was a module of the General Social Survey (GSS). While attempts were made by Statistics Canada to make the survey questions on spousal violence in the two surveys as similar as possible, any comparisons should be made with this caveat in mind.
[56] Weir, Erica. 2000. Wife Assault in Canada. *Canadian Medical Association Journal.* 163 (3): 328. Cited in Colman, Ronald. 2003. A Profile of Women's Health Indicators in Canada. GPI Atlantic. Halifax. p.117.
[57] According to Statistics Canada, Uniform Crime Reporting Survey (UCR): "UCR data reflect reported crime that has been substantiated by police…. The UCR Survey produces a continuous historical record of crime and traffic statistics reported by every police agency in Canada since 1962. In 1988, a new version of the survey was created, UCR2, and is since referred to as the "incident-based" survey, in which microdata on characteristics of incidents, victims and accused are captured." Available from http://www.statcan.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=3302&lang=en&db=imdb&dbg=f&adm=8&dis=2. Accessed 12 October, 2008.
[58] The most recent in the series is: Canadian Centre for Justice Statistics. 2007. Family Violence in Canada: A Statistical Profile, 2007. Statistics Canada. Available from http://www.statcan.ca/english/freepub/85-224-XIE/85-224-XIE2007000.htm. Accessed September 5, 2008. However, because this 2007 report focuses specifically on spousal homicide, we here use the 2006 report for trends in police-reported family violence in general.
[59] Canadian Centre for Justice Statistics. 2006. Family Violence in Canada: A Statistical Profile, 2006. Statistics Canada. Available from http://dsp-psd.tpsgc.gc.ca/Collection/Statcan/85-224-X/85-224-XIE2006000.pdf. Accessed September 11, 2008.
[60] Ibid. p. 13.
[61] Weir, Erica. 2000. Wife Assault in Canada. *Canadian Medical Association Journal.* 163 (3): 328. Cited in Colman, Ronald. 2003. A Profile of Women's Health Indicators in Canada. GPI Atlantic. Halifax. p.117.

[62] Statistics Canada. Aboriginal people as victims and offenders, 2004. The Daily, June 6, 2006. Available from http://www.statcan.ca/Daily/English/060606/d060606b.htm. Accessed October 11, 2008.
[63] It was not possible to ascertain a trend for Prince Edward Island because the 2004 data were too unreliable to be published due to very wide sampling variability.
[64] Canadian Centre for Justice Statistics. 2005. Family Violence in Canada: A Statistical Profile, 2005.
[65] CCJS (2001), Table 4.4; CCJS (2006), p. 19.
[66] Canadian Centre for Justice Statistics. 2001. Family Violence in Canada: A Statistical Profile, 2001. Available from http://www.statcan.ca/english/freepub/85-224-XIE/0100085-224-XIE.pdf. Accessed September 17, 2008, p. 27.
[67] CCJS (2006), pp. 19-24.
[68] CCJS (2006), p. 52.
[69] CCJS (2006), p. 53.
[70] Canadian Centre for Justice Statistics. 1999. Family Violence in Canada: A Statistical Profile, 1999. p. 27. Available from http://www.statcan.ca/english/freepub/85-224-XIE/0009985-224-XIE.pdf. Accessed September 17, 2008.
[71] Canadian Centre for Justice Statistics. 2007. Family Violence in Canada: A Statistical Profile, 2007. Available from http://www.statcan.ca/english/freepub/85-224-XIE/85-224-XIE2007000.pdf. Accessed September 10, 2008; Canadian Centre for Justice Statistics. 2001. Family Violence in Canada: A Statistical Profile, 2001. Available from http://www.statcan.ca/english/freepub/85-224-XIE/0100085-224-XIE.pdf. Accessed September 17, 2008.
[72] According to Statistics Canada, the UCR2 Trend Database can be used to examine trends in physical and sexual assault against children and youth from 1998 to 2005. This information is based on a non-representative sample of 62 police services that have consistently reported to the survey and account for 51% of the population of Canada in 2005. However, rates of physical and sexual assault against children and youth by family members prior to 2003 were not readily available. CCJS (2007), p. 23.
[73] CCJS (2007), p. 33.
[74] Ibid.
[75] CCJS (1998), p. 25.
[76] Canadian Centre for Justice Statistics. 2003. Family Violence in Canada: A Statistical Profile, 2003. Available from http://www.statcan.ca/english/freepub/85-224-XIE/85-224-XIE03000.pdf. Accessed September 17, 2008.
[77] CCJS (2007), p. 33. At the time of writing, it was not possible to locate comparable rates of senior abuse by family members (per 100,000 senior population). Very few CCJS documents (published annually from 1998-2007) contained rates (per 100,000) of violent attacks on seniors by family members. Rather, the CCJS publications publish actual incidents (by gender and age), which are therefore more readily available. However, in order to ascertain easily whether the incidence of this kind of elder abuse is increasing or decreasing, it is recommended that Statistics Canada also make the rate data readily available.
[78] These direct cost estimates exclude deaths, injuries and property damage due to impaired driving; non-hospital medical, drug and counselling costs; private spending on criminal lawyers; the economic and medical costs of "victimless" crimes like illegal drug use and prostitution; non-retail business spending on alarms, electronic surveillance and other crime prevention detection equipment; and most white collar crime.
[79] Solicitor General Canada. *Canadian Urban Victimization Survey, Bulletin 5: Cost of Crime to Victims. 1985,* p. 1.
[80] For complete details on data limitations, methodologies, and caveats applicable to this costing exercise, please refer to the original 1999 GPI Atlantic *Cost of Crime in Nova Scotia* report by Colin Dodds and Ronald Colman (1999) available from http://www.gpiatlantic.org. Unless otherwise stated, the methodologies used in the 1999 report have been used in this update.
[81] New data regarding economic losses per crime were not available, and therefore estimates of the loss per criminal incident were taken from the original 1999 report (based on Solicitor General, *Canadian Urban Victimization Survey, Bulletin 5: Cost of Crime to Victims, 1985)* and updated using the Consumer Price Index (CPI). The actual number of property crime incidents for Nova Scotia is taken from Uniform Crime Reporting Survey data. The CPI has been used in all costing categories to convert all cost estimates to 2007 constant dollars. More recent data on victim losses than in the 1985 Solicitor General's report are available from Statistics Canada's General Social Surveys, but these are not presently comparable to the data used for the cost estimates in GPI Atlantic's 1999 Cost of Crime report and are not publicly available on an average per incident basis, which is necessary for the cost estimation methodologies employed here. For a description of GSS data on victim losses due to crime, See AuCoin

Kathy and Diane Beauchamp, Impacts and Consequences of Victimization, GSS 2004. *Juristat.* Volume 27, No. 1. Statistics Canada. Ottawa. Catalogue 85-002-XIE. Available from http://www.statcan.ca/english/freepub/85-002-XIE/85-002-XIE2007001.pdf. Accessed 21 October, 2008. According to this source (pp.3-4): "In order to capture the financial costs of household and property-related incidents, respondents were asked to report on the dollar value of the items that were stolen and/or damaged during the incident experienced during the previous 12-months. Overall, more than eight out of ten incidents resulted in losses. The majority of incidents resulted in losses of under $500 (60%), while in 15% of household and property-related incidents losses of more that $1,000 were reported…. Overall, the proportion of all household and property-related incidents that resulted in no out-of-pocket losses doubled to 19% from 9% when taking into account incidents that obtained monies through compensation…. Of those incidents in which the respondent had insurance and submitted a claim (19% of household or property related incidents), more than seven out of ten received monetary compensation (72%). In addition to direct losses, property and household incidents are also costly when considering the time lost to replace damaged and/or stolen goods, or to wait for service or insurance agents. More than six out of ten property and household-related incidents resulted in disruptions of the victim's day-to-day activities that exceeded 6 hours. A larger percentage of these non-violent incidents resulted in victims losing one day (38%) of normal activities, followed by 18% of incidents resulting in two days of disruption and a further 12% of incidents resulting in three days of disruption." Time and resources did not permit the authors to access the GSS micro-data in order to assess per incident costs in such a way as to ensure comparability with GPI Atlantic's earlier 1999 cost estimates, or to recalculate the victim loss estimates based on the new GSS data.

[82] For example, the loss of human life if clearly far more costly in human and social terms than the economic loss of productive output. Only reported crimes are included in this estimate. Non-hospital medical and drug costs, counselling costs and other expenditures are also excluded because accurate data are not currently available.

[83] The Solicitor General's figures are from Canadian Urban Victimization Survey: Cost of Crime to Victims, Bulletin No. 5, 1985, p. 4. The Solicitor General has not updated this report. The sources used for hospitalization costs in the original 1999 GPI Cost of Crime study were not available for this update: Statistics Canada. Hospital Indicators, Cat. No. 83-246,and Hospital Statistics, Cat.No.83-217, Table 12. As a proxy, the overall cost of health care in the province has been used, as provided by the Canadian Institute for Health Information, available from http://secure.cihi.ca/cihiweb/en/media_07dec2005_tabb11_e.html. Accessed October 3, 2008. In the original 1999 Cost of Crime report, the hospitalization costs were calculated based on all criminal incidents (rather than just on violent crime incidents) based on the Canadian Solicitor General's Report *Canadian Urban Victimization Survey: Cost of Crime to Victims,* which found that victims spent 50,500 nights in hospital due to injuries incurred during 1,600,000 criminal incidents nationwide—translating into 3.15% of all criminal incidents resulting in an average of one day in hospital. The number of days spent in hospital due to injuries resulting from criminal incidents in Nova Scotia was estimated using this ratio. This rationale for using the total number of criminal incidents, as opposed to only violent victimization incidents, was also employed in this update since the same ratio of one hospital day per 3.15% of all criminal incidents was also used here.

[84] In the 1999 cost estimates for 1997, the productivity loss due to homicide was assessed only for those homicide victims who would have been between the ages 16 and 65 in 1997, and therefore those likely participating in the workforce in 1997. In this update, all 2007 homicide victims are included, regardless of their age, and therefore the estimates for lost productivity due to homicide presented in this update are not properly comparable to the earlier calculations. Page 120 of GPI Atlantic's 1999 Cost of Crime report notes: "[F]or the purposes of this report, GPI Atlantic has tabulated data on all homicide victims in NS back to 1921. Age data have been assessed to determine the number of victims who would have been of working age (16-65) in any given year. For example, if someone age 20 were murdered in 1950, the value of one year of productive work would be assessed as a cost of crime for each year up to 1995. Similarly, a 20-year-old killed in 1996 would register only one year's lost potential production in 1997, but the costs of that crime would continue to appear in the GPI until the year 2042."

[85] Productivity losses due to homicide and absenteeism were adjusted for higher GDP levels in 2007 (i.e., output per worker in 2007 was higher than in 1997, therefore potential production loss per homicide or attack victim was also higher). That increase in GDP drove the increased cost attributable to crime-related absenteeism despite the drop in crime rates. In the case of homicides, the drop in homicides was considerably greater than the rise in GDP value, so productivity losses due to homicide are estimated here to have declined markedly despite the per-worker increase in output.

[86] Canadian Centre for Justice Statistics. 1999. Police Resources in Canada, 1999. Available from http://dsp-psd.tpsgc.gc.ca/Collection-R/Statcan/85-225-XIE/0009985-225-XIE.pdf. Accessed October 1, 2008. Also, Canadian Centre for Justice Statistics. 2007.Police Resources in Canada, 2007. Statistics Canada. Catalogue no. 85-225-XIE. Available from http://www.statcan.ca/english/freepub/85-225-XIE/85-225-XIE2007000.pdf. Accessed September 30, 2008. Data are for 1999 and 2006.
[87] This includes both provincial and federal police officers. Provincial/territorial expenditure totals exclude federal police spending because the latter is not paid for by the provinces/territories. Federal expenditures on RCMP are therefore listed separately here.
[88] Ibid, Tables 7, 8 and 9. Calculations by author.
[89] CCJS. 2008. Adult Criminal Court Statistics, 2006/2007. *Juristat.* Vol. 28. no. 5. Statistics Canada. Available from http://www.statcan.ca/english/freepub/85-002-XIE/85-002-XIE2008005.pdf. Accessed October 1, 2008.
[90] Ibid.
[91] Direct Nova Scotia data for the total cost of courts are currently not available, so these estimates cannot presently be verified from other sources. In the original 1999 GPI report, the likely Nova Scotia share of total Canadian court costs was extrapolated from Statistics Canada estimates for criminal court costs in Canada. The number of court cases has been used here as a proxy for the 2007 adjustments made to these estimates. There were 17,325 court cases in Nova Scotia in 1997-98: CCJS. Adult Criminal Court Statistics, 1997-1998. Table 5. Available from http://www.statcan.ca/english/freepub/85-002-XIE/0149885-002-XIE.pdf. Accessed October 2, 2008. There were 11,685 court cases in Nova Scotia in 2006-2007: CCJS. Adult Criminal Court Statistics, 2006/2007. *Juristat*. Vol. 28. no. 5. Statistics Canada. Available from http://www.statcan.ca/english/freepub/85-002-XIE/85-002-XIE2008005.pdf. Accessed October 1, 2008.
[92] CCJS. 2008. Adult Correctional Services in Canada, 2005/2006. *Juristat.* Vol. 28 no. 6. Statistics Canada. Available from http://www.statcan.ca/english/freepub/85-002-XIE/85-002-XIE2008006.pdf. Accessed October 2, 2008.
[93] Ibid.
[94] CCJS. 2008. Adult Criminal Court Statistics, 2006/2007. *Juristat.* Vol. 28. no. 5. Statistics Canada. Available from http://www.statcan.ca/english/freepub/85-002-XIE/85-002-XIE2008005.pdf. Accessed October 1, 2008.
[95] Since Nova Scotia taxpayer dollars fund both federal and provincial prisons, federal expenditures on Nova Scotia criminals must be added to the provincial corrections costs. Since the general population pays the taxes that fund federal penitentiaries, the Nova Scotia share of operating federal corrections is here based simply on share of general population, though this share should rightly be further adjusted for income and actual share of federal tax burden.
[96] Data are from *Juristat,* Vol. 28, no. 6. Available from http://www.statcan.ca/english/freepub/85-002-XIE/85-002-XIE2008006.pdf Accessed October 1, 2008.
[97] Statistics Canada. General Social Survey on Victimization, Cycle 18: An Overview of Findings. 2004. Available from http://www.statcan.ca/english/freepub/85-565-XIE/85-565-XIE2005001.htm. Accessed September 9, 2008. Tables 3 and 4.
[98] Statistics Canada. General Social Survey on Victimization, Cycle 18: An Overview of Findings. 2004. Available from http://www.statcan.ca/english/freepub/85-565-XIE/85-565-XIE2005001.htm. Accessed September 9, 2008.
[99] Updated data based on the sources used in the 1999 GPI report are not available. Instead, Home Security System purchases by household (CANSIM Table 203-0005) have been used as a proxy. The original 1997 numbers, as reported in GPI Atlantic's 1999 Cost of Crime report were used as a starting point for the calculations, and the percentage change in the CANSIM table on household home security system purchases was then used to calculate the 2007 total.
[100] In 1997 home security expenditures amounted to $56 million and spending on private security guards and investigatrors was $69.8 million— for a total of $125.8 million (all $2007). Using Nova Scotia population data from the 1996 Census (909,280), the per capita spending on these private security costs was $138.35. If spending on private defensive expenditures were at the same per capita rate in 2007 (for a population of 913,465 according to 2006 Census data) as it was in 1997, then the cost would have been $126.4 million as opposed to the actual cost of $112.3 million ($46 million for home security + $66.3 million for private security guards and investigators). This would represent a savings of $14.1 million attributable to greater feelings of safety and security.
[101] The data used for the 1997 cost estimates in the 1999 GPI Cost of Crime report are not available, and so.changes in the level of Home Security System purchases by household (CANSIM Table 203-0005) have again been used as a proxy. According to GPI Atlantic's 1999 Cost of Crime report: "The Retail Council of Canada reports that 56% of

respondents with annual sales under a million dollars reported spending more than 0.51% of sales revenues on loss prevention equipment . . . . Since slightly more than half the Retail of Council of Canada respondents reported spending more than 0.51% of sales on loss prevention equipment, that figure may be assumed here to represent a median estimate for business expenditures . . . . Statistics Canada's monthly retail sales figures (CANSIM Matrix 2399) are used here to estimate the percentage of all retail sales revenues that can be attributed to business defensive expenditures on electronic article surveillance and other crime prevention and detection equipment: 0.51% of $7.255 billion in annual retail sales in Nova Scotia amounts to $37 billion for 1997."

[102] In 1997 there were 4,082 reported property crimes per 100,000 in Nova Scotia and in 2007 there were 3,072. In 1962 there were only 1,168 reported property crimes per 100,000.

[103] When property crime is broken down into the various sub-types, 60% of all crimes (or 15,620 incidents) committed against property in Nova Scotia in 2007 were theft under $5,000. Breaking and entering ranked second in terms of actual number of incidents (6,192), or 23% of property crimes that year. Theft over $5,000 accounted for only 1% of all property crime (356 incidents) in 2007. The total for property crime here does not include mischief, which falls under the category of "other criminal code" violations, but which accounts for a large number of crimes against property in Nova Scotia: 13,460 incidents of mischief under $5,000 and 367 incidents of mischief over $5,000 in 2007.

[104] According to the Insurance Bureau of Canada definition: "'Claims incurred' are estimates of total claims and claim expenses outstanding at the end of a term, plus all claims paid during the period, minus the total of outstanding claim estimates at the beginning of the term." Insurance Bureau of Canada. 2008. Facts 2008 of the General Insurance Industry in Canada, p. 6. Available from http://www.ibc.ca/en/Need_More_Info/documents/FactsBook2008.pdf. Accessed October 2, 2008. The net premiums include those for auto insurance, accident and sickness insurance, liability, commercial property insurance, and personal property insurance (including theft).

[105] Current Nova Scotia data specifically for theft insurance costs are not available. Instead, the likely rate of change for Nova Scotia has been calculated using pan-Canadian data on all insurance available from the Insurance Bureau of Canada (2008). Attempts were made to access data from the Insurance Bureau of Canada for the gap specifically between theft insurance premiums and theft insurance claims only, as well as for the annual number of claims since 1997. However, at the time of writing, these data had not yet been made available by the Insurance Bureau of Canada. Thus, it is unclear whether the increased gap between premiums and claims is due to fewer claims or to higher premiums or both. If people are paying higher theft insurance premiums at a time of reduced crime and fewer claims, then it can be argued that insurance companies may be gouging their customers unfairly and failing to pass along the benefits of savings accruing due to reduced crime and theft claims. In principle, at least, it might be expected that insurance companies would lower premiums in proportion to reduced claims and crime rates, so that members of the public at large, rather than only the insurance companies, would benefit and profit from reduced crime rates and break-ins. However, it is not possible to examine this hypothesis without data both on the number of claims and on premiums paid, and thus on whether the increased gap between premiums and claims is due primarily to a fall in claims or an increase in premiums.

[106] Nova Scotia population data for 1962 are from Census data. Statistics Canada, Historical Statistics of Canada. Available from http://www.statcan.ca/english/freepub/11-516-XIE/final_pdf/english/seriesa.PDF. Accessed October 3, 2008. It should again be noted that the methodology employed here and the results it produces are not scientific but only illustrative. Many other factors will affect the 1962 actual cost of crime. For example, per capita health care costs, including hospitalization, were much lower in 1962 than today, and GDP per capita was much lower (thereby affecting and possibly inflating productivity estimates). All of these factors would need to be adjusted as well as the crime rates in order to make accurate comparisons between crime costs in 1962 and crime costs in 2007. Since we have not made these further adjustments—beyond adjusting for higher current reporting rates in some crime categories—the actual dollar savings are likely to be less dramatic than what we have presented here.

[107] Statistics Canada. The Daily. General Social Survey: Criminal victimization, 2004. November 24, 2005. Available from http://www.statcan.ca/Daily/English/051124/d051124b.htm. Accessed September 1, 2008. The data indicate that in 2004 54% of break and enters, 49% of motor vehicle theft incidents, 29% of household property theft, and 31% of vandalism cases were reported to police.

[108] CCJS. Criminal Victimization in Canada, 1999. *Juristat*. Vol. 20 no. 10. Available from http://www.statcan.ca/english/freepub/85-002-XIE/0100085-002-XIE.pdf. Accessed October 2, 2008.

[109] UCR survey data indicate that there were 28,700 property crimes reported to police in Nova Scotia in 2007. Applying the ratio of 3:1 derived from the 2004 GSS data for Canada to Nova Scotia in 2007, and then subtracting the number of police-reported crimes from the UCR survey, it is estimated that 57,400 property crimes were unreported that year.
[110] Canadian Centre for Justice Statistics. 2006. Uniform Crime Reporting. Statistics Canada. Available from http://ivt.crepuq.qc.ca/juridique/documentation2006/2005-canada-province-cma.pdf. Accessed September 5, 2008.
[111] In 1997 there were 38,062 reported property crime incidents in Nova Scotia, compared to 28,700 in 2007. Uniform Crime Reporting survey data from Crime Statistics by Detailed Offences, CANSIM Table 252-0013.
[112] Statistics Canada. The Daily. General Social Survey: Criminal victimization, 2004. November 24, 2005. Available from http://www.statcan.ca/Daily/English/051124/d051124b.htm. Accessed September 1, 2008.
[113] UCR survey data indicate there were 9,935 violent crimes (minus homicides) reported to police in Nova Scotia in 2007. Applying the ratio of 3:1 derived from the 2004 GSS data for Canada to Nova Scotia in 2007 to get the total number of violent crimes (29,805), and then subtracting the number of police-reported crimes (UCR survey), it is estimated that 19,870 violent crimes were unreported that year. It should be noted that the method used here to derive the number of unreported violent crimes in Nova Scotia based on GSS data is different from the method used in GPI Atlantic's 1999 Cost of Crime report which gave a total of 17,276 violent incidents, of which 9,598 (or 56%) werereported (56%)—a much higher reporting rate than indicated in the 2004 GSS. Thus, the cost estimates here are not properly comparable to those in the 1999 report.
[114] Costs per violent incident were updated using the CPI.
[115] Canadian Centre for Justice Statistics. 2006. Uniform Crime Reporting. Statistics Canada. Available from http://ivt.crepuq.qc.ca/juridique/documentation2006/2005-canada-province-cma.pdf. Accessed September 5, 2008.
[116] Based on the Solicitor General's report, for every 100 criminal code incidents, victims spent 3.15 days in hospital and missed 25.3 days of work. This has been applied to the total number of police-reported (UCR) criminal incidents in Nova Scotia in 2007.
[117] For source details please refer to the original 1999 GPI Cost of Crime Report. The methodology used here has been updated, and therefore these estimates of lost production from unpaid work are not entirely comparable to the earlier estimates.
[118] Replacement value for household work is $11.34 ($2007) based on replacement values from Statistics Canada, Households' Unpaid Work, cited in Colman, Ronald. 1998. The Economic Value of Civic and Voluntary Work in Nova Scotia. Halifax. It should be noted that because the calculations for unpaid work loss here are based on police-reported crime data only, they are lower than the actual costs associated with unpaid work losses, since many crimes are not reported to the police.
[119] Hall, Michael, David Lasby, Glenn Gumulka, and Catherine Tryon. 2006. Caring Canadians, Involved Canadians: Highlights from the 2004 Canada Survey of Giving, Volunteering and Participating. Statistics Canada. Minister of Industry. Ottawa.
[120] Statistics Canada. General Social Survey on Time Use. Overview of the Time Use of Canadians, 2005. Table 1.4. In 2005, Nova Scotians aged 15 and older spent an average of 146 hours a year on civic and voluntary work. Population data from 2006 Census.
[121] This is an underestimate because it does not include the lost voluntary services of homicide victims. These estimates also do not include either the unpaid work losses of offenders or the community service work contributed by offenders as conditions of their sentence.
[122] Hall, Michael, David Lasby, Glenn Gumulka, and Catherine Tryon. 2006. Caring Canadians, Involved Canadians: Highlights from the 2004 Canada Survey of Giving, Volunteering and Participating. Statistics Canada. Ottawa.
[123] It was not possible to deduct volunteer hours for "politics" from the category of "law, advocacy and politics." Due to differences in questionnaire and methodology, the volunteer hours data from the Canada Survey of Giving, Volunteering and Participating (the source of the formal volunteering data used here) are not comparable to data from earlier Statistics Canada surveys on this subject—particularly the 1997 National Survey of Giving, Volunteering and Participating, which was used in the original 1999 GPI Cost of Crime report.
[124] The business shrinkage rate for Canada is used as a proxy for the Nova Scotia estimates. Source for business shrinkage rate: Retail Council of Canada. 2003. Canadian Retail Security Report: Executive Summary http://www.respectrfid.com/Ref/Canadian%20retail%20security%20survey2003.pdf.
[125] Retail figures are from Statistics Canada: http://www40.statcan.ca/l01/cst01/trad17a.htm.

[126] Retail Council of Canada, Canadian Retail Security Survey 2007. Available from http://members.retailcouncil.org/advocacy/lp/issues/asr/login_2007_CanadianRetailSecuritySurvey.asp. Accessed 23 October, 2008.
[127] Due to time and resource constraints it was not possible at this time to update the increase in insurance premiums attributable to fraudulent claims in Nova Scotia. Previous data used in the 1999 GPI Cost of Crime report were obtained from the Canadian Coalition Against Insurance Fraud. For our purposes here, the estimates reported in the 1999 Cost of Crime report were simply updated to 2007 dollars using the Consumer Price Index (CPI.), so the figure used here is essentially the same as the one used in the original GPI Cost of Crime report.
[128] Brantingham, Paul, and Stephen Easton. 1996. “The Crime Bill: Who Pays and How Much?” Fraser Forum, 1996, The Fraser Institute, Vancouver.
[129] Since it is not possible to assess changes in the intensity and severity of the social and emotional impact of crime on victims and their families, the changes here have simply been estimated based on the change in the number of violent crime incidents between 1997 and 2007, on the assumption that the societal prevalence of psychological and emotional suffering due to crime declined in proportion to the decline in the violent crime rate.
[130] Leung, Ambrose. 2004. The Cost of Pain and Suffering from Crime in Canada. Department of Justice Canada. Research and Statistics Division. Ottawa.
[131] All Department of Justice estimates were in 1999 constant dollars. For comparison purposes they have been converted to 2007 constant dollars using CPI.
[132] Viscusi, W. K. 1993. The value of risks to life and health. Journal of Economic Literature 31 (4): 1912-46.

Chapter 11: Educated Populace
[1] United Nations Educational, Scientific, and Cultural Organization (UNESCO), Educating for a Sustainable Future: A Transdisciplinary Vision for Concerted Action, International Conference in Thessaloniki, December 9-12, 1997, 1998, accessed March 2005; Available from http://unesdoc.unesco.org/images/0011/001106/110686eo.pdf. p. 18.
[2] Orr, David. W., Ecological Literacy. Education and the Transition to a Postmodern World, Albany: State University of New York Press, 1992. p. 133.
[3] Rychen, D.S. and L.H. Salganik, Definition and Selection of Competencies: Theoretical and Conceptual Foundations (DeSeCo). Summary of the Final Report: Key Competencies for a Successful Life and a Well-Functioning Society, Organisation for Co-operation and Development (OECD), 2003, accessed January 2006; Available from http://www.portal-stat.admin.ch/deseco/deseco_finalreport_summary.pdf. p. 2.
[4] Ibid. pp. 2–3.
[5] Ibid. p. 3. The OECD defined three categories of key competencies: interacting in socially heterogeneous groups; acting autonomously; and using tools interactively.
[6] Formal education includes primary, secondary, and postsecondary schooling. Informal learning is the process of learning outside formal school settings: through friends, colleagues, or relatives; in a variety of places, such as the workplace, community, library, cultural events, and home; through a variety of activities, including leisure (such as reading books or using the Internet) and physical activities. Nonformal learning includes taught courses or lectures that do not lead to a formal qualification in the educational system. It can refer to courses taken for personal interest to enrich one’s life or to courses taken to upgrade skills or otherwise contribute to employment-related initiatives.
[7] McMurtry, John, Professor of Philosophy, University of Guelph, personal communication with Karen Hayward, reviewer comments, email correspondence, July 27 and August 23, 2006.
[8] Ibid.
[9] Special Study Panel on Education Indicators, *Education Counts: An Indicator System to Monitor the Nation's Educational Health,* Washington, D.C.: National Centre for Education Statistics, 1991.
[10] Special Study Panel on Education Indicators, *Education Counts: An Indicator System to Monitor the Nation's Educational Health,* Washington, D.C.: National Centre for Education Statistics, 1991.
[11] Alberta drop out rate is for 2002/2003 to 2004/2005 school year average.
[12] Council of Ministers of Education Canada (CMEC), *Education Indicators in Canada: Report of the Pan-Canadian Education Indicators Program, 2005.* Table C4.6, p. 208.
[13] Organisation for Economic Co-operation and Development (OECD), *School Factors Related to Quality and Equity. Results from PISA 2000,* Paris: OECD, 2005.

[14] Statistics Canada, *Class of 2000: How Are They Faring Two Years Later?*, Statistics Canada, 2004, accessed August 2006; Available from http://www.statcan.ca/english/freepub/81-004-XIE/200406/ngs.htm. These figures exclude graduates who have pursued Masters or Doctorate degrees.

[15] Maritime Provinces Higher Education Commission. 2008. Intentions of Maritime University Students Following Graduation: A Survey of the Class of 2007. Executive Summary. Available from http://www2.mphec.ca/english/pdfs/Intentions2007En.pdf

[16] Maritime Provinces Higher Education Commission. 2007. 2005 Survey of 2003 Maritime University Graduates: Selected Provincial Statistics. MPHEC. Available from http://www2.mphec.ca/english/pdfs/GFU2003in2005ProvEng.pdf. Table 1.11a. Data are for all graduates and refers to the average amount borrowed from all sources for the 2003 degree, post-2003 education or both, by province of graduation. Unfortunately, no time series pan-Canadian data are available for combined public and private debt loads, therefore provincial comparisons outside the Maritimes are not currently possible.

[17] EKOS Research Associates, *Investing in Their Future. A Survey of Student and Parental Support for Learning*. pp. 55-56.

[18] Wealth is defined as assets minus debts. It is also referred to as net worth.

[19] Tran, Kimberley and Ronald Colman. 2008. Financial Security and Debt in Atlantic Canada. GPI Atlantic. Halifax. Available from http://www.gpiatlantic.org/. Original data source: Statistics Canada's Summary Tables Online (Income, Pensions, Spending and Wealth) "Assets and debts held by family units, total amounts." Survey of Financial Security, 2005.

[20] Canadian Education Statistics Council, *Education Indicators in Canada: Report of the Pan-Canadian Education Indicators Program, 2005*. Canadian Education Statistics Council, *Education Indicators in Canada: Report of the Pan-Canadian Education Indicators Program, 2003*.

[21] Nova Scotia Department of Education. Media Release. October 18, 2007. NS Tuition Decreasing, StatsCan Report Shows. Available from http://www.gov.ns.ca/news/details.asp?id=20071018004

[22] Ibid.

[23] Cited in Brian Flinn. Fees could negate tuition cuts, students warn. Halifax Daily News. January 29, 2008. Available from http://halifax.metronews.ca/index.cfm?sid=103037&sc=89

[24] Statistics Canada. The Daily. University Tuition Fees, 2007/2008. Thursday, October 18, 2007. Available from http://www.statcan.ca/Daily/English/071018/d071018b.htm

[25] Maritime Provinces Higher Education Council. Trends in Maritime Higher Education. Surveying the Enrolment Landscape: Factors and Trends in Maritime University Enrolment 2000-2001 to 2006-2007. Volume 5, no. 1. June, 2007. Available from http://www2.mphec.ca/english/pdfs/TrendsSurveyingen.pdf

[26] Statistics Canada, Labour Force Survey, 1976-2006.

[27] Carriere, Gisele, "Weekly Work Hours and Health-Related Behaviours in Full-Time Students," *Health Reports*, vol. 16, no. 4, 2005: 11-21.

[28] Blouin, Patric and Marie-Josee Courchesne. 2007. Research Paper: Summary Public School Indicators for the Provinces and Territories, 1998/1999 to 2004/2005. Statistics Canada. Ottawa; Statistics Canada, The Daily, July 28, 2000. School board revenues and expenditures, 1993–1997. Accessed December, 2004.

[29] Canadian Education Statistics Council, Education Indicators in Canada: Report of the Pan-Canadian Education Indicators Program, 2003, Ottawa: Statistics Canada, and Council of Ministers of Education, Canada, 2003. p. 127.

[30] McMurtry, John, "Education and the Market Model," *Journal of Philosophy of Education*, vol. 25, no. 2, 1991: 209-217. p. 214.

[31] Dufay, Larry, Senior Research Officer, Canadian Association of University Teachers (CAUT), personal communication with Linda Pannozzo, September 14, 2006.

[32] Statistics Canada, *Building on Our Competencies: Canadian Results of the International Adult Literacy and Skills Survey, 2003*, Statistics Canada, Catalogue no. 89-617-XIE, and Human Resources and Social Development Canada, 2005, accessed January 2006; Available from http://www.statcan.ca/cgi-bin/downpub/listpub.cgi?catno=89-617-XIE2005001. Ottawa. Statistics Canada catalogue no. 89-617-XIE, and Human Resources and Social Development Canada. 2005. p. 13.

[33] Organisation for Economic Co-operation and Development (OECD), *Literacy in the Information Age: Final Report of the International Adult Literacy Survey*, OECD and Statistics Canada, 2000, accessed January 2005; Available from http://www.oecd.org/LongAbstract/0,2546,en_2649_34509_1897266_119699_1_1_1,00.html., p. 16.

[34] Statistics Canada, *Building on Our Competencies: Canadian Results of the International Adult Literacy and Skills Survey, 2003*. p. 26.
[35] People at level 1 (score 0–225), for example, would have a hard time understanding how to follow directions in a cookbook or on a prescription, or how to follow maps. Those at level 2 (score 226–275) would be able to read simple texts but would have difficulty with job applications or bank deposit slips, and would have trouble learning new job skills. Level 3 (score 276–325) is the "desired threshold," or the "minimum for persons to understand and use information contained in the increasingly difficult texts that characterize the emerging knowledge society and information economy." Individuals with a proficiency at level 4 or 5 (scores of 326–375 or 376–500, respectively) in prose and document literacies are able to make complex and high-level inferences, and use specialized and complex information.
[36] 1994 literacy data for Nova Scotia are not available, as the province did not pay to increase the sample size to produce provincial results. The only Atlantic province that did so was New Brunswick. Therefore, comparisons between 1994 and 2003 prose and document literacy results can only be made at the regional level.
[37] Despite the major differences in definition and method, Statistics Canada did attempt an approximate comparison between results from the 1989 Literacy Skills Used in Daily Activities (LSUDA) survey and the 1994 IALS results. It found that the basic literacy profile of Canadians had also changed little over that earlier 5-year period, attributing this stability to the "social and economic determinants at play." Statistics Canada, *Reading the Future: A Portrait of Literacy in Canada*, Catalogue no. 89-551-XPE, Ottawa: Minister of Industry, 1996. Since there was also no significant difference at the national level between the 1994 and 2003 literacy results, it is reasonable to conclude that literacy levels have actually remained relatively stable since 1989.
[38] Statistics Canada, "International Adult Literacy and Skills Survey," *The Daily*, Nov 9, 2005, accessed November 2005; Available from http://www.statcan.ca:80/Daily/English/051109/d051109a.htm, and http://www.statcan.ca:80/Daily/English/051130/d051130b.htm. p. 3.
[39] Canadian Council on Learning (CCL), *Press Release: Low Literacy Rate*, CCL, 2005, accessed May 2006; Available from http://www.ccl-cca.ca/CCL/Newsroom/Releases/11May05-Literacy.htm.
[40] Milner, Henry, "Civic Literacy: How Informed Citizens Make Democracy Work," Paper presented at the Conference of the Society for the Advancement of Socioeconomics (SASE), Amsterdam, June, 2001; accessed July 2005; Available from http://www.sase.org/conf2001/papers/milner_henry.pdf. pp. 2–3.
[41] Milner, Henry, "Compétences Civiques, Croissance Économique et Redistribution Sociale," *Policy Options*, April, 2004, 73-78. (abstract)
[42] Milner, Henry, "Informed Citizenship: Canada in a Comparative Context," *Canadian Diversity*, vol. 2, no. 1, 2003. p. 5.
[43] Delli Carpini, Michael X., "In Search of the Informed Citizen: What Americans Know About Politics and Why It Matters," Paper presented at the Transformation of Civic Life Conference, Middle Tennessee State University, Murfreesboro and Nashville, Tennessee, November 12-13, 1999; accessed July 2005; Available from http://www.mtsu.edu/~seig/paper_m_carpini.html.
[44] Ibid.
[45] Howe, Paul, "Political Knowledge and Electoral Participation in the Netherlands: Comparisons with the Canadian Case," Paper presented at the Annual conference of the Canadian Political Science Association, Winnipeg, June 3-5, 2004; accessed July 2005; Available from http://www.cpsa-acsp.ca/template_e.cfm?folder=conference&page_name=agm-papers-2004.htm - h. p. 3.
[46] Many of the CES questions are similar in each survey and include questions pertaining to political knowledge, voting behaviour and other political participation, opinions on government performance and leaders, motivation and interest in political issues, and opinions on a wide variety of social, economic, and political topics. The CES basic knowledge questions are quite limited and include the names of political party leaders, the name of the respondent's provincial premier, and knowledge of party positions. The data, however, are not consistent from survey to survey, since questions are time-sensitive and worded differently in different surveys, and some questions are relevant only to particular elections.
[47] Howe, "Political Knowledge and Electoral Participation in the Netherlands: Comparisons with the Canadian Case". p. 5.
[48] Ibid. See pages 4 to 5 for a detailed explanation of the methodology used.

[49] World Wildlife Fund–Canada, Canadian Living Planet Report, 2007. Available from http://www.wwf.ca/LivingPlanet/livingplanet_report.asp. Accessed January 24, 2008. Data for average Canadian Ecological Footprint are for 2003.
[50] Orr, *Ecological Literacy. Education and the Transition to a Postmodern World*. p. 9.
[51] Estimates developed by Hans Messinger, HFM Consulting, are based on source data from Statistics Canada's Social Policy Simulation Database, National Accounts Analytical Studies Branch, and Global Footprint Network / International Institute for Sustainable Development data for the National Ecological Footprint and Biocapacity Accounts, 2005 edition. The ecological Footprints by education illustrate the global hectares consumed per person for the individual with the highest income in each household disaggregated by that person's level of formal educational attainment. Global hectares is an area weighted by productivity or "the amount of biological material useful to humans that is generated in a given area." (Global Footprint Network, *Footprint Term Glossary*, 2007; accessed August 2007; Available from http://www.footprintnetwork.org/gfn_sub.php?content=glossary.)
[52] Global Footprint Network. 2007. *Footprint Term Glossary*. Available from http://www.footprintnetwork.org/gfn_sub.php?content=glossary. Accessed August 2007.

Chapter 12: Soils and Agriculture
[1] Indirect expenditures are defined as "those that occur when the direct supplier of goods and services, in turn, purchases goods and services that are necessary to produce their particular good or service." Induced effects "result from the spending of income (wages and salaries) earned through direct and indirect effects on goods and services for the consumer." (ATi Consulting. 2002. The Impact of Local Government on Farm Business in Nova Scotia. ATi Consulting Project No. 50.5200. Nova Scotia Federation of Agriculture.)
[2] The data for this chapter were taken from several reports that examined agriculture in both Nova Scotia and Prince Edward Island, so PEI data appear in several of the following figures. The comparison also helps indicate that the trends described are not unique to Nova Scotia.
[3] The definition of net income is: total cash receipts minus operating expenses after rebates plus income in kind minus depreciation charges (on buildings and machinery) plus value of inventory change.
[4] Statistics Canada 2008. *Agriculture Economic Statistics—Net Farm Income*. Cat. No. 21-010-X. May 2008.
[5] Since 2007 net income figures became available on the eve of publication, they were inserted here just before this report went to press. Therefore the total farm cash receipt data are presented for the period 1971–2006 (the latest available at the time of writing), while net income data are presented for the period 1971–2007.
[6] "Operator" is a term used to describe the person or people who own and run the farm. They are not "employees."
[7] An expense to income ratio of 80% or less is particularly important for the farming sector in order to account for the inherent risks and fluctuations associated with farming above and beyond normal business risks and cycles. These additional risks include weather fluctuations, crop and livestock losses from pests and diseases, trade policy decisions, and the effects of production methods and policies (such as agricultural subsidies) in other countries. To accommodate these fluctuations over which local farmers have no control, a minimum 20% average margin is considered essential for a healthy farming sector.
[8] In some cases, farmers remain on their land even when losing money, but sell lots off their farms, if zoning regulations allow, in order to compensate for farming losses.
[9] Rates of increase are calculated using trend lines. The trend lines are used to calculate the overall percentage increases, because they even out the many fluctuations and provide straight line trends that incorporate all the information in the fluctuating data lines. For Nova Scotia, the trend line for Figure 4 starts at $240 million and ends at $590 million. Therefore, (590-240)/240 * 100 = 146%. So, debt rose by 146%. If only the start year (1971 = $255 million) and end year (2006 = $680 million) had been used, the increase would have been (680-255)/255*100 = 167%.
[10] Given the rapid accumulation of farm debt in recent years, and the financial, economic, and debt crisis faced by an increasing number of farmers, as outlined in this report, it has been suggested that this "solvency ratio" should properly be named the "insolvency ratio," particularly since it assesses liabilities in relation to assets rather than the reverse.
[11] As with all other percentage changes in this report, these ones are calculated from the trend lines. Thus, according to the trend line for the Nova Scotia solvency ratio: (33-16)/16*100 = 106% increase. Given the large annual fluctuations in farm finances that are due to a wide range of factors like weather, pests, crop diseases, and commodity price changes, it is important to use the trend lines to calculate the average rates of increase, rather than

simply the start and end dates shown in the graphs, which may well reflect anomalies in those particular years, while the trend lines reflect the average rate of change for the period as a whole.

[12] Statistics Canada. *Agriculture Economic Statistics.* Cat. No. 21-011. Payments (subsidies) are subtracted from Farm Cash Receipts.

[13] Strategis http://strategis.ic.gc.ca/sc_mrkti/tdst/engdoc/tr_homep.html. Total agricultural exports from Nova Scotia, NAICS codes: 111 and 112. February 11, 2008.

[14] Statistics Canada CANSIM tables 386-0001 and 386-0002. The latest inter-provincial export data available are for 2004, and are used here instead of 2006 data to complete the estimate. Only 30% of the "meat, fish, and dairy products" category is used, because we have assumed here that about 70% of that category consists of fish and seafood products that cannot be included in this assessment of Nova Scotia's land-based farms.

[15] Statistics Canada. *Food Consumption in Canada*, Parts I and II. 2002. Cat. No. 32-229, Appendix B, p.C7. The amount spent on food is derived by multiplying total annual food expenditures per person by the population of Nova Scotia (Statistics Canada CANSIM table 051-00005). Food spending for 2006 is estimated based on 2005 figures from Statistics Canada, *Spending Patterns in Canada*, Cat. No. 62-202, Table 2, p.18.

[16] Lefebvre, A., W. Eilers, and B. Chunn (eds.), 2005. *Environmental Sustainability of Canadian Agriculture: Agri-Environmental Indicator Report Series—Report #2*, p. 62. Agriculture and Agri-Food Canada. Available from http://www.agr.gc.ca/env/naharp-pnarsa/index_e.php. Accessed December 6, 2006.

[17] For a more detailed discussion of this issue, please refer to Scott, Jennifer and Julia Cooper. 2002. *GPI Soils and Agriculture Accounts, Part Two: Resource Capacity and Use: Soil Quality and Productivity*. GPI Atlantic. Halifax. Available at http://gpiatlantic.org/pdf/agriculture/soilqp.pdf.

[18] "Other land" includes forests, windbreaks, marshes, barnyards, and greenhouses.

[19] Productive capacity is estimated by subtracting farm expenses from farm revenues for the year in question. All subsidies, insurance payments, and producer premiums were excluded from the valuation. Depreciation on buildings and machinery, however, was included in the calculation, as was the value of inventory changes, but the value of unpaid labour was not included. Productive capacity is therefore very similar to net farm income with the subsidies removed (Statistics Canada 2008. *Agriculture Economic Statistics*. Cat. Nos. 21-011 and 21-012.)

[20] Productive value divided by estimated total market land value.

[21] Total productive value divided by total farmed land.

[22] OECD. 2001. *Environmental Indicators for Agriculture. Volume 3. Methods and Results*. Paris: OECD Publication Service, p. 293. Cited in Scott, Jennifer. 2002. *GPI Agriculture Accounts, Part Two: Resource Capacity and Use: The Value of Agricultural Biodiversity*. GPI Atlantic. Halifax. Available at http://gpiatlantic.org/pdf/agriculture/biodiversity.pdf.

[23] For a full discussion on this and on the studies being referred to here, please see Scott (2002), ibid. Chapter 3.

[24] OECD biodiversity indicators from OECD. 2001. *Environmental Indicators for Agriculture, Volume 3: Methods and Results*. Paris: OECD Publication Service. Cited in Scott (2002), pp. 3–4.

[25] These figures include land occupied by Christmas trees.

Chapter 13: Forests

[1] Wright, Ronald. 2004. A Short History of Progress. Anansi Press. Toronto. p. 105.

[2] Wendell Berry cited in GPI Forest Accounts, Volume 2, 2001. Available from http://www.gpiatlantic.org.

[3] Dr. Wilfrid Creighton was the Deputy Minister of the Nova Scotia Department of Lands and Forests and retired in 1969. This quote was taken from a transcript of his comments given at a public forum on forest issues held at Dalhousie University in 1998. The transcript first appeared in *Clearcutting in Perspective,* 2000. Nova Scotia Public Interest Research Group. Dalhousie University, Halifax.

[4] 1958 is taken as a benchmark year in these estimates, only because it provides the earliest comparable inventory data set. The 1958 figures in no way represent a pristine, unspoiled, or natural forest. As outlined in GPI*Atlantic*'s 2001 Forest Accounts (Volume 1), the 1958 forest survey conducted by the provincial Department of Lands and Forests observed that NS had already lost most of its primary forest by that year. Even the first provincial forest survey in 1912 found the province's forest already depleted. Therefore, when these most recent inventory data are presented here, it must be kept in mind that if these were compared to the naturally existing Acadian forest of the province prior to European settlement and logging, the loss in age diversity would be far more dramatic than what is presented here.

[5] Nova Scotia Department of Lands and Forests. 1958. The Forest Resources of Nova Scotia. Prepared by L.S. Hawboldt and R.M. Bulmer, p. 30.
[6] Dr. Fernow made observations about the Nova Scotia forest in 1910. His remarks are cited in Nova Scotia Department of Lands and Forests. 1958. The Forest Resources of Nova Scotia. Prepared by L.S. Hawboldt and R.M. Bulmer, p. 62.
[7] Ibid.
[8] Nova Scotia Department of Natural Resources. l997. Toward Sustainable Forestry, A Position Paper. Nova Scotia, pp. 1-8.
[9] 1981-1996 data are from the NSDNR, 1997, Toward Sustainable Forestry: A Position Paper. 1999-2006 data are from NSDNR Registry of Buyers Annual Reports. The Registry of Buyers was established in 1998.
[10] According to the 1997 NSDNR publication "Toward Sustainable Forestry," the provincial forest inventory maintained since the late 1950s is the basis for "making estimates of the volumes of major tree species groups growing in the forest. Coupled with other data, it is possible to make harvest level projections that the forest can support. This inventory produces quantitative measures for broad policy planning purposes. It compares favourably to similar programs in other jurisdictions." p. 4
[11] The 1958 inventory provided no data for the 0-20 age category.
[12] No 0 to 20 age class data were provided in 1958. The earliest data for this age class were reported in the 1965-1971forest inventory. These 1965-71 data were therefore used in the calculation for percentage increase.
[13] Personal communication with Ken Snow, Manager Forest Inventory, NSDNR. January 3, 2008.
[14] The NSDNR's Interim 1999 Old Forest Policy defines "old growth" as forests over 125 years of age.
[15] According to Ken Snow, Manager of Forest Inventory with the NSDNR, PSP data for age classes do exist going back to 1965, but have not been published. Mr Snow writes: "It would be a very interesting research project to calculate provincial age class distributions in five year periods from 1965-70 to 2003-08 when the 2008 field season is completed." Personal communication with Linda Pannozzo, November 21, 2007.
[16] Personal communications with Ken Snow, Manager, Forest Inventory, NSDNR. November 21 and December 13, 2007. Historical PSP age class data were not made available to GPI*Atlantic* for the purposes of such an analysis.
[17] For a more in-depth analysis of the conflict between the GIS age class data and the PSP age class data please refer to Section 6.3.1 of the GPI Forest Accounts, Volume 1, 2001.
[18] Nova Scotia Department of Natural Resources. 2004. Nova Scotia Forest Inventory Based on Permanent Sample Plots Measured Between 1999 and 2003. Report FOR 2004-3. NSDNR. Truro, p. 4.
[19] These do not add up to 100 because in 1998, 0.6% of the plots were categorized as "unevenaged." The 2003 PSP report did not estimate whether plots were "unevenaged."
[20] Ken Snow, Manager of Forest Inventory, NSDNR. Personal communication, November 26, 2007.
[21] NSDNR. 1999. Nova Scotia Wood Supply: Forecast for Nova Scotia, 1996-2070. Powerpoint Presentation. Cited in GPI Atlantic. Forest Accounts for Nova Scotia. Volume 1, p. 61. Available from http://www.gpiatlantic.org/pdf/forest/forest1.pdf. Accessed February 20, 2008.
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[24] Su, Q., D.A. MacLean, and T.D. Needham. 1996. The influence of hardwood content on balsam fir defoliation by spruce budworm. *Canadian Journal of Forest Research*. 26: 1620-1628. Cited in GPI Forest Accounts, 2001, Vol. 1, p. 70.
[25] NSDNR defines an "old growth" forest as any forest stand with a minimum of 30% crown closure, 50% or more of the basal area in climax species, and 30% or more of the stand's basal area 125 years old or older. NSDNR policy is to set aside 8% of crown land in each of the province's 38 EcoDistricts as old growth and old forest. Interim Old Forest Policy. Available from http://www.gov.ns.ca/natr/forestry/planresch/oldgrowth/policy.htm. Accessed November 29, 2007.
[26] While further investigation is required into the causes of the increase in number of known forest-dependent species at risk, it is possible that at least part of the explanation lies in factors such as increased research effort, new information arising from recent studies/surveys, and policy or definitional changes with regard to Species at Risk.

[27] Trout prefer cool water in summer months. Because studies indicate that high water temperatures caused by loss of forest canopy cover or shade (caused by clearcutting) can cause physiological stress and mortality to trout, it has been suggested that they are a forest-dwelling species. Please refer to the GPI Forest Accounts (Volume 1) for details.
[28] Species at Risk category definitions: Endangered: a species facing imminent extirpation or extinction; Threatened: a species likely to become endangered if limiting factors are not reversed; Vulnerable: a species of special concern because of characteristics that make it particularly sensitive to human activities or natural events; Extirpated: a species that no longer exists in the wild in the province but exists in the wild outside the province; Extinct: a species that no longer exists.
[29] Amanda Lavers writes: "In Nova Scotia, 69% of land is owned privately (NSDNR 2004). This provides a unique challenge for the conservation of rare species, particularly for those (such as nocturnal flying squirrels) that are not well-known among the public. The public must be engaged if forest harvest practices are to be modified for long-term wildlife conservation. The information campaign to solicit records of *G. volans* was a preliminary step in both public engagement and research about this species. Communication of research results and natural history details to the public should continue and a strategy to conserve flying squirrels should be developed in Nova Scotia." Personal communication, December 4, 2007.
[30] According to Mark Elderkin, the Species at Risk biologist with the NSDNR, all private landowners are also expected to "exercise some degree of due diligence to ensure their actions" do not negatively impact a species at risk including red- and yellow-listed species. Personal communication, December 20, 2007.
[31] Information about the forest-dependence of Odonata (dragonflies) was provided by Paul Brunelle, Research Associate of the New Brunswick Museum and Regional Coordinator of the Atlantic Dragonfly Inventory Program. Personal Communication, November 2, 2007.
[32] Personal communications with John Gilhen, December 7, 2007, and January 3, 2008.
[33] Audubon Society. 2007. State of the Birds. Common Birds in Decline. Available from http://stateofthebirds.audubon.org/cbid/ Accessed October 12, 2007.
[34] Sustainable forest management is not the whole answer. Even with the most careful harvesting techniques, there will be some level of impact on forest ecosystems. While there is a great difference between clearcutting and selection harvesting systems, they both involve the construction of roads and removal of biomass. Even the highest standards applied on a particular woodlot cannot guarantee the needed protection of critical forest values at the landscape level. Therefore, no matter how excellent forest operations may be, they are not a substitute for an adequate network of representative protected areas in Nova Scotia.
[35] The NSDNR also has a system of land classification called Ecological Land Classification (ELC), comprised of 8 ecoregions, 39 ecodistricts and 637 ecosections, further broken down into ecosites—all within the Acadian Forest Ecozone. This program is used as part of its Integrated Resource Management planning process, which is a multiple-use planning process for Provincial Crown lands. The Department of Environment's 80 "natural landscapes" are used for provincial protected area planning and management processes and for assessing the level of landscape representation with protected areas. According to Peter Neily, Forest Ecologist with the NSDNR, the landscape unit used by the Department of Environment and Labour is based on the "Natural History of Nova Scotia," while the NSDNR's ELC system is based on the biophysical land classification for Nova Scotia. Neily says the Natural Landscape system does not capture the variability and detail that the NSDNR's ELC system does. Personal communication, December 5, 2007.
[36] Nova Scotia Department of Environment and Labour. 2002. Natural Landscapes of Nova Scotia. Summary Descriptions. Protected Areas Branch. Available from http://www.gov.ns.ca/enla/protectedareas/docs/landscapes_report.pdf. Accessed November 30, 2007. p. 3.
[37] In 1989, the WWF started the Endangered Spaces Campaign in an effort to protect a network of all of Canada's terrestrial regions by the year 2000. While the WWF recommended 12% protection, it has been suggested by Department of Environment and Labour staff that this number is not scientifically defensible and should probably be much higher. (Dave MacKinnon, personal communication, 2001). In any case, in 2007-08, Nova Scotia still has a long way to go to reach the 12% minimum recommended by the WWF. Nova Scotia's 2007 Environmental Goals and Sustainable Prosperity Act commits the province to protect 12% of its land mass by the year 2015—more than 25 years after the original WWF campaign began.
[38] The recently announced designation of new areas (i.e., Ship Harbour Long Lake) will be significant enough to change the representation level of some landscapes, but they are not counted until the designations are actually in

place. Personal communication with Dave MacKinnon, Ecologist and Systems Planner with the Protected Areas Division, Department of Environment and Labour. December 19, 2007.
[39] Kaitlin Fahey, Office coordinator, Nova Scotia Nature Trust. Personal communication, October 17, 2007.
[40] Of the roughly 10,000 ha of land acquired from Bowater Mersey by the NSDNR and the Department of Environment and Labour, 11 areas will become nature reserves, 12 will be provincial park reserves, and 7 will become wilderness areas.
[41] Nova Scotia Department of Natural Resources. l997. Toward Sustainable Forestry, A Position Paper. Nova Scotia, pp. 1-8.
[42] Shelterwood cutting is defined as the removal of mature trees from a stand in two or more stages instead of all at once, as with a clearcut. In essence, however, shelterwood is a form of clearcutting, since it also generally results in the entire removal of a forest stand.
[43] Selection harvest methods mimic the non-catastrophic natural disturbance regimes of this region. Group selection, or patch cutting, for instance, mimics the natural process of an occasional large tree falling and taking out several others with it, thus opening up a larger gap in the canopy and opening up areas for light penetration. This encourages the regeneration of less shade-tolerant species such as white pine. In 2001, the GPI Forest Accounts (volume 2) reported on Windhorse Farm's use of selection cutting. In that case study, it was reported that the tallest trees in the canopy were never removed from a stand, even if dead. These trees increase canopy height and the structural diversity of a stand. Group selection can also be used to restore the diversity of a simplified woodlot in which a particular species is under-represented. For example, four or five trees may be removed from around a tree that is unable to regenerate in the shade of the existing canopy.
[44] Preliminary results from the first of a three phase public opinion survey conducted for the Nova Forest Alliance in 1999. According to NFA staff Kelly Dalling, "industry was not happy" with the results of the first telephone survey and as a result questions for the second and third phases of the survey would be vetted by industry representatives prior to use. Cited in *Clearcutting in Perspective.*2000. Nova Scotia Public Interest Research Group. Volume 8, p. 30. The final NFA report on survey results can be found at http://www.novaforestalliance.com/media/documents/publicperceptions.pdf. Accessed February 26, 2008.
[45] All dollar figures have been converted to 2007 constant dollars using the Bank of Canada Inflation Calculator, January 18, 2008.
[46] It is not possible to provide a time series for value-added wood products per volume of wood harvested by province because some value-added data have been suppressed "to protect confidentiality," according to Statistics Canada. It is GPI*Atlantic*'s position, as a public interest research institute, that data suppression to protect confidentiality must be balanced against the importance of making publicly available those data that reflect vital public interests—as these do—since the health of our renewable natural resources is essential for sustainability and the wellbeing of future generations.
[47] There is some anecdotal evidence that the success and size of the value-added wood sector in Manitoba is due to the presence of nearly 40 Hutterite Colonies, where craftsmanship in woodworking is a traditional and highly regarded skill and many colonies engage in the manufacturing of cabinets and furniture to support themselves. In addition, Winnipeg has successfully attracted highly skilled immigrants who are working in the value-added sector. Success of the value-added industry in Manitoba is likely also related to the provincial government support of the industry. Personal communication with Adrian Wilson, Marconi Campus, Nova Scotia Community College, March 3 and 19, 2008. Wilson referred to Manitoba as a "leader in Canada" in regards to value-added and recently travelled to Winnipeg to take a look at 4-5 value-added wood industries in operation.
[48] Manitoba Department of Conservation. 2006. Five Year Report on the Status of Forestry, April 2001 to March 2006. Available from http://www.gov.mb.ca/conservation/forestry/pdf/5year.pdf. Accessed February 26, 2008.
[49] British Columbia Ministry of Labour and Citizens' Services. 2003. *BC Stats: Value added wood production lagging behind in BC.* Available from http://www.bcstats.gov.bc.ca/releases/info2003/in0334.pdf. Accessed February 26, 2008.
[50] Ibid.
[51] Candace Christiano, Finewood Flooring and Lumber Limited. Personal communication, November 30, 2007.
[52] Bowater Inc. is headquartered in South Carolina and makes bleached market pulp and lumber products. It has 12 pulp and paper mills in the United States, Canada, and South Korea. In North America, it also operates one converting facility and owns 10 sawmills. Available from http://www.bowater.com/en/. Accessed January 18, 2008. Neenah Paper was part of Kimberly-Clark until late 2004, when it became a stand-alone company. It manufactures

and distributes a wide range of premium and specialty paper grades, and produces and sells bleached pulp, primarily for use in the manufacture of tissue and writing papers. Neenah Paper is based in Alpharetta, Georgia, and has manufacturing operations in Wisconsin, Michigan, Ontario, and Nova Scotia. Kimberly-Clark now focuses its operations on "health and hygiene" products. Neenah Paper, press release, March 23, 2005. Available from http://www.neenahpaperinc.com/pr/PR222304.aspx. Accessed January 18, 2008. According to a recent Securities and Exchange Commission filing by Neenah Paper Inc., the company plans to sell the Pictou mill and all its remaining woodland assets in Nova Scotia. According to the filing, the company committed to this plan in February 2008 and foresees the sale of the mill and woodlands to be complete within the next twelve months. To see Neenah's SEC filing please go to http://www.secinfo.com/d11MXs.tGSs.htm#1stPage.
In December 2007, Swedish-owned Stora Enso divested its North American paper operations to US company NewPage, a coated paper producer. Available from http://www.storaenso.com/CDAvgn/main/0,,1_EN-8861-18547-,00.html. Accessed January 4, 2008. The long-term future of the Port Hawkesbury operation in Nova Scotia and the impact this will have on employees is unclear. But for the time being, the plant remains in operation and NewPage announced on January 16, 2008, that the Port Hawkesbury newsprint and fine coated paper mills will not be among the facilities that will close as part of its US $265-million "synergies" plan. That cost-saving, restructuring plan closed several of its US facilities. ("NS paper mills dodge bullet as NewPage announces US closures," *The Canadian Press,* 16 January, 2008. Available from http://www.topix.com/ca/port-hawkesbury-ns/2008/01/n-s-paper-mills-dodge-bullet-as-newpage-announces-u-s-closures. Accessed February 24, 2008.)
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[54] Aktrin-Dossenbach Associates. 2003. Nova Scotia Value-Added Wood Products Industry. Sector Export Strategy Final Report. Prepared for ACOA, Enterprise Cape Breton Corporation, and Nova Scotia Community College, p. 4.
[55] Ibid., p. 26.
[56] Ibid., pp. 44-57.
[57] Ibid.
[58] "About WPG." Reference is from the Wood Products Group website at http://www.woodproductsgroup.com/wpg/about_wpg/about_default.aspx. Accessed March 22, 2008.
[59] Personal communication with Adrian Wilson, Wood Products Manufacturing Technology Program, Marconi Campus, NSCC. March 4, 2008. Wilson wrote the Request for Proposals that resulted in the 2003 Aktrin–Dossenbach Report on Nova Scotia Value-Added Wood Products Industry.
[60] NSDNR Registry of Buyers. 2007. Report on Primary Forest Products Acquired, Secondary Forest Products Produced and Wood Acquisition Plan Program. Available from http://www.gov.ns.ca/natr/forestry/registry/ann_report.htm. Accessed October 15, 2007.
[61] Labour Force Survey data provided to GPI*Atlantic* by Patrick Brannon, Research Analyst, Atlantic Provinces Economic Council, October 16, 2007.
[62] Candace Christiano, Finewood Flooring and Lumber Limited. Personal communication, November 30, 2007.

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Chapter 15: Air Quality
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[20] Under the Canadian Environmental Protection Act, a substance is "toxic" if it is entering or may enter the environment in a quantity or concentration or under conditions

(a) having or that may have an immediate or long-term harmful effect on the environment;
(b) constituting or that may constitute a danger to the environment on which human life depends; or
(c) constituting or that may constitute a danger in Canada to human life or health.

PM_{10}, and particularly $PM_{2.5}$, are considered to be entering the environment in a quantity or concentration or under conditions that constitute or may constitute a danger in Canada to human life or health.
[21] For statistics on salmon and brook trout declines in Nova Scotia, see *The GPI Water Quality Accounts,* available at www.gpiatlantic.org.
[22] Eutrophication, also known as nutrient enrichment, is the process of over-fertilization of a body of water by nutrients that produce more organic matter than the self-purification reactions can overcome. Eutrophication can be a natural process or it can be accelerated by an increase of nutrient loading to a water body by human activity.
[23] Greenhouse gases are those gases in the atmosphere, either naturally occurring, produced by humans, or both, that can absorb the longer wavelengths of radiation and trap heat within the atmosphere, thereby enhancing the "natural" greenhouse effect
[24] Each GHG is rated, by internationally accepted standards, according to its ability to trap solar heat, on a scale called the "global warming potential." In this scale, the warming potential of each gas is compared to the global warming potential of 1 kg of CO_2. For more information, see *The Greenhouse Gas Accounts for the Nova Scotia Genuine Progress Index* (Walker et al., 2001) available at www.gpiatlantic.org .

Chapter 16: Water Quality
[1] Nova Scotia Municipal/Provincial Joint Advisory Group. October 2006. Municipal Wastewater Effluent Newsletter. Primary treatment refers to more advanced wastewater treatment than secondary or tertiary treatment.
[2] Bill No. 146: Environmental Goals and Sustainable Prosperity Act. April 12, 2007. Available from: http://www.gov.ns.ca/legislature/legc/bills/60th_1st/1st_read/b146.htm. Accessed 17 December, 2008.
[3] Personal communication with David Briggins, Manager of Water and Wastewater Branch, Nova Scotia Environment, 22 October, 2008
[4] Canadian drinking water guidelines, recreational water quality guidelines, and guidelines for the protection of aquatic life and for agricultural water uses (irrigation and livestock water) can be found at:

http://www.ec.gc.ca/ceqg-rcqe/English/ceqg/water/default.cfm

[5] Turbidity is commonly measured in Nephelometric Turbidity Units (NTU). This measurement unit compares the light scattered by a sample to the light scattered by a reference solution.
[6] These water bodies are located throughout Nova Scotia. St. Mary's River is located on the east coast in Guysborough county. North East Margaree River is located in the northwest of the province in Inverness County, Cape Breton. Annapolis River is located on the southwest coast in Annapolis county. Pockwock Lake is located near the east coast in Halifax County. Tusket River is located at the south end of the province in Yarmouth County.

Chapter 17: Energy
[1] GPI*Atlantic,* 2005. *Nova Scotia Current Energy System Cannot Survive*. Press Release. Available from http://www.gpiatlantic.org/releases/pr_energy.htm. Accessed January 24, 2008.
[2] These indicators are based on 'total primary and secondary energy use, final demand', although in fact those numbers do not include all primary energy used in the Province but only primary and secondary energy used by end consumers (energy used by homes, businesses, and institutions). Primary energy refers to energy in the form of raw resources, such as wood, coal, oil, natural gas, uranium, wind, hydro power, and sunlight. Secondary energy refers to the more usable forms to which primary energy may be converted, such as electricity and gasoline. The term "energy use, final demand" as used by the National Energy Board (NEB) and Statistics Canada, however, does not include energy losses due to conversion of fuels to electricity, in-house energy consumption by refineries, and non-energy uses of petroleum products (e.g. in agriculture and plastics). Therefore this total does not express overall energy demand for the province. Total primary energy use data for Nova Scotia are suppressed by Statistics Canada for confidentiality reasons and are therefore not publicly available. As well, the available statistics exclude wood.
[3] Derived from CANSIM Tables 128-0002 (Statistics Canada, 2005) and 128-0009 (Statistics Canada, 2008).
[4] GPI*Atlantic Energy Accounts for the Nova Scotia Genuine Progress Index*, 2005a, p. 97.
[5] Available Statistics Canada data on energy consumption by source and fuel type were incomplete for Nova Scotia in 2006, and therefore 2005 data were used in this chapter to allow for a more complete comparative analysis.
[6] GPI*Atlantic Energy Accounts for the Nova Scotia Genuine Progress Index*, 2005a, p.97.
[7] GPI*Atlantic Energy Accounts for the Nova Scotia Genuine Progress Index*, 2005a, p.84.
[8] GPI*Atlantic Energy Accounts for the Nova Scotia Genuine Progress Index*, 2005a, p.85.
[9] Statistics Canada (2007b). *2005 Report on Energy Supply-Demand in Canada*. Catalogue no. 57-003-XIE. Available from http://www.statcan.ca/bsolc/english/bsolc?catno=57-003-XIE#formatdisp. Accessed January 3, 2008.
[10] Emera (2006). *Annual Financial Report 2006*. Available from http://www.emera.com/investors/AR/Emera06financial.pdf. Accessed January 24, 2008.
[11] GPI*Atlantic Energy Accounts for the Nova Scotia Genuine Progress Index*, 2005a.
[12] Government of Nova Scotia (2007). *Environmental Goals and Sustainable Prosperity Act*. Available from http://www.gov.ns.ca/legislature/legc/bills/60th_1st/3rd_read/b146.htm. Accessed January 23, 2008.
[13] GPI*Atlantic Energy Accounts for the Nova Scotia Genuine Progress Index*, 2005a.
[14] Per capita mercury emissions were derived from Environment Canada (2007a). *National Pollutant Release Inventory*. Available from http://www.ec.gc.ca/pdb/npri/npri_home_e.cfm. Accessed January 14, 2008, and from 2006 population estimates reported in CANSIM Table 051-0001 (Statistics Canada, 2007a).
[15] NSPI's share of mercury emissions derived from Environment Canada's *National Pollutant Release Inventory* (2007a).
[16] Per capita sulphur oxide emissions were derived from Environment Canada's *National Pollutant Release Inventory* (2007a), and from 2006 population estimates reported in CANSIM Table 051-0001 (Statistics Canada, 2007a).
[17] NSPI's share of sulphur oxide emissions is derived from Environment Canada's *National Pollutant Release Inventory* (2007a) and Environment Canada (2007b). 2005 Criteria Air Contaminants (CAC) Emissions Summaries. Available from http://www.ec.gc.ca/pdb/cac/cac_home_e.cfm. Accessed December 15, 2007.
[18] NSPI, 2008. Available from http://www.nspower.ca/environment/current_projects/electrostatic/index.shtml. Accessed October 1, 2008.
[19] GPI*Atlantic Energy Accounts for the Nova Scotia Genuine Progress Index*, 2005a.

[20] Hughes, L. (2007). *Energy Security in Nova Scotia*. Canadian Centre for Policy Alternatives. Available from http://policyalternatives.ca/documents/Nova_Scotia_Pubs/2007/ccpa_ns_energy_security.pdf. Accessed December 15, 2007.
[21] *Energy Security in Nova Scotia*, (Hughes, 2007).
[22] GPI*Atlantic Energy Accounts for the Nova Scotia Genuine Progress Index*, 2005a.
[23] *Energy Security in Nova Scotia*, (Hughes, 2007).
[24] See GPIAtlantic (2005a) for a detailed description of Dr. Tol's derivation of per tonne damage cost estimates for GHG emissions.

Chapter 19: Solid Waste
[1] CCME criteria require that diversion rates be based on the diversion of solid waste from landfills compared to the amount of waste sent to landfills in 1989.
[2] The Department has been through several name changes—from Nova Scotia Department of Environment to Nova Scotia Department of Environment and Labour and, most recently, back to Nova Scotia Environment. Throughout this chapter, the Department is referred to as Nova Scotia Department of Environment for the sake of consistency, regardless of the reference date of the particular citation.
[3] GPI*Atlantic* recognizes that it is difficult to attribute an exact dollar value to goods and services that traditionally do not have a market price. Therefore, assumptions and ranges are outlined for each of the costs and benefits addressed in the 2004 analysis of the Nova Scotia Solid Waste-Resource Management System. As a consequence, a range in net savings—from low-end, more conservative estimates to higher end estimates—is provided both here and in the original report. For example, estimates of the potential benefits of avoided greenhouse gas emissions and air pollutants differ widely in the literature, depending on different climate change models and estimates of pollution damages. Thus, higher end climate change cost estimates include more catastrophic scenarios resulting from higher rates of ice melt and positive feedback loops like permafrost melting than do more conservative models, while higher end pollutant damage estimates include the adverse effects of acid rain on lakes and forests rather than only more immediate impacts on human health alone. Estimates of potential benefits and savings from avoided emissions attributable to waste diversion from landfills will similarly vary depending on the models used. The range of potential benefits provided here reflects such different assumptions in the literature.
[4] A fiscal year runs from April 1-March 31. For example, fiscal year 2001 runs from April 1, 2000 to March 31, 2001 and fiscal year 1997 runs from April 1, 1996 to March 31, 1997.
[5] Walker, Sally, Ronald Colman, Jeffrey Wilson, Anne Monette, and Gay Harley. 2004. The Nova Scotia GPI Solid Waste-Resource Accounts. GPI Atlantic. Halifax, pp. iii-v.
[6] Ibid. p. viii.
[7] OECD. 1999. OECD Environmental Data Compendium, 1999. OECD Publications. Paris. Cited in Walker et al. 2004, p. 18.
[8] OECD. 2008. Key Environmental Indicators. OECD Environment Directorate. Paris. Available from http://www.oecd.org/dataoecd/20/40/37551205.pdf. Accessed August 7, 2008. Data values for the OECD countries were not available in this OECD publication, therefore a Canadian estimate is not provided here. Also, the OECD municipal solid waste figures for OECD countries do not include construction and demolition debris waste, and therefore the figures reported by the OECD would likely be much lower than those reported by Statistics Canada, which does include such waste in its estimates.
[9] Nova Scotia Department of Environment. 2008. Final Report on Nova Scotia's 1995 Solid Waste Resource Management Strategy. Available from http://www.gov.ns.ca/nse/waste/docs/SolidWasteStrategyFinalReport2008.pdf. Accessed August 5, 2008, p. 3.
[10] Bob Kenney. Solid waste-resource analyst. NS Department of Environment. Personal communication, October 15, 2008.
[11] Nova Scotia Department of Environment, 1999. Nova Scotia Solid Waste Resource Recovery Semi-Annual Report. Cited in Walker et al. (2004), pp. 26-27. Table 5 in the GPI Solid Waste-Resource Accounts provides detail and examples of wastes included and excluded from the CCME /Nova Scotia Department of Environment definitions of "solid waste."
[12] According to Bob Kenney, preliminary data for 2007-2008 indicates that the disposal rate continues to go down and composting and recycling rates continue to go up. In other words, the reversal in the upward trend continues. Kenney, personal communication, October 15, 2008.

[13] Data from Bob Kenney. Solid Waste-Resource Analyst. Nova Scotia Department of Environment. Personal communication, September 2, 2008. Nova Scotia is divided into seven Solid Waste-Resource Management Regions. The DOE receives data from two regions (HRM and the Valley) and the rest of the data comes from municipalities or groups of municipalities. These data are then used to calculate disposal and diversion rates for each region. Due to time constraints, it was not possible to include data from waste regions in this update. Future updates should include these data.
[14] Nova Scotia Department of Environment, 2008. Final Report on Nova Scotia's 1995 Solid Waste Resource Management Strategy. Available from http://www.gov.ns.ca/nse/waste/docs/SolidWasteStrategyFinalReport2008.pdf. Accessed August 5, 2008, p. 5.
[15] Ibid.
[16] While comparable per capita waste disposal data were unavailable for PEI, Bob Kenney, Solid Waste Resource Analyst, Nova Scotia Department of Environment, notes that PEI may actually have the lowest waste disposed per capita in the country (for residential and business) due to the program it has had in place for several years. Personal communication, August 19, 2008. In PEI, blue bags are used for recyclables, a green cart for compost and a black cart for waste. According to the Island Waste Management Corporation Web site, solid coloured bags or blue bags containing waste are never accepted for collection. Waste must be put in a black cart, where the contents are visible to the collector. If small shopping bags are used to take waste to the black cart, they cannot be tied closed. More information available from http://www.iwmc.pe.ca/waste.htm. Accessed October 6, 2008.
[17] Walker et al. (2004), p. 29. Original GDP data were in 1997 constant dollars. They have been converted to $2006 here for comparison purposes and to adjust for inflation.
[18] Expenditure-based GDP data for Nova Scotia are from Statistics Canada, CANSIM Table 384-0002. Available from http://www40.statcan.ca/l01/cst01/econ15.htm. Accessed August 18, 2008. Population data for Nova Scotia are from the Nova Scotia Department of Finance, Statistical Reviews for 2003 to 2007. Available from http://www.gov.ns.ca/finance/statistics/agency/publications/publications.asp?id=Pub21. Accessed August 18, 2008.
[19] Nova Scotia Department of Environment. 2008. Final Report on Nova Scotia's 1995 Solid Waste Resource Management Strategy. Available from http://www.gov.ns.ca/nse/waste/docs/SolidWasteStrategyFinalReport2008.pdf. Accessed August 5, 2008, p. 5.
[20] It should be noted that while comparable per capita waste disposal data were unavailable for PEI, it may actually have the lowest waste disposed per capita (for residential and business sector) due to the fact that this province has had a mandatory program in place for several years now where garbage is visible in loose or clear bags. Bob Kenney. Solid Waste Resource Analyst. Nova Scotia Department of Environment. Personal communication, August 19, 2008.
[21] Data were unavailable for Prince Edward Island and Nunavut.
[22] Statistics Canada and the CCME calculate diversion rates differently. Kenney, personal communication, October 15, 2008.
[23] CCME criteria require that diversion rates be based on the diversion of solid waste from landfills compared to the amount of waste sent to landfills in 1989 (the base year and the year in which the CCME set the 50% diversion target).
[24] The diversion rate is here defined, according to CCME criteria, as the estimated tonnes per capita of solid waste diverted from landfills (through composting, recycling, and reuse) in Nova Scotia, expressed as a percentage of waste disposed in 1989. Data provided by Bob Kenney. Solid Waste-Resource Analyst. Nova Scotia Department of Environment. Personal communication, September 2, 2008.
[25] Walker et al. (2004), p. 29.
[26] Walker et al. (2004), p. 30.
[27] Bob Kenney. Solid Waste-Resource Analyst. Nova Scotia Department of Environment. Personal communication, August 22, 2008.
[28] Ibid.
[29] In response to GPI*Atlantic*'s question on the difference between the diversion rates reported by Nova Scotia Environment and Statistics Canada, Bob Kenney, Solid Waste-Resource Analyst, Nova Scotia Department of Environment, wrote: "We do not add up the total tonnage of materials diverted—which is what Statistics Canada does. Our diversion number is calculated based on disposal numbers. Statistics Canada somehow gets a total tonnage of materials diverted from the business sector and adds it to the numbers we provide them from the residential side. They then put that number over the total tonnage generated (not disposed). I think this number is

very inconsistent between the provinces and is very likely why Statistics Canada will not be calculating that number in the future. They will only be focusing on disposal tonnages." In the same communication, Mr. Kenney also observes that Statistics Canada's disposal numbers are slightly different from those provided by Nova Scotia Environment, as also noted in the previous section above, and he remarks that Statistics Canada does not "provide enough detail for us to understand the differences." Kenney, Bob. Personal communication. 18 September, 2008.

[30] Statistics Canada. Waste Management Industry Survey. Cited in Statistics Canada. 2007. Envirostats. Volume 1, no. 1. Catalogue no. 16002-XIE. Available from http://www.statcan.ca/english/freepub/16-002-XIE/2007001/article/10174-en.htm. Accessed August 18, 2008.

[31] Nova Scotia Department of Environment (2008), p. 7. Leachate is the liquid formed when waste, and organic waste in particular, is exposed to water.

[32] Statistics Canada. 2007. Envirostats. Volume 1, no. 1. Catalogue no. 16002-XIE. Available from http://www.statcan.ca/english/freepub/16-002-XIE/2007001/article/10174-en.htm. Accessed August 18, 2008. These figures only include those who participate in a curbside pickup composting program and do not include residents who may be composting using a backyard composting system.

[33] For more detail on the Town of Bedford's 1995 *Residential Backyard Composting Promotional, Educational and Monitoring Program* please refer to Walker et al. (2004), pp. 59-60.

[34] Walker et al. (2004), p. 44.

[35] Statistics Canada. 2007. Envirostats. Volume 1, no. 1. Catalogue no. 16002-XIE. Available from http://www.statcan.ca/english/freepub/16-002-XIE/2007001/article/10174-en.htm. Accessed August 18, 2008. While Statistics Canada reports a 97% access rate for Nova Scotia (Figure 8), the Nova Scotia Department of Environment claims that 100% of Nova Scotia residents actually have access to curbside collection of recyclable materials. Nova Scotia Department of Environment. 2008. Final Report on Nova Scotia's 1995 Solid Waste Resource Management Strategy. Available from http://www.gov.ns.ca/nse/waste/docs/SolidWasteStrategyFinalReport2008.pdf. Accessed August 5, 2008, p. 8.

[36] Statistics Canada. 2007. Envirostats. Volume 1, no. 1. Catalogue no. 16002-XIE. Available from http://www.statcan.ca/english/freepub/16-002-XIE/2007001/article/10174-en.htm. Accessed August 18, 2008.

[37] Walker et al. (2004), p. 66.

[38] Likely less than 1/10th of 1% (0.1% of the waste stream). Kenney, Bob. Solid Waste-Resource Analyst. Nova Scotia Department of Environment. Personal communication, August 22, 2008.

[39] Kenney, Bob. Solid Waste-Resource Analyst. Nova Scotia Department of Environment. Personal communication, August 21, 2008.

[40] Alanna McPhee. Manager of Education, Resource Recovery Fund Board, Inc. Personal communication, August 21, 2008. The schedule of fees can be found on the RRFB web site at http://www.rrfb.com/pages/programs/HHWdis.cfm. Accessed August 2008.

[41] Nova Scotia Department of Environment. 2008. Final Report on Nova Scotia's 1995 Solid Waste Resource Management Strategy. Available from http://www.gov.ns.ca/nse/waste/docs/SolidWasteStrategyFinalReport2008.pdf. Accessed August 5, 2008, p. 7.

[42] Nova Scotia Department of Environment, "Nova Scotia's New Electronic Waste Regulations." Available from http://www.gov.ns.ca/nse/waste/ewaste.asp. Accessed 5 October, 2008.

[43] Nova Scotia Department of Environment. 1995. Nova Scotia Solid Waste-Resource Management Strategy. Available from http://www.gov.ns.ca/nse/waste/swrmstrategy.asp#stewardship. Accessed August 5, 2008.

[44] Nova Scotia Department of Environment (2008), p. 14.

[45] Walsh, Valda. Regional coordinator of the Nova Scotia Product Stewardship Working Group. Personal communication, October 15, 2008.

[46] Ibid.

[47] The NSPSWG document states that although it is listed as #6 in the "top 20 list" it "should not be targeted for socio-economic reasons."

Chapter 20: Ecological Footprint

[1] Because existing data do not allow commodity breakdowns according to place of origin, the calculated Footprint or productive area required for any particular commodity is the area of world average productive land for that commodity. In other words, a tomato grown in Spain has exactly the same (cropland) Footprint as one grown in California, since this is expressed in terms of world-average tomato growing cropland.

[2] Brundtland, G. H., 1987. *Our Common Future*, Report of the World Commission on Environment and Development, chaired by G. Brundtland, Oxford University Press, p.166.
[3] Sanjayan, M.A. and M.E. Soul. Moving Beyond Brundtland: The Conservation Value of British Columbia's 12 Percent Protected Area Strategy: A Preliminary Report. Available from http://archive.greenpeace.org/comms/97/forest/soule.html#drawbacks. Accessed 18 October, 2008.
[4] Dearden, Philip, and Jessica Dempsey, Protected Areas in Canada: Decade of Change. The Canadian Geographer, Vol. 48, 2004.
[5] See the accompanying chapter in this report updating GPI Atlantic's forest indicators.
[6] Province of Nova Scotia, Environmental Goals and Sustainable Prosperity Act, passed April 13, 2007. Available from http://www.iijcan.com/ns/laws/sta/2007c.7/20070717/whole.html. Accessed 18 October, 2008.
[7] On the implications of this biodiversity set-aside for Footprint calculations, see Wackernagel, Mathis, 2001. *What We Use and What We Have: Ecological Footprint and Ecological Capacity,* Redefining Progress. See the Redefining Progress Web site: www.rprogress.org/
[8] Sanjayan, M.A. and M.E. Soul. Moving Beyond Brundtland: The Conservation Value of British Columbia's 12 Percent Protected Area Strategy: A Preliminary Report. Available from http://archive.greenpeace.org/comms/97/forest/soule.html#drawbacks. Accessed 18 October, 2008.
[9] Ibid.
[10] In order not to exaggerate ecological scarcity, Mathis Wackernagel, in his original Ecological Footprint analysis followed the internationally accepted recommendation, deriving from the Brundtland Commission report, to set aside 12% of bioproductive area for biodiversity preservation. The *Living Planet Report 2000* set aside 10%, while conservative biologists recommend a minimum of 30%. It is now well accepted that the burden of this protection effort must be shared by all of humanity and not only by those regions of the world where biologically productive spaces remain relatively untouched by humans (Wackernagel, Mathis, 2001. *What We Use and What We Have: Ecological Footprint and Ecological Capacity,* Redefining Progress. See the Redefining Progress Web site: www.rprogress.org/). According to Anders Reed, GFN Associate (personal communication, October 20, 2008): "GFN no longer speci[fies] an area for other species, since there is a lack of consensus on how much this area should be."
[11] Myers, Ransom, and Boris Worm, Rapid worldwide depletion of predatory fish communities. *Nature* 423, 280-283 (15 May 2003). Available from http://www.nature.com/nature/journal/v423/n6937/full/nature01610.html. Accessed 18 October, 2008.
[12] There is growing recognition of the need to standardize sub-national Footprint application methods in order to increase their comparability across studies and over time. In response to this need, methods and approaches for calculating the Footprint of cities and regions are currently being aligned through the global Ecological Footprint Standards initiative. For more information on current Footprint standards and ongoing standardization initiatives, see http://www.footprintstandards.org.
[13] Global Footprint Network. National Footprints. Available from http://www.footprintnetwork.org/gfn_sub.php?content=national_footprints. Accessed September 23, 2008.
[14] A global hectare is defined in the *Living Planet Report* as a hectare with world-average ability to produce resources and absorb wastes. World Wildlife Fund, Zoological Society of London, and Global Footprint Network. 2008. Living Planet Report. Available from http://www.panda.org/news_facts/publications/living_planet_report/index.cfm. Accessed December 2008.
[15] Ibid, p. 2.
[16] United Nations Population Fund (UNFPA). The State of World Population 2001. Available from http://www.unfpa.org/swp/2001/english/ch01.html. Accessed 18 October, 2008.
[17] Myers, Norman, The new millennium: An ecology and an economy of hope. *Current Science.* Volume 78, no. 6. 25 March, 2000. Available from http://www.iisc.ernet.in/currsci/mar252000/generalarticles.pdf. Accessed 18 October, 2008.
[18] Mackenzie, Hugh, Hans Messinger, and Rick Smith. 2008. Size Matters. Canada's Ecological Footprint by Income. Canadian Centre for Policy Alternatives. Ottawa. p. 5. http://www.policyalternatives.ca/Reports/2008/06/ReportsStudies1910/. Accessed August 15, 2008.
[19] Ibid. p. 6.
[20] *Living Planet Report* (2006), pp. 14-15.

[21] This analysis was not done in the 2008 *Living Planet Report*, so we present it here from the previous WWF report. World Wildlife Fund, Zoological Society of London and Global Footprint Network. 2006. Living Planet Report, Table 2. Available from http://www.panda.org/news_facts/publications/living_planet_report/linving_planet_report_timeline/lp_2006/index.cfm. Accessed December 2008.

[22] The 70% estimate is an approximation derived from the 2002 *Living Planet Report* and is demonstrated graphically in Figure 4 of Monette, Anne et al., *The Prince Edward Island Ecological Footprint,* GPI Atlantic. Halifax. September, 2003. Based on those data, it was apparent that roughly 69% of the world's population was living within the per capita available biological capacity of the planet, while just over 30% exceeded that biocapacity. Time and resources did not permit a recalculation of these percentages based on the 2006 *Living Planet Report.*

[23] Wackernagel, Mathis (1998), "The Ecological Footprint of Santiago de Chile," *Local Environment*, 3(2), p. 16. Chambers et al. (2000) also support this approach: "Where specific data about a city are not known then its Footprint can be estimated by apportioning the per capita impact" (p.135). Despite excellent work by Statistics Canada on inter-provincial trade flows, uncertainties in the data still do not permit accurate estimates of provincial imports and exports of the more than 1,300 categories of traded goods considered in the compound approach to national Ecological Footprint calculations.

[24] Global Footprint Network. National Footprints. Available from http://www.footprintnetwork.org/gfn_sub.php?content=national_footprints. Accessed September 23, 2008.

[25] The City of Calgary. 2008. Toward a Preferred Future. Understanding Calgary's Ecological Footprint. Available from http://www.calgary.ca/docgallery/bu/environmental_management/ecological_footprint/towards_preferred_future.pdf. Accessed September 22, 2008.

[26] Ibid. p. 4.

[27] Ibid. p. 13.

[28] Ibid. p. 22.

[29] Anders Reed, Associate, Global Footprint Network. Personal communication, 14 October 2008.

[30] Data from Bob Kenney. Solid Waste Resource Analyst. NS Department of Environment and Labour. Personal communication, September 2, 2008.

[31] 1996-2002 GDP data are reproduced here from Walker, Sally et al. 2004. The GPI Solid Waste-Resource Management Accounts. GPI Atlantic. Halifax. Available from http://www.gpiatlantic.org/pdf/solidwaste/solidwaste.pdf. Accessed August 18, 2008. Original GDP data cited in that report were reported in 1997 constant dollars, and have been converted here to $2006 for comparison purposes. For 2003-2006, expenditure-based GDP data for Nova Scotia are from Statistics Canada, CANSIM Table 384-0002. Available from http://www40.statcan.ca/l01/cst01/econ15.htm. Accessed August 18, 2008. Population data for Nova Scotia used to assess per capita GDP are from the Nova Scotia Department of Finance, Statistical Reviews for 2003 to 2007. Available from http://www.gov.ns.ca/finance/statistics/agency/publications/publications.asp?id=Pub21. Accessed August 18, 2008.

[32] Nova Scotia Department of Environment. 2008. Final Report on Nova Scotia's 1995 Solid Waste Resource Management Strategy. Available from http://www.gov.ns.ca/nse/waste/docs/SolidWasteStrategyFinalReport2008.pdf. Accessed August 5, 2008, p. 5.

[33] It should be noted that while data were unavailable for Prince Edward Island, that province may actually have the lowest waste disposed per capita in the country, due to the fact that PEI has had a clear bag program in place for several years that allows better monitoring and enforcement. Bob Kenney. Solid Waste Resource Analyst. Nova Scotia Department of Environment. Personal communication, August 19, 2008.

[34] Data were unavailable for PEI and Nunavut.

[35] The data in this section are primarily from Lipp, Judith and Seth Cain. 2005. The Energy Accounts for the Nova Scotia Genuine Progress Index, Halifax, p. 28. Available from http://www.gpiatlantic.org, and from the energy chapter update in this report.

[36] In 2003, the electricity *fuel mix* in Nova Scotia was dominated by coal (75%); oil (12%); hydro (including tidal power) and wind (9%). Lipp, Judith and Seth Cain. 2005. The Energy Accounts for the Nova Scotia Genuine Progress Index, Halifax, p. 28. Available from http://www.gpiatlantic.org. In 2006 80.4% of Nova Scotia's electricity generation was from coal, representing coal's highest share of the fuel mix since 1993.

[37] Industry Canada. Hydropower in Canada. Ottawa. June, 2008. Available from http://www.ic.gc.ca/epic/site/rei-ier.nsf/en/h_nz00010e.html. Accessed 19 October, 2008.
[38] Environment Canada. Forum on Hydropower. Gatineau, Quebec. October 28, 2005. Speaking notes for Stephane Dion. Available from http://www.ec.gc.ca/media_archive/minister/speeches/2005/051028_s_e.htm. Accessed 19 October, 2008.
[39] The data in this section are primarily from the transportation chapter in this report and from Savelson, Aviva, et al. 2006. The GPI Transportation Accounts: Sustainable Transportation in Nova Scotia. GPI Atlantic. Halifax. Available from http://www.gpiatlantic.org/pdf/transportation/transportation.pdf.
[40] Statistics Canada, Commuting Patterns and Places of Work of Canadians, 2006 Census: Data tables, figures and maps. Available from http://www12.statcan.ca/english/census06/analysis/pow/tables.cfm. Accessed 19 October, 2008.
[41] Organization for Economic Co-operation and Development. OECD Environmental Data—Compendium 2002, Tables 8.5 and 12.1A.
[42] World Wildlife Fund, Zoological Society of London and Global Footprint Network. 2006. Living Planet Report, p. 2. Available from http://www.panda.org/news_facts/publications/living_planet_report/index.cfm. Accessed September 19, 2008.
[43] Biological capacity or biocapacity is defined as the capacity of ecosystems to produce useful biological materials and to absorb waste materials generated by humans, using current management schemes and extraction technologies. Global Footprint Network. Footprint Term Glossary. Available from http://www.footprintnetwork.org/gfn_sub.php?content=glossary. Accessed September 20, 2008.
[44] Living Planet Report (2006), p. 2.
[45] Ibid. pp. 20-21.
[46] Ibid, p. 22.
[47] Ibid.
[48] In the Living Planet Report, GFN only lists four of the seven major shifts required. For more information on the other three shifts please refer to Pacala, S and Socolow, R. 2004. Stabilization wedges: solving the climate problem for the next 50 years with current technologies. Science 305: 968-972.
[49] Living Planet Report (2006), p. 23.
[50] Ibid.
[51] Ibid, p. 24.
[52] Ibid, p. 25.
[53] Figures are based on most recent 2008 data. Calculations by Anders Reed, Global Footprint Network Associate. Personal communication, October 23, 2008.
[54] Ibid.

Chapter 21: Greenhouse Gas Emissions
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