GPI Atlantic

Genuine Progress Index for Atlantic Canada / Indice de progrès véritable - Atlantique

MEASURING SUSTAINABLE DEVELOPMENT

APPLICATION OF THE GENUINE PROGRESS INDEX TO ATLANTIC CANADA

THE PRINCE EDWARD ISLAND ECOLOGICAL FOOTPRINT

Prepared for the Province of Prince Edward Island

by
Anne Monette, MES
Ronald Colman, Ph.D
Jeffrey Wilson, BES

September 2003

EXECUTIVE SUMMARY

Small Province, Big Feet: Prince Edward Island's Ecological Footprint

Development that is "sustainable" requires that:

1) we do not consume more resources than the planet can provide, and that we do not produce more waste than the planet can assimilate;
2) we live in such a way that we meet the needs of the present without compromising the ability of future generations to meet their needs; and
3) we do not consume resources at the expense of others' basic survival and livelihood.

In other words, "sustainable development" requires that we live responsibly and with awareness, so as not to deplete our natural wealth and leave a poorer world for our children and others to inherit.

Measurements of sustainable development generally look at the "supply" side of the equation – whether we are harvesting our fish, logging our forests, and growing our food in sustainable ways. But such measurements put the whole onus for sustainable development on the producer. The "ecological footprint" looks at the "demand" side of the equation and places the responsibility for sustainable development equally on the consumer. The Nova Scotia Genuine Progress Index, a pilot project for Canada that includes 22 environmental, social and economic components, measures sustainable development in both these ways.

How we eat, shop, travel, use energy and build our houses directly affects the environment. Almost everything we do consumes natural resources and produces waste. Our ecological footprint is the amount of space we take up, or the amount of land and sea area it takes to meet our current levels of consumption. It tells us what impact our consumption patterns have on the environment and whether we are exceeding the capacity of the environment to satisfy our wants.

The world has a limited supply of productive land for growing food and timber, limited supplies of fish, finite quantities of oil, gas, metals and other non-renewable resources, and a limited capacity to absorb waste. If we overload the earth's capacities, or use up resources faster than they can replenish themselves, then the natural systems that support life on earth break down.

Living Beyond our Means

Scientists tell us that if we want to survive, we can't use all the world's productive land entirely for our own needs, and they suggest that at least 30% of land needs protection. World leaders have committed to set aside just 12% of our land to protect the millions of other species on the planet, on whom our survival ultimately depends. If we set aside that 12% to protect biodiversity, and divide the remaining 88% of biologically productive area by the current world population, then we have 1.7 hectares (ha) per person to supply all our human needs and assimilate all our waste.

Researchers at Redefining Progress have found that our global resource consumption and waste production required 2.28 hectares per person in 1999. That is the *average* "ecological footprint" of a human being in the world today. In other words, human beings are in a state of "overshoot," depleting resources faster than they can regenerate and producing more waste than the world can handle.

This is like living in debt, with a gradually accumulating ecological deficit. Just as the present generation is paying for over-spending in the 1970s and 1980s with reduced government services, so future generations will inherit the ecological debt of current ecological overshoot. We may have already begun to see its effects in the collapse of Atlantic ground-fish stocks, global climate change, higher child asthma rates, and new environmental illnesses.

But all ecological footprints are not the same size. Thirty-two percent of the world's population consumes 70% of the world's resources, and produces 70% of the world's waste. The average African ecological footprint was just 1.36 ha per person in 1999, and the average North American footprint was 9.61 ha per person in 1999. The richest one-fifth of the world's people consumes 45% of all meat and fish, 58% of all energy and 84% of all paper, and it owns 87% of all cars. The poorest one-fifth consumes just 5% of all meat and fish, less than 4% of energy, 1.1% of paper, and less than 1% of all cars.

This GPI*Atlantic* report has found that Prince Edward Island's average ecological footprint in 1999 was 8.98 ha per person, far in excess of the 1.7 ha per person globally available. If all the world's people were to consume at PEI levels, we would need almost five planets earth to provide the necessary resources and waste assimilation capacity. Ecological footprint analysis therefore makes it clear that global ecological sustainability depends on the affluent reducing their present share of consumption so that those in poverty can meet their basic human needs.

Of this 8.98 ha/capita, energy consumption accounts for 4.29 ha/capita, food for 3.49 ha/capita, and all other consumption for the remaining 1.2 ha/capita. Energy and food consumption together account for 7.78 hectares per person or 87% of the average Prince Edward Islander's ecological footprint. It is within these two areas that Prince Edward Islanders can make the greatest reductions in their personal footprint and help lead Prince Edward Island toward a healthy, sustainable future. These two areas should also be the primary focus of social and economic policy attention to guide Prince Edward Island toward sustainable transportation, land use and consumption patterns.

Just as global ecological footprints differ, not all PEI ecological footprints are the same size. Charlottetown-Summerside residents have an average footprint of 8.30 ha per person, and the wealthiest 20% of Prince Edward Islanders have a footprint of 11.4 ha per person (compared to 7.63 ha per person for the poorest 20%), because the wealthy consume more resources and produce more waste.

The PEI ecological footprint has grown by 65% in the last 20 years, and is projected to increase by another 20% to 10.8 ha per person in the next 20 years. PEI's transportation footprint is expected to increase by 24% in the next 20 years, as more cars log more kilometres. The increase in fuel-inefficient SUVs, minivans and light trucks has expanded the transportation footprint sharply, with one SUV averaging three times the impact on the environment of a small car.

Conventionally, gross domestic product (GDP) *growth* is taken as the primary indicator of how "well off" we are as a society, with a higher per capita GDP denoting higher consumption levels and greater wellbeing. From the GPI perspective, on the other hand, a *smaller* ecological footprint denotes less impact on the environment and correspondingly greater long-term wellbeing and sustainability. The GDP and the ecological footprint, however, are not simply *separate* indicator sets pointing towards contrasting assessment and measurement systems. Economic growth is the primary driver of ecological footprint growth, because it generally denotes higher consumption levels.

Not surprisingly, the Canadian and Prince Edward Island per capita ecological footprints have largely followed per capita GDP growth since the late 1980s, with both inclining upwards through the 1990s. In conventional terms it is almost heresy to suggest that this growth is not inherently a "good" thing. Ecological footprint analysis, however, suggests that the more complex relationship between economic growth, increased consumption, environmental degradation, waste production, and the rate of resource depletion must at least be considered if as much value is placed on the wellbeing of future generations as is placed on the current generation.

Reducing Prince Edward Island's Ecological Footprint: A Quarter Million Hectare Target for 2005

This report, Canada's third provincial ecological footprint analysis, concludes that Prince Edward Islanders could quickly and easily reduce their collective ecological footprint by almost one quarter of a million hectares from 8.98 ha per person to 7 ha per person without compromising their quality of life. Consuming fewer of some items, shifting certain consumption choices, and changing public policy priorities can actually improve wellbeing and quality of life while reducing our impact on the environment.

There are a number of practical choices available to households that could significantly reduce the province's residential energy footprint. Indeed, household energy consumption choices are one of the simplest ways that ordinary citizens can reduce their ecological footprint *and* save money. A few intelligent energy choices can reduce household energy consumption by 50% and save significantly on household energy costs:

- Switch to a time based-programmable thermostat and turn down the thermostat at night to 17 degrees
- Switch to halogen bulbs or compact fluorescent bulbs
- Install a low flow shower head
- Switch to energy efficient appliances
- Add an insulating blanket to hot water heater
- Clean furnace filter regularly

Changes to driving style and driver education can significantly reduce the footprint of transportation, as well as bringing overall fuel economy savings. Strategies to greener driving include:

- Service vehicles regularly
- Avoid idling
- Accelerate and brake smoothly
- Use the correct gears for the speed
- Do not carry unnecessary weight
- Check tire pressure regularly
- Use air conditioning less frequently
- Use a timer that will turn on the block heater just before driving

Commuting to work is a major contributor to transportation footprint. **Commuting alone by car contributes 12 times more than cycling and over 4 times more than taking the bus to ecological footprint**. Commuting footprint can be reduced by car-pooling, taking the bus, or cycling – one, three, or five days per week. Rethinking how we travel to and from work can dramatically reduce our commuting footprint. For example, a small change like car-pooling with one other person results in a 50% reduction in our commuting footprint. Cycling to work and back every day instead of driving alone corresponds to a 92% reduction in the impact of our commuting habits on the environment.

Intelligent choices can be made that will substantially reduce food footprint and the impact of food consumption patterns on the environment. In particular, Islanders can:

- Maintain a healthy weight, reduce the tendency to overeat, and not waste food
- Eat the amount of daily calories that are appropriate for one's age and level of activity
- Eat locally produced foods and support local farmers, thus reducing high transportation and energy inputs into the food system
- Eat organically grown and sustainably farmed foods, thus reducing footprint-intensive energy and synthetic, petroleum-based inputs into agriculture.

Beyond such individual choices, this report also points to the social and political decisions that are necessary to reduce the province's ecological footprint to *less* than 7 ha per person, and to become a model of responsible and sustainable living. These social choices include:

- Investments in public transportation and bicycle lanes
- Integrated land use/transportation planning to counter suburban sprawl
- Tax incentives to support environmentally friendly Danish-style co-housing developments
- Support for local agriculture, sustainable farming methods, and nutritional education

Prince Edward Islanders have already dramatically reduced their solid waste footprint by 50%, and Prince Edward Island's world leadership in composting, recycling and solid waste diversion is a model of government-citizen cooperation that can show a sustainable way forward into the future. The Premiers' Conference and Tree Canada organized the first "carbon neutral" conference in PEI in 2003. This innovative plan offset the carbon dioxide emissions created by the delegates attending the conference by calculating and planting the number of trees needed to absorb those emissions. Clearly, footprint reductions are not only possible but have already been successfully accomplished in PEI.

The average Prince Edward Islander's total ecological footprint (8.98 ha/person in 1999) was 7% smaller than the size of the average American's footprint (9.7 ha/person), but it was still 1.8 times the average West European's footprint (4.97 ha/person), indicating that we might more productively look to Europe and elsewhere for workable models of sustainable development rather than to the U.S. Denmark, for example, has become a world leader in wind energy; the Netherlands is actively promoting bicycle use and pesticide-free farming; BMW cars are now made with 35% recycled parts; and Curitiba, Brazil, has become a world leader in integrated land use/transportation planning and mass transit use.

In sum, for a PEI determined to reduce its ecological footprint, there is no shortage of outstanding examples of sustainable living and development, including powerful ones within its own borders. The purpose of this Ecological Footprint analysis is to encourage concrete public-private steps toward a more sustainable future that we are proud to leave to future generations.

ACKNOWLEDGEMENTS

This Ecological Footprint analysis is built on the work of William Rees at the University of British Columbia and Mathis Wackernagel at Redefining Progress. The authors would like to acknowledge William Rees and Mathis Wackernagel for their extraordinary insight, understanding and research in developing the Ecological Footprint concept as a remarkable tool to gauge the sustainability of human consumption patterns. The authors and **GPI***Atlantic* deeply appreciate the advice and assistance of Mathis Wackernagel and Chad Monfreda, of Redefining Progress, in developing and updating the assessment methodologies used in this report.

Several people provided support for this project by supplying important reports and data. The authors appreciate the contributions of Sara Campbell Mates, World Wildlife Fund Canada; Karen Guilbault, Agriculture and Agri-Food Canada; Colin Dodds and Jennifer Scott, **GPI***Atlantic*; and Diane Griffin, PEI Department of Fisheries, Aquaculture and Environment.

Inspiration for the Nova Scotia Genuine Progress Index came from the ground-breaking work of Redefining Progress, which produced the first GPI in the U.S. in 1995. Although **GPI***Atlantic*'s methods differ in many ways, particularly in not aggregating index components for a single bottom line, we share with the original GPI the attempt to build a more comprehensive and accurate measure of wellbeing than can be provided by market statistics alone. **GPI***Atlantic* also gratefully acknowledges the pioneers in the field of natural resource accounting and integrated environmental-economic accounting on whose work this study and the GPI natural resource accounts build.

This report was prepared for the Province of Prince Edward Island with funding assistance from the National Round Table on the Environment and the Economy. The views expressed in this report are those of the authors and do not necessarily represent the views of the Government of Prince Edward Island, or the National Round Table. All analysis, interpretations and viewpoints expressed, as well as any errors or misinterpretations, are the sole responsibility of the authors and ***GPI***Atlantic*. While the authors have made every effort to provide accurate Internet addresses at the time of publication, neither* ***GPI***Atlantic *nor the authors assume any responsibility for errors or changes that occur after publication.*

Copies of this report and other **GPI***Atlantic* publications may be obtained through the GPI web site at www.gpiatlantic.org. For those interested in supporting the work of **GPI***Atlantic*, please see the membership information on this web site. The *GPI News* is also available on the web site, and contains updates on **GPI***Atlantic* activities, work in progress, latest results, and useful statistics on social, environmental and economic realities.

TABLE OF CONTENTS

Part I – Introduction

Part II – Ecological Footprint – The Global Context

Part III – The Prince Edward Island Ecological Footprint

Part IV – Reducing Prince Edward Island's Ecological Footprint

LIST OF TABLES

LIST OF FIGURES

PART I
INTRODUCTION

THE PRINCE EDWARD ISLAND ECOLOGICAL FOOTPRINT

1. The Ecological Footprint and the Genuine Progress Index

Ecological Footprint analysis is one of the core components of the Genuine Progress Index (GPI), a new measure that can provide more accurate and comprehensive information on wellbeing and sustainable development than current measures that are based on economic growth rates and related market statistics. **GPI***Atlantic* is currently constructing such an index of sustainable development for Nova Scotia, as a pilot project for Canada.

Conventionally, economists, politicians and journalists measure progress according to how fast the Gross Domestic Product (GDP) is growing. The GDP simply measures the total market value of goods and services produced, and the total amount of consumer spending. But measuring wellbeing and progress in this way sends very misleading signals to policy makers and the general public. The GDP counts the depletion of our natural resource wealth as economic gain, because it measures only the market value of our resources once they are harvested. The more fossil fuels we burn, the more trees we cut down, the more fish we sell, and the more rapidly we deplete our resources, the faster the economy will grow, which, in turn, is interpreted as a sign of wellbeing and progress.

The GDP also does not care *what* is growing: more crime, sickness, pollution, accidents and natural disasters all make the economy grow. And the GDP ignores anything that doesn't have a price tag – such as volunteer work, unpaid household work, free time, and vital life-supporting services provided free by nature. The GDP can grow even as inequality and poverty grow. In short, the GDP and related economic growth statistics are incapable of telling us how "well off" we are, let alone whether our development is sustainable, and its architects never intended it as a measure of wellbeing and progress, as it is used today.

By contrast, the Genuine Progress Index attempts to account for our social, environmental *and* economic health. Its 22 components include natural resource accounts, time use variables (including the value of unpaid work and free time), and indicators of health, educational attainment, livelihood security, equity and environmental quality.[1] It also counts liabilities such as crime, pollution, greenhouse gas emissions, sickness and accidents as costs, rather than gains to the economy.

Unlike the GDP, which measures only current income and spending regardless of its consequences, the GPI takes a long-term perspective and assesses whether we are leaving the

[1] The 22 components of the Nova Scotia GPI are listed in Appendix B of this report.

world a better place for our children as well as ourselves. Therefore, it is called an index of *sustainable* development because it assesses whether current production and consumption patterns can be *sustained* over time without depleting our wealth (our natural, social and produced capital) and without denying a decent standard of living to our children and to others in the world.

Ecological Footprint analysis is one of the most essential elements of the GPI, for four basic reasons:

- It assesses the *demand* side of the sustainable development equation as well as the supply side, and places the onus for sustainability on the *consumer* as well as on the producer.
- It challenges fundamentally the economic growth paradigm and the assumption that "more" is necessarily "better." In the GPI, a *smaller* footprint is a sign of genuine progress.
- It links environmental sustainability clearly and directly with social justice and equity.
- It links local consumption patterns with global consequences.

Let us briefly examine each of these functions in turn.

Onus for sustainability

Most measures of sustainable development implicitly place the onus of change on the producer rather than the consumer. Natural resource accounts, for example, assess whether timber, fish, agricultural products and other resources are being harvested sustainably, and they may recommend more sustainable harvesting methods (e.g. selection logging, restrictions on dragnet trawling, and shifts to organic farming) which require changes in production techniques. But few measures place the onus for sustainability directly on the shoulders of the consumer. Because it addresses the *demand* side of the sustainability equation and assesses the environmental impacts of our *consumption* patterns, the ecological footprint is an essential complement to other GPI components that focus on the *supply* side of sustainable development.

Economic growth paradigm

Conventional measures of progress based on the GDP and related economic growth statistics implicitly assume that "more" is "better." The more economic activity there is, and the more money people spend, the "healthier" and more "robust" our economy is said to be, and the "better off" we are assumed to be. When sales go up, economic experts and journalists pronounce that "consumer confidence is strong." When sales go down, that confidence is said to be "weak," and the slowdown spells trouble. The language we use daily reflects the implicit assumption that "growth" equates to "health" and "wellbeing."

The GPI challenges that core assumption directly, and contains several components in which "less" is frequently "better," and a more accurate signal of societal wellbeing. As noted above, more crime, more pollution, more sickness and accidents, more greenhouse gas emissions and natural disasters all make the economy grow simply because more money is being spent on prisons, police, hospitals, pollution cleanup and other regrettable expenditures. The prison industry is one of the fastest growing sectors of the U.S. economy, contributing $42 billion a year to the U.S. GDP. The *Exxon Valdez* contributed more to the Alaska GDP by spilling its oil than if it had delivered its oil safely to port.

By contrast, *less* crime, pollution, sickness, accidents and greenhouse gas emissions are signs of genuine progress and wellbeing in the GPI. This is common-sense economics, but it challenges our current reliance on economic growth statistics to assess societal wellbeing.

Ecological Footprint analysis clearly illustrates the point that "less" is sometimes "better." A sustainable ecological footprint, which is significantly *smaller* than the current ecological footprint of Prince Edward Islanders and Canadians, is a sign of genuine progress because it indicates that we are having *less* impact on the environment and preserving the health of our natural wealth more successfully for the benefit of future generations. The large current footprint of Prince Edward Islanders and Canadians indicates quite simply that we are living beyond our means, and that the Earth cannot indefinitely sustain our current consumption habits.

Scientists have noted that the natural world thrives on equilibrium and balance and rests firmly on inherent *limits* to growth. The only biological organisms that thrive on unlimited growth – cancer cells – are inherently destructive. This is an apt metaphor and warning for a human economic paradigm that remains wedded to a doctrine of limitless growth.[2]

The ecological footprint assessment is a tool devised by University of British Columbia scientists William Rees and Mathis Wackernagel to quantify the environmental impact of consumption patterns and to document the current ecological "overshoot" created by excess consumption in the industrialized world.

Although not part of the original U.S. GPI produced by Redefining Progress in California, an ecological footprint analysis is included in the GPI being developed for Nova Scotia, as the most direct and comprehensive challenge to the industrial and economic paradigm on which current measures of wellbeing and progress are based.

Environmental sustainability, social justice and equity

The basic principle linking and integrating the components of new measures of progress and wellbeing is the view of "sustainable development," which reflects a concern (a) to live within the limits of the world's and the community's resources and (b) to ensure the long-term prosperity and wellbeing of present and future generations.

Unlike measures of wellbeing based on economic growth, which implicitly assume that a rising tide lifts all boats, sustainable development measures acknowledge that there is no such thing as an indefinitely rising tide and that the metaphor seriously distorts nature's processes. Measures

[2] For one of the most thorough and systematic critiques of the economic growth paradigm, see Daly, Herman, *Beyond Growth,* Beacon Press, Boston, 1996.

based on a recognition of *limited* resources therefore acknowledge that societal wellbeing is a *distributional* issue and that poverty will not be solved simply by producing *more* goods and services.

Unlike the GDP, which can grow despite increasing inequity and poverty, the GPI goes up when equity increases and when poverty is reduced. Ecological Footprint analysis, by explicitly recognizing the relationship between income, consumption and environmental impact, links environmental sustainability to social equity more clearly and directly than any other component of the GPI.

That understanding is firmly rooted in accepted definitions of sustainable development. Both inter-generational and intra-generational equity are cited as specific characteristics of sustainability in the Brundtland Commission's seminal definition of sustainable development:

> "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs... But physical sustainability cannot be secured unless development policies pay attention to such considerations as changes in access to resources and in the distribution of costs and benefits. Even the narrow notion of physical sustainability implies a concern for social equity between generations, a concern that must logically be extended to equity within each generation."[3]

Statistics Canada notes that, from this definition,

> "A consensus has emerged that sustainable development refers at once to economic, social and environmental needs... A clear social objective that falls out of the definition (of sustainable development) is that of equity, both among members of the present generation and between the present and future generations... It is clear that the spirit of sustainable development implies that all people have the right to a healthy, productive environment and the economic and social benefits that come with it."[4]

The power of the ecological footprint is, therefore, that it explicitly links environmental sustainability and social justice, not as a matter of ethics 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, then their impact on the environment is 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 to exceed the Earth's physical carrying capacity. Conversely, greater equity and a reduction in poverty require that excess consumption be curbed. In sum, ecological footprint analysis cuts through the

[3] World Commission on Environment and Development (Brundtland Commission), 1987. *Our Common Future,* Oxford University Press, New York.
[4] Statistics Canada, 1997, *Econnections: Linking the Environment and the Economy: Concepts, Sources and Methods of the Canadian System of Environmental and Resource Accounts*, catalogue no. 16-505-GPE, Ottawa.

illusion that we can improve the living standards of the poor without also examining closely the consumption patterns of the rich.

Local consumption – global consequences

Finally, most components of the GPI, including the natural resource accounts, assess local impacts of local practices. However, the reality of an interdependent world and a global economy is that local behaviour has global impacts, and that distant events affect PEI. Local greenhouse gas emissions, for example, have an impact on global warming that may produce flooding in Bangladesh; and the destruction of the Amazon rainforest will affect the climate of Canada.

A particular contribution of the Ecological Footprint analysis, therefore, is its recognition that local consumption practices may involve natural resource depletion far away. Wackernagel and Rees recognize that we may indulge unsustainably high levels of consumption in North America, perhaps even without depleting local resources, but rather by "appropriating the carrying capacity" of other countries through trade. The global perspective of the Ecological Footprint approach is an important reminder that, ultimately, provincial and national "genuine progress" cannot be assessed in isolation from our impact on the world.

For all these reasons, the Ecological Footprint is an essential complement to the GPI natural resource accounts, and a central component of the Genuine Progress Index. For more details on the purposes, principles and framework of the Genuine Progress Index, please see the Appendix A and B of this report or visit the **GPI***Atlantic* web site at www.gpiatlantic.org.

2. What the Ecological Footprint Measures

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 measure 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. This study is the third provincial ecological footprint analysis undertaken in Canada. Provincial ecological footprint analyses have been completed for Nova Scotia and Alberta.[5, 6]

---

[5] Wilson, J., R. Colman and A. Monette (2001). *The Nova Scotia Ecological Footprint*. **GPI***Atlantic*, Halifax, NS. *The Nova Scotia Ecological Footprint* details the environmental impact of consumption patterns, including transportation, residential energy use, and food consumption, including trends over time, projections to 2020 and assessments of alternative footprint reduction options. For more information, see the **GPI***Atlantic* web site: www.gpiatlantic.org.

[6] Wilson, J. (2001). *The Alberta GPI Accounts: Ecological Footprint*. The Pembina Institute for Appropriate Development, Drayton Valley, AB. This report presents the ecological footprint of Albertans, ecological footprint trends over time, comparisons between Alberta, Canada and other regions of the world, the major contributors to the Alberta ecological footprint, projections over 20 years, the correlation between Alberta's ecological footprint and

The *Prince Edward Island Ecological Footprint* assesses how much biologically productive area Prince Edward Islanders need and utilize to maintain their current lifestyles. The results provide a benchmark of how sustainable Prince Edward Islanders' current lifestyles are, and they identify the challenges Islanders face to reduce their ecological footprint and their impact on the environment. The study also suggests what individuals can do to reduce their personal ecological footprint, and provides a mechanism to document progress toward a more sustainable PEI. Unlike measures of progress based on the GDP and related economic growth statistics in which "more" is assumed to be "better," a *smaller* ecological footprint indicates greater sustainability and thus is considered a sign of progress in the Genuine Progress Index (GPI). The smaller an individual'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 therefore have an impact on the Earth simply because they consume nature's products and services. Our personal ecological footprint, therefore, corresponds to the *amount* of nature 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 and renew itself without depleting natural resource stocks. The sustainability challenge, therefore, is to attain a high quality of life for all Prince Edward Islanders while ensuring that their resource consumption and waste generation remain within the carrying capacity of nature.

But are Islanders 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 **all the resources it consumes** and to take in all the **wastes it creates.** The ecological footprint therefore becomes a benchmark for measuring the "bottom line" of sustainability. 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, represents the precondition necessary for securing the wellbeing of present and future generations.[7, 8, 9, 10, 11]

---

consumption, and how the ecological footprint can be used to create a more sustainable Alberta. For more information, see the Pembina Institute's web site: http://www.pembina.org.

7 The ecological footprint concept discussed throughout this report is based on the work of Wackernagel and Rees (1996). *Our Ecological Footprint: Reducing Human Impact on the Earth.* New Society Publishers, Gabriola Island, BC. For details on the book, see www.newsociety.com/oef.html. For more details on the footprint method and its

Most measures of sustainable development subtly place responsibility on *producers*. Natural resource accounts for forests, fisheries, soils and agriculture, for example, assess whether current harvesting practices are sustainable. Ecological footprint analysis, by contrast, shifts responsibility to *consumers* by assessing the impact of consumption patterns on the natural world. The ecological footprint perspective 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, and which producers aim to fulfill. The critical importance of this component of the GPI, therefore, is to make the sustainability challenge the shared collective responsibility of *all* Prince Edward Islanders.

Ecological footprint calculations are based on two simple facts: First, most of the resources consumed by a population, and the wastes that are generated by that population, can be accounted for. Secondly, 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, country) is the biologically productive area required to:

1. Produce the food, wood, energy and all the other resources that humans consume;
2. Provide room for infrastructure such as buildings and roads; and
3. Absorb the wastes, carbon dioxide and other pollutants that result from human activity.

To provide results in comparable units of measure, all components are adjusted for their biological productivities. This means that land with higher than average productivity appears larger in footprint accounts than resource-poor land. Since the resources we consume come from all corners of the planet and the wastes we generate 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 Prince Edward Islanders eat bananas from Guatemala and use wood from the Amazon rainforest, the land area required in those countries to produce these commodities consumed in PEI is counted as part of the PEI footprint.[12, 13, 14, 15]

---

applications, visit Redefining Progress at www.rprogress.org or the Anáhuac University of Xalapa's Centre for Sustainability Studies in Mexico at www.edg.net.mx/~mathiswa.

[8] Wackernagel, M., L. Onisto, P. Bello, A. Callejas Linares, I. S. López Falfán, J. Méndez García, A. I. Suárez Guerrero, and S. Guerrero (1999). "National natural capital accounting with the ecological footprint concept," *Ecological Economics,* Vol. 29, pp. 375-390.

[9] Lewan, L., M. Wackernagel, and C. Borgstrom Hansson (1999). "Evaluating the Use of natural Capital with the Ecological Footprint. Applications in Sweden and subregions," *Ambio* **28(7)**, pp. 604-612.

[10] Onisto, L.J., E. Krause, and M. Wackernagel (1998). *How Big Is Toronto's Ecological Footprint? Using the Concept of Appropriated Carrying Capacity For Measuring Sustainability.* Centre for Sustainable Studies and the City of Toronto, Toronto, Canada.

[11] Wackernagel, M., L. Onisto, A. Callejas Linares, I.S. López Falfán, J. Méndez García, A.I. Suárez Guerrero, S. Guerrero (1997). *Ecological Footprints of Nations: How Much Nature Do They Use? How Much Nature Do They Have?* Commissioned by the Earth Council for the Rio+5 Forum. International Council for Local Environmental Initiatives, Toronto.

[12] WWF International, Redefining Progress, United Nations Environment Program World Conservation Monitoring Centre (UNEP-WCMC), and Anáhuac University of Xalapa Centre for Sustainability Studies, 2000. *Living Planet Report 2000*. Available at http://www.panda.org/downloads/general/lpr2000.pdf.

[13] WWF International, Redefining Progress, and United Nations Environment Program World Conservation Monitoring Centre (UNEP-WCMC), 2002. *Living Planet Report 2002*. Available at http://www.panda.org/downloads/general/LPR_2002.pdf.

It is important to note that current ecological footprint estimates err on the conservative side. Low-end figures have been consistently used; areas set aside for the protection and treatment of water are not included in ecological footprint estimates, and areas for the absorption of wastes, pollutants and toxic materials, with the exception of carbon dioxide, have been omitted. In addition, the footprint analysis takes no account of the probability that chemical pesticide and fertilizer use, soil compaction, clear-cutting and other non-sustainable harvesting practices will reduce future soil productivity. The current biological productivity of a given piece of land is assumed to continue into the future. These assumptions render current footprint analyses highly conservative.

3. Methodology

Two previous provincial ecological footprint analyses were completed for Nova Scotia and Alberta, and were based on the methodology developed by Rees and Wackernagel in *Our Ecological Footprint: Reducing Human Impact on The Environment* and, more specifically, on the results presented in Wackernagel's 1996 Canadian Ecological Footprint estimate, which was part of the *Living Planet Report 2000*.[16, 17] This PEI ecological footprint analysis builds on the work of the Nova Scotia and Alberta analyses, and includes updates to the methodologies developed for the *Living Planet Report 2002*.[18, 19] The Wackernagel and Rees approach, often referred to as the "compound" approach to calculating the ecological footprint, measures consumption based on quantity and type of consumption as well as trade flows and energy data.[20]

The compound approach to footprint calculations

The following excerpt, from *Sharing Nature's Interest*, summarizes the main elements of the ecological footprint methodology:[21]

---

[14] Wackernagel et al. (1997). See footnote 11.
[15] Wackernagel and Rees (1996). See footnote 7.
[16] Idem.
[17] Redefining Progress and the Centre for Sustainability Studies contributed to the *Living Planet Report 2000* by calculating the ecological footprint of the world's 150 countries with a population over 1 million, using 1996 data, as well as the ecological footprint for the world population from 1961 to 1997. Calculations are available at http://www.redefiningprogress.org/ef/LPR2000/ef1996.zip. The original study of national footprints was: *Ecological Footprints of Nations: How Much Nature Do They Use? How Much Nature Do They Have?* See footnote 11 above. The methods are also described in Wackernagel et al. (1999. See footnote 8) above.
[18] *Living Planet Report 2002*. See footnote 13 above.
[19] Wackernagel, M., C. Monfreda, and E. Gurarie (2002). *Improvements to National Footprint Accounts Since The Living Planet Report 2000*. Redefining Progress, Oakland, CA.
[20] An explanation of the "compound approach" and other approaches to calculating the ecological footprint are available in Chambers, N., C. Simmons, and Mathis Wackernagel (2000). *Sharing Nature's Interest.* Earthscan Publications Ltd., London, p.67.
[21] Idem.

> "The calculation is composed of three main parts. The first part consists of a consumption analysis of over 50 biotic resources including meat, dairy, produce, fruit, vegetables, pulses, grains, tobacco, coffee, wood products, and so on.[22] Consumption is calculated by adding imports to production and subtracting exports.[23] Where necessary, further adjustments are made to avoid double counting across categories. Using FAO [Food and Agriculture Organization of the United Nations] estimates of world average yield, consumption is translated into appropriated ecologically productive area. In other words, the consumption quantities are divided by their corresponding (world average) biotic productivity, which gives the arable, pasture, or forest land and productive sea area necessary to sustain this consumption.
>
> The second part of the calculation determines the energy balance – considering both locally generated energy and that embodied in over 100 categories of traded goods. Where the primary fuel used is known, this is adjusted for carbon content. This portion of the calculation is used to derive the energy footprint – usually the amount of forested land necessary to sequester the CO_2 emissions.
>
> The final part of the calculation summarizes the ecological footprint in six categories and gives the total, presented as per capita figures. Multiplying the per capita data by the country's population gives the total footprint of the nation. An adjustment is also made to express the result in world average productive land. 'Equivalence factors' are used to scale the land categories in proportion to their productivities. The total is then compared with an estimate of how much biocapacity exists within the country. The actual land area is adjusted by a 'yield factor' to equate local productivity of each land category to the global average. This scales the national areas in proportion to their true productivities.'"

Results are presented as global hectares (gha) per capita. A global hectare is defined as one hectare (ha)[24] of biologically productive space (including ocean, cropland, grazing land, forest land, inland waters, and built up land) with world-average productivity. A hectare of highly productive land represents more global hectares than the same surface of less productive land.

The ecological footprint calculations presented in the *Living Planet Report 2002* include six categories that are mutually exclusive uses of the planet's bioproductive surface that compete for the Earth's available biologically productive space:[25]

---

[22] Each category includes both primary resources (such as raw timber or milk) and manufactured products that are derived from them (such as paper or cheese).
[23] Consumption is calculated by adding imports to, and subtracting exports from, the domestic production, i.e., Net Consumption = Domestic Production – Exports + Imports.
[24] A hectare (ha) is a unit of surface or land equivalent to 10,000 square metres (m^2) or 2.47 acres.
[25] Summarized from Wackernagel, M., N.B. Schulz, D. Deumling, A.C. Linares, M. Jenkins, V. Kapos, C. Monfreda, J. Lohi, N. Myers, R. Norgaard and J. Randers (2002). Tracking the ecological overshoot of the human economy. *Proceedings of the National Academy of Sciences*, **99 (14)**, pp. 9266–9271; and the Redefining Progress web site (http://www.rprogress.org/programs/sustainability/ef/methods/components.html).

1. **Cropland Footprint**: growing crops for food, animal feed, fibre, oil, and rubber, and includes growing tobacco; calculated as arable land used for crop production.
2. **Grazing Land Footprint**: grazing animals for meat, hides, wool, and milk; calculated as pasture land demand by cattle, sheep, goats, equines, and camels.
3. **Forest Footprint**: harvesting timber for wood, fibre, and fuel; calculated as natural and plantation forest land. Fuel wood is not included in the total Forest Footprint – it makes up part of the Total Energy Footprint.
4. **Fishing Ground Footprint**: marine and freshwater fishing; calculated as productive fishing ground.
5. **Built-Up Land Footprint**: accommodating infrastructure for housing, transportation, industrial production, and hydro-electric power; calculated as arable land used for infrastructure, based on the assumption that human settlements are predominantly located in the most fertile areas of a country.
6. **Total Energy Footprint**: burning fossil fuel, calculated as the biologically productive area that would be needed to sequester enough carbon dioxide (CO_2) emissions to avoid an increase in atmospheric CO_2. The total energy footprint includes CO_2 emissions from fossil fuels, fuel wood, and nuclear and hydro energy. This does not include energy required for the production of food (e.g., transportation of food, energy inputs into agriculture), which are included in the cropland, grazing land and fishing ground footprints.

The calculation of the PEI ecological footprint follows the methodology used for calculating the Nova Scotia ecological footprint and summarizes the footprint in five slightly modified categories:

1. **Food Footprint**: Cropland Footprint + Grazing Land Footprint + Fishing Ground Footprint – Non-Food Cropland Footprint
2. **Other Crop Footprint**: footprint of non-food items, including fibre crops (e.g., cotton), rubber, and tobacco
3. **Forest Footprint**: corresponds to the *Living Planet Report 2002* Forest Footprint category (#3 above)
4. **Built-Up Area Footprint**: corresponds to the *Living Planet Report 2002* Built-Up Footprint category (#5 above)
5. **Energy Footprint**: corresponds to the *Living Planet Report 2002* Energy Footprint category (#6 above)

The compound approach to ecological footprint calculations takes its primary unit of analysis as the nation state. Reliable data on trade flows, consumption, energy use and land categories are available at the national level. However the complete data set necessary to calculate the ecological footprint at the provincial level using the compound approach is not currently available, primarily due to inadequacies in the inter-provincial trade flow data.

Therefore, the 1999 Prince Edward Island ecological footprint presented in this report was calculated indirectly by adjusting the 1999 per capita Canadian footprint area, as calculated by Rees, Wackernagel and their colleagues, to account for differences in consumption patterns between PEI and Canada. 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."[26]

The PEI consumption adjustments rely primarily on the following Statistics Canada surveys and sources: *Food Expenditure Surveys, Family Expenditure Surveys,* and other sources as listed in the footnotes. PEI's energy footprint is calculated using the *National Energy Use Database* of the Natural Resources Canada Office of Energy Efficiency. Because the most recent year for which a detailed footprint has been calculated for Canada is 1999, data for 1999 consumption patterns is used to adjust this footprint to PEI, and 1999 is used as the base year for all historical and projected footprint trends in this report.

GPI*Atlantic* recognizes that using input-output tables at the provincial level to track resource and waste flows through the economy would be a more accurate and comprehensive way of calculating human impacts on the environment. **GPI***Atlantic* has recommended to Statistics Canada that future updates of this report use the expanded input-output tables in the Material and Energy Flow Accounts that are part of Statistics Canada's new Canadian System of Environmental and Resource Accounts. Although Statistics Canada has developed conventional provincial input-output tables, the expanded Material and Energy Flow Accounts still exist only at the national level. Statistics Canada hopes to develop corresponding provincial and regional accounts in the future, which will allow for significant improvements in the ecological footprint calculations.

GPI*Atlantic* is aware of only one study to date that has used input-output tables to calculate an ecological footprint. Interestingly, that New Zealand study produced results that were quite close to those based on the methodology of Wackernagel and Rees in British Columbia. For that reason, and because of the conservative assumptions described above, the authors and **GPI***Atlantic* are confident that the results presented in this analysis are reasonable estimates.[27] At the same time, we recognize clearly the limitations of the methodologies used in this study and welcome improvements that will increase the accuracy of the estimates given here.

[26] Wackernagel, M. (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). See footnote 20. 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 100 categories of traded goods considered in the compound approach to ecological footprint calculations.

[27] A study undertaken by Bicknell et al., from Lincoln University, Canterbury, New Zealand used input-output tables to calculate a New Zealand ecological footprint. Interestingly, the New Zealand analysis, using an entirely different method, produced comparable results to the original UBC analysis. Bicknell, K.B., R.J. Ball, R. Cullen, H.R. Bigsby (1998). "New methodology for the ecological footprint with an application to the New Zealand economy," *Ecological Economics* **27**, 149-160. See also Statistics Canada, 1997 (footnote 4).

4. Understanding the Ecological Footprint

The ecological bottom line

If all the biologically productive land and sea on this planet is divided by the human population, there is an average of 1.9 hectares of biologically productive land and sea per person.[28] If 12% of the ecologically productive land is set aside for biodiversity preservation, as recommended by the Brundtland Commission, the available bioproductive space per person shrinks from 1.9 ha to just under 1.7 ha.[29, 30]

Since we share the planet with over 10 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. Conservative biologists recommend a minimum set-aside of 30% for biodiversity preservation, so the 12% set-aside, recommended by the Brundtland Commission and used in this report, actually minimizes the ecological scarcity seen by many scientists.[31] Indeed, the 12% target is what is currently deemed *politically* feasible based on international agreements. 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 *greater* land protection.

In sum, sustainable living therefore requires that each global citizen fulfill all his or her physiological, social, and economic needs within the 1.7 ha of biologically productive space available to each person. Any increase in the set-aside for biodiversity preservation will correspondingly decrease that estimate of available space.

The sustainability challenge will not become any easier with a projected population of 10 billion people within the next 30 to 50 years. At that time, the available space will be reduced to 1.1 ha per person worldwide. Again it must be emphasized that this projection has not factored in the probable loss of biologically productive space due to unsustainable harvesting methods, clear-cutting, soil erosion, and the expansion of the built environment, nor does it include the impact

---

[28] About 11.4 billion hectares, slightly less than ¼ of the Earth's surface, are biologically productive (*Living Planet Report 2002*. See footnote 12 above). The remaining ¾ of the Earth's surface including deserts, ice caps, and deep oceans, support comparatively low concentrations of bioproductivity. Biocapacity per capita in 1999 was calculated at 1.9 ha per person based on a global population in 1999 of 5,978.7 million.

[29] In his Canadian Footprint analysis Wackernagel follows the internationally accepted Brundtland Commission recommendation to set aside 12% of bioproductive area for biodiversity preservation in order not to exaggerate ecological scarcity. The *Living Planet Report 2000* (see footnote 12) sets aside 10%, while conservative biologists recommend a minimum of 30%. The burden of this protection effort must clearly be shared by all of humanity and not only those regions of the world where biologically productive spaces remain relatively untouched by humans (Wackernagel, 2001. *What We Use and What We Have: Ecological Footprint and Ecological Capacity,* Redefining Progress. See the Redefining Progress web site: www.rprogress.org/).

[30] 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.

[31] Wackernagel, (2001). See footnote 29 above.

of most waste products. Given these highly conservative assumptions and exclusions, the 1.7 ha available per person can be considered a very generous estimate.[32]

The human footprint exceeds the sustainable capacity of the Earth

The 1999 average global ecological footprint is 2.3 ha per person.[33] With an available space of just 1.7 ha per person, humanity already exceeds the sustainable capacity of the Earth by 35%. This means that humanity is consuming more than nature can regenerate, or human demand is exceeding nature's supply. This global "ecological overshoot" is temporarily possible, but only by:

- depleting reserves of natural capital (e.g., oil, natural gas, old growth forests);
- over-harvesting renewable resources to the brink of collapse (e.g., the Atlantic cod fisheries);
- causing irreversible ecological damage (e.g., species extinction, desertification); and
- overloading the environment with waste products (e.g., air and water pollution, climate change, stratospheric ozone depletion, and toxic chemical build up).

To take just one example from this list, scientists estimate that 100 living species become extinct every day, largely from habitat destruction and pollution. If current trends continue, 50% of the world's flora and fauna will become extinct within the next century. The present species extinction rate is estimated to be one thousand times the natural rate.[34]

For a while, many of us can live quite comfortably in the midst of this overshoot and will not pay for its consequences in our own lifetimes. But our comfort is quite clearly at the expense of future generations who will pay the ecological costs of current over-consumption, just as taxpayers are now struggling to service the public debt accumulated during the 1970s and 1980s. Not only does the current ecological overshoot deplete the biologically productive space or footprint area that will be available for our children and their children to achieve healthy lives, but it also leaves them to deal with the toxic impacts of excess current waste generation. Reduced salmon and cod stocks, global warming, higher child asthma rates, and new environmental illnesses may well be current precursors of these longer-term consequences.

A simple, but operational understanding of what sustainability means[35]

> "Sustainability is a simple idea. It is based on the recognition that worsening ecological conditions ultimately threaten people's wellbeing. Thus, sustainability is… a commitment to satisfying lives for all within the means of nature.

---

[32] The *Living Planet Report 2000*. See footnote 12 above.
[33] *Living Planet Report 2002*. See footnote 13 above.
[34] Morell, V. (1999). "The Sixth Great Extinction," *National Geographic*, **195(2)**.
[35] Wackernagel (2001). *Framing Sustainability with the Ecological Footprint – Dismantling the taboo in order to unleash sustainability*. Draft Document prepared for Environment Canada workshop on sustainable development indicators, January 23, 2001, Toronto, p. 2.

When humanity's ecological demands in terms of resource consumption and waste generation exceed what nature can supply, we move into what is termed 'ecological overshoot.' Just as constant erosion of business capital weakens an enterprise, such overshoot erodes the planet's 'natural capital,' and thus reduces the ultimate means people depend on.[36]

At the core of the quest for sustainability is the need to be able to live with ecological limits. These limits are not like a rigid wall that brings a speeding car to a halt. Rather, ecological limits can be transgressed easily. More timber can be harvested than regrows, more fish can be caught than are spawned, more CO_2 can be emitted than nature can reabsorb, and topsoil can be eroded while crops grow. Initially, most of these transgressions go unnoticed.

The importance of avoiding overshoot is still ignored not only in general conversations but also in many public policy discussions of sustainability. In fact, our ability to transgress ecological limits without perceptible consequences may create influential misconceptions in the sustainability debate. For example, in a recent interview on reaching a world population of 6 billion, Nafis Sadik, then Executive Director of the UN Population Fund, stated that 'many environmentalists think [that the carrying capacity of the Earth] is four billion, maximum. But now we have six billion people.'[37]

Overshoot is also the driver behind inequities. In a world that is in overshoot, people not only compete with other species for ecological space, but against each other. Overshoot obscures this reality by allowing the accumulation of 'ecological debts' (or the depletion of the natural capital stock), leaving the burden for future generations. In other words, it makes possible the trade off between increasing resource depletion, intra-generational equity and intergenerational equity. Overshoot is not merely an abstract construct, but can be measured. This translates the 'means of nature' into a specific and accountable proposition."

Strong sustainability or weak sustainability[38]

This approach is consistent with the notion of "**strong sustainability**" which requires that *natural* capital not be depleted, and that human societies live off the "interest" (or services provided by natural capital stocks) without drawing down the "principal" (the natural capital stocks themselves). The concept of "**weak sustainability**," by contrast, implies that there be no depletion of *total* capital, i.e. natural plus human-made capital. Weak sustainability policies allow natural capital to be diminished as long as it is balanced by a commensurate increase in human-made capital.

---

[36] See also Daly, H. (1996). *Beyond Growth,* Beacon Press, Boston.
[37] Motavalli, J. (1999). "Conversations with Dr. Nafis Sadik: The UN's Prescription for Family Planning," *E: The Environmental Magazine,* **10(4)**, 10–13.
[38] Based on notes from Mathis Wackernagel, personal communication with Jeffrey Wilson, 2001; and Wackernagel and Rees, *Our Ecological Footprint*, 1996, p. 37.

Apart from serious problems arising from the lack of adequate methods to compare the value of human-made and natural capital, such weak sustainability would assume that there is **substitutability** between human-made and natural capital. While there is some substitutability among different aspects of natural capital (e.g. fuel wood versus bio-fuel from corn), and even some marginal substitutability between natural capital and human-made capital (e.g. fuel-wood versus wind-mills), there is no absolute substitutability for essential ecosystem services, since human and non-human life ultimately depend on the functioning of the biosphere. Put simply, the relationship between natural and human-made capital is not an equal two-way flow. The human economy and human society depend completely on nature (for air, water, heat, energy, productive land, resources, climate regulation and other vital ecosystem services), but nature does not depend for its survival on human economy and society. That reality makes the assumption of substitutability highly questionable, although the assumption is widely accepted in actual practice.

In addition, it *may* be possible to substitute human-made capital for certain *functions* of particular natural capital assets. But these natural assets frequently perform a wide range of functions, many of which are not performed by the human-made substitute. For example, a sewage treatment plant may partially replace the natural waste cycling capacity of a river or other water body, but it cannot compensate for the many other vital life-supporting ecological functions performed by the river. In other words, the sewage treatment plant does not make the river dispensable nor allow its health to be compromised without a wide range of other consequences, many of which are likely to be adverse to human wellbeing.

In the past, weak sustainability may have appeared as a sufficient criterion for beneficial development. But this illusion can no longer be sustained in a time of global overshoot. Since humanity is using the biosphere's capacity more rapidly than it can regenerate, further trade-offs of building human-made capital at the expense of natural capital in order to maintain or increase total capital are highly likely to undermine the wellbeing of future generations.

Nevertheless, strong sustainability by no means condemns humanity to stagnation nor does it imply any barrier to human and social development and progress. On the contrary, long-term stagnation and regression are more likely under weak sustainability policies, since those policies could continue to liquidate the natural capital assets on which human economic prosperity ultimately depends. By contrast, strong sustainability provides stronger guarantees of long-term prosperity by preserving natural wealth for the benefit of future generations. Under such policies, societies are more likely to flourish through the development of appropriate technologies that can provide services to society without drawing down natural capital reserves. As well, efforts to stabilize human population and curb excessive material consumption can help foster human and social development without increasing ecological overshoot.[39]

[39] See also *Beyond Growth,* footnote 2.

PART II
ECOLOGICAL FOOTPRINT – THE GLOBAL CONTEXT

5. Not All Footprints Are the Same Size

Responsibility for ecological overshoot is not equally shared. As Figures 1 and 2 demonstrate, there is a great disparity between the ecological footprints of different countries and different regions, with wealthy nations having a disproportionately greater impact on the environment.

As Figures 1 through 5 clearly show, the industrialized regions tend to live on footprints significantly larger than the less industrialized regions of the world. For example, Africa and the Asia/Pacific region had ecological footprints of 1.36 ha per capita and 1.37 ha per capita in 1999 respectively, while North America and Western Europe had ecological footprints of 9.61 ha per capita and 4.97 ha per capita respectively.

Figure 3 shows the ecological footprints of seven geographical regions of the world in 1999:

- The size of each box is proportional to the aggregate footprint of each region.
- The height of each box is proportional to the region's average ecological footprint per person;
- The width of the box is proportional to the population of the region; and
- The low, middle, and high income columns refer only to average ecological footprint per person.

In fact, four billion people, or 68% of the world's population, consume an average of just 1.1 ha of bioproductive capacity per person, considerably less than the land and sea space available for human use (Figure 4). Arguably global environmental decline can therefore be attributed to 32% of the world's population – the 1.9 billion people who consume an average of 4.1 ha of productive space per person. In fact, this 32% of the world's population is responsible for 70% of global resource consumption and waste generation and has an aggregate ecological footprint equal to 93% of the Earth's total biologically productive area.[40]

This group of consumers is largely concentrated in the high income countries[41] whose average per capita ecological footprint in 1999 was 6.48 ha and the middle income countries[42] whose average ecological footprint in 1999 was 1.99 ha per capita. By contrast, the low income

---

[40] The 32% of the population with the largest footprint is responsible for 70% of the world's resource consumption and waste generation. Because humans are in a state of global overshoot, the actual footprint area that this group occupies is equal to an area the size of 93% of the Earth's total biologically productive area.

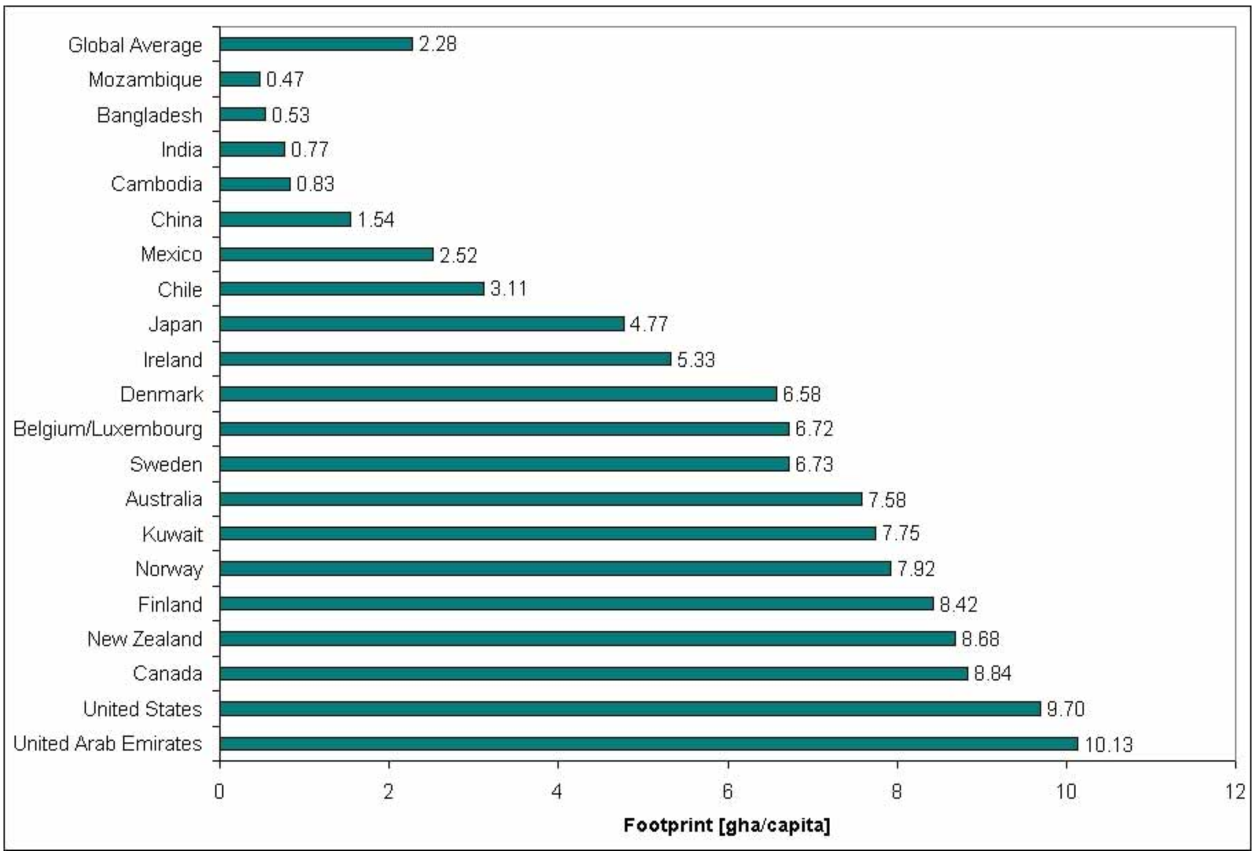
[41] High income countries in the *Living Planet Report 2002* include: Australia; Austria; Belgium; Canada; Denmark; Finland; France; Germany; Greece; Ireland; Israel; Italy; Japan; Korea, Rep.; Kuwait; Netherlands; New Zealand; Norway; Portugal; Slovenia; Spain; Sweden; Switzerland; United Arab Emirates; United Kingdom; and the United States of America.

[42] Middle income countries in the *Living Planet Report 2002* include: Algeria; Argentina; Belarus; Bolivia; Botswana; Brazil; Bulgaria; Chile; China; Colombia; Costa Rica; Croatia; Cuba; Czech Rep.; Dominican Rep.; Ecuador; Egypt; El Salvador; Estonia; Gabon; Georgia; Guatemala; Hungary; Indonesia; Iran; Iraq; Jamaica; Jordan; Kazakhstan; Korea, Dem. Rep.; Latvia; Lebanon; Libya; Lithuania; Macedonia; Malaysia; Mauritius; Mexico; Morocco; Namibia; Panama; Papua New Guinea; Paraguay; Peru; Philippines; Poland; Romania; Russian Federation; Saudi Arabia; Slovakia; South Africa, Rep.; Sri Lanka; Syria; Thailand; Trinidad and Tobago; Tunisia; Turkey; Ukraine; Uruguay; Uzbekistan; Venezuela; and Yugoslavia, Fed. Rep.

countries[43] had an average ecological footprint of 0.83 ha/per capita in 1999, less than half the 1.7 ha per capita bioproductive space available for human use.[44] As Figure 3 indicates, most people in Africa, Asia and the Pacific region consume considerably less than that average per capita biocapacity available for human use. Since the available bioproductive space is finite, it is clear that excessive consumption in the rich nations directly undermines the ability of many others to secure their basic human needs.

A caveat must be added here. The country figures on which these estimates are based do not account for income disparities within nations. Excessive consumption by even a small proportion of the population of poor nations may raise average footprint sizes and conceal the poverty of a significant proportion of the population.

Figure 1. Disparity in Ecological Footprint Size by Country, 1999

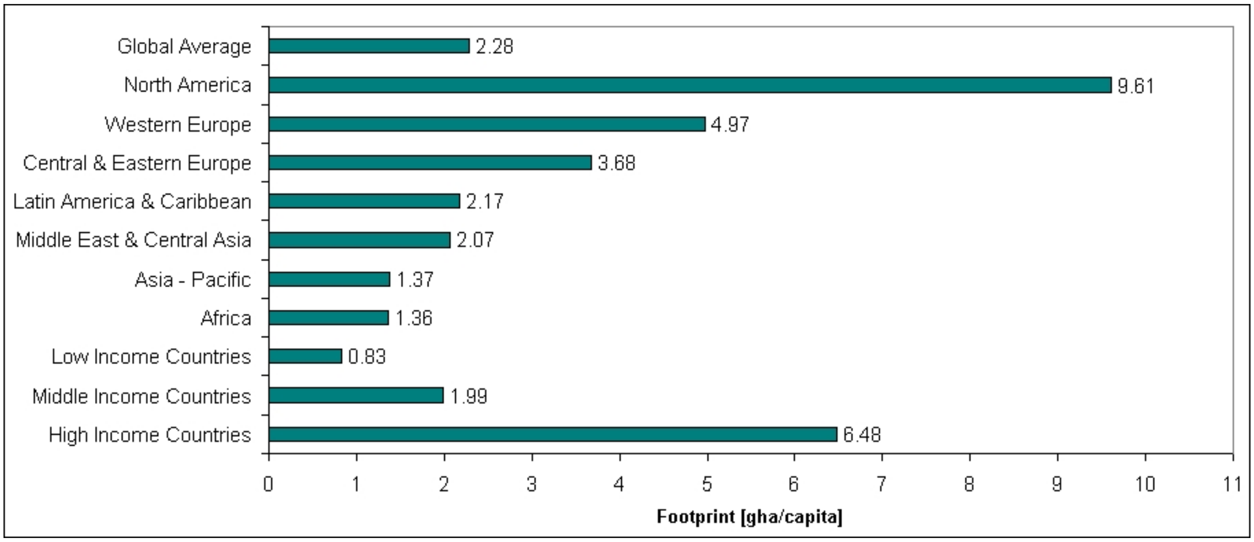


Source: *Living Planet Report 2002*.

[43] Low income countries in the *Living Planet Report 2002* include: Afghanistan; Albania; Angola; Armenia; Azerbaijan; Bangladesh; Benin; Bosnia Herzegovina; Burkina Faso; Burundi; Cambodia; Cameroon; Central African Rep.; Chad; Congo; Congo, Dem. Rep.; Cote d'Ivoire; Eritrea; Ethiopia; Gambia, The; Ghana; Guinea; Guinea-Bissau; Haiti; Honduras; India; Kenya; Kyrgyzstan, Rep.; Lao PDR; Lesotho; Liberia; Madagascar; Malawi; Mali; Mauritania; Moldova, Rep.; Mongolia; Mozambique; Myanmar; Nepal; Nicaragua; Niger; Nigeria; Pakistan; Rwanda; Senegal; Sierra Leone; Somalia; Sudan; Tajikistan; Tanzania, United Rep.; Togo; Turkmenistan; Uganda; Vietnam; Yemen; Zambia; Zimbabwe.

[44] Based on *Living Planet Report 2002* data tables. See footnote 13.

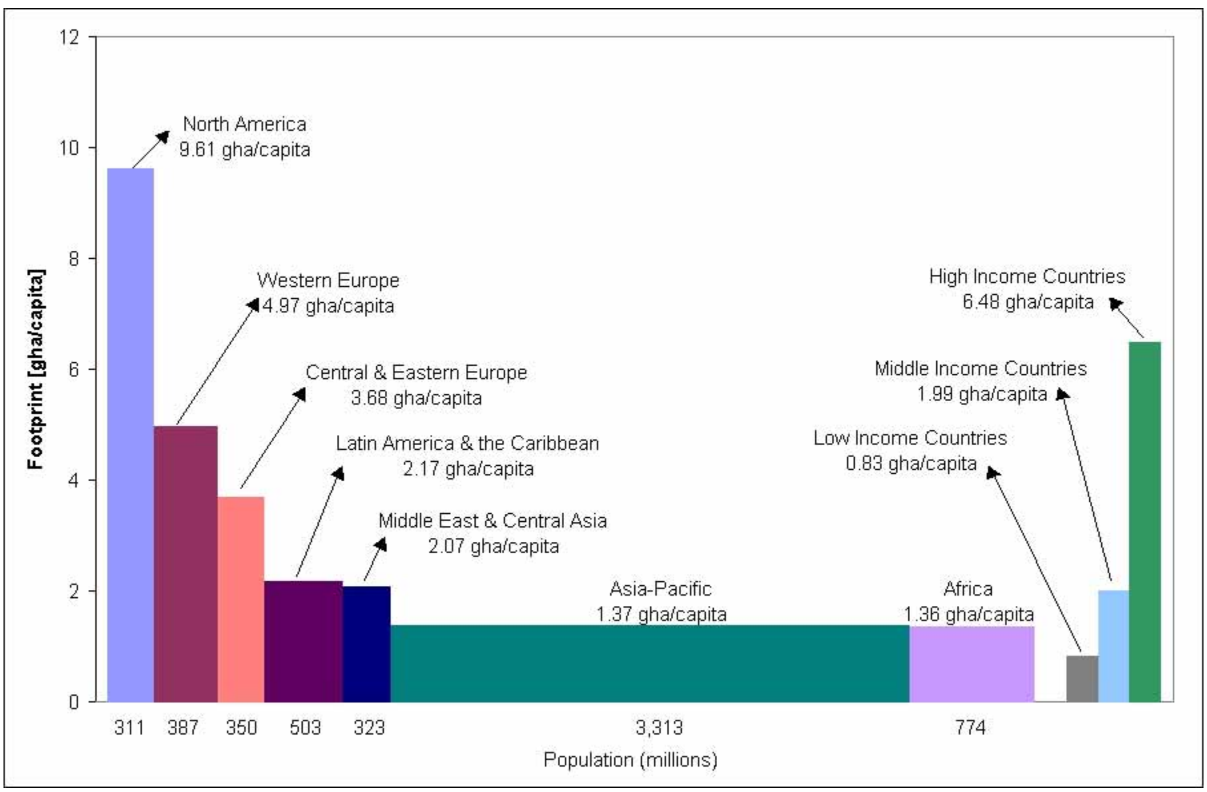
Figure 2. Disparity in Ecological Footprint Size by Region and Income, 1999



Note: For a list of countries included in the averages for the low, middle, and high income countries, see footnotes 41 through 43.

Source: *Living Planet Report 2002*.

Figure 3. Ecological Footprint By Region, 1999



Note: This Figure is based on Figure 8 of the *Living Planet Report 2002* (see footnote 13) and Figure 2 of *The Nova Scotia Ecological Footprint* (see footnote 5).

Source: *Living Planet Report 2002*.

It has been argued that technological advances, such as genetically modified foods, may effectively expand the bioproductive space available for human consumption by making each hectare of land and sea considerably more productive than it has been historically. In an earlier era, the "Green Revolution" held out the same promise. In keeping with the conservative nature of estimates in this report that exclude the probable degradation and loss of currently productive land to soil erosion, compaction, nutrient leaching, desertification, pollution and other factors, and acknowledging that bioengineering and other yield-expanding innovations are still in the experimental stage, this report assumes the same bioproductive capacity for each hectare of land into the future as currently exists. From that perspective, available resources remain finite, and excess consumption and waste generation by some in effect depend on the continued poverty and deprivation of others.

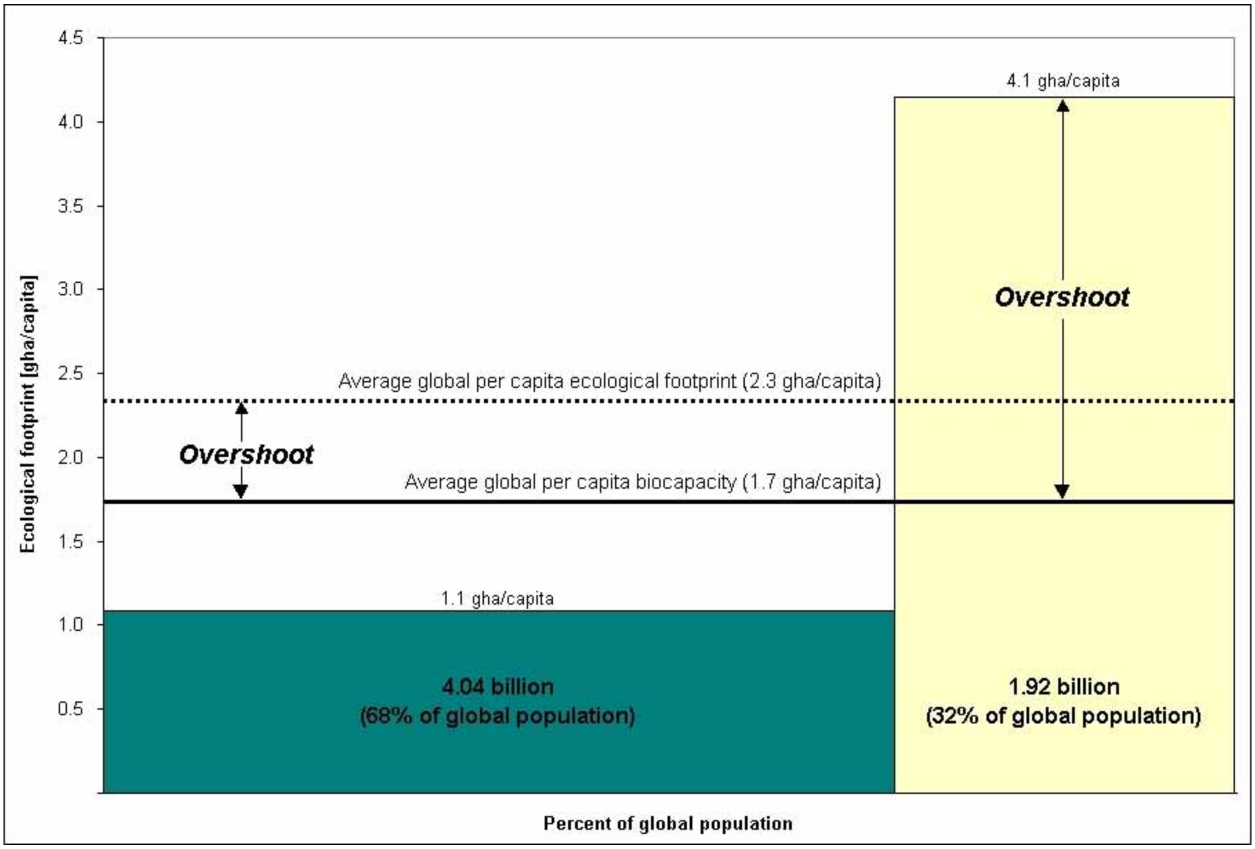
Figure 4 illustrates both the average per capita ecological overshoot, and the overshoot of 32% of the world's population, based on 1999 data. Figure 5 reveals the remarkable distribution of ecological footprints in 1999 by percentage of the world's population and per capita GDP. The 6% of the world's population[45] with the largest ecological footprints (including Canada and the U.S.) have an average footprint of 8.1 ha/capita or almost six times the 1.4 ha/capita footprint of 40% of the world's population, and over ten times the 0.8 ha/capita footprint of the poorest 27% of the world's population.

Ecological footprint studies highlight the ethical dimensions of sustainability. In 1999, nine countries occupied footprints at least four times larger than the biologically productive space available per global citizen.[46] In marked contrast, 33 countries have footprints of 1 ha or less per capita.[47]

This empirical reality clearly demonstrates the equity dimension of sustainable development that is explicit in the Brundtland Commission's seminal definition. The Brundtland report remarks that "even the narrow notion of physical sustainability implies a concern for social equity between generations, a concern that must logically be extended to equity within each generation."[48] According to Statistics Canada, "the spirit of sustainable development implies that all people have the right to a healthy, productive environment and the economic and social benefits that come with it." Therefore "equity, both among members of the present generation and between the present and future generations (is) a clear social objective that falls out of the definition."[49]

[45] This includes United Arab Emirates; United States of America; Canada; New Zealand; Finland; Norway; Kuwait; Australia; Sweden; Belgium & Luxembourg; and Denmark. Based on *Living Planet report 2002* ecological footprint results and population figures. See footnote 13.
[46] These nine countries are United Arab Emirates, United States of America, Canada, New Zealand, Finland, Norway, Kuwait, and Australia. Based on *Living Planet Report 2002*. See footnote 13.
[47] These 33 countries are Sri Lanka; Gambia; Albania; Bolivia; Afghanistan; Congo; Cote d'Ivoire; Liberia; Georgia; Armenia; Madagascar; Angola; Malawi; Lesotho; Togo; Nepal; Cambodia; Haiti; Laos; Congo, Dem. Rep.; Eritrea; Ethiopia; India; Vietnam; Yemen; Myanmar; Guinea-Bissau; Tajikistan; Pakistan; Sierra Leone; Bangladesh; Burundi; and Mozambique. Based on *Living Planet report 2002*. See footnote 13 above.
[48] World Commission on Environment and Development (Brundtland Commission) (1987). See footnote 3 above.
[49] Statistics Canada, 1997. See footnote 4 above.

Figure 4. Global Distribution Above and Below Per Capita Global Biocapacity, 1999



Note: Overshoot (or ecological deficit) occurs when human consumption and waste production exceed the capacity of the earth to create new resources and absorb waste. During overshoot, natural capital is liquidated to support current resource use, reducing the Earth's ability to support future life.

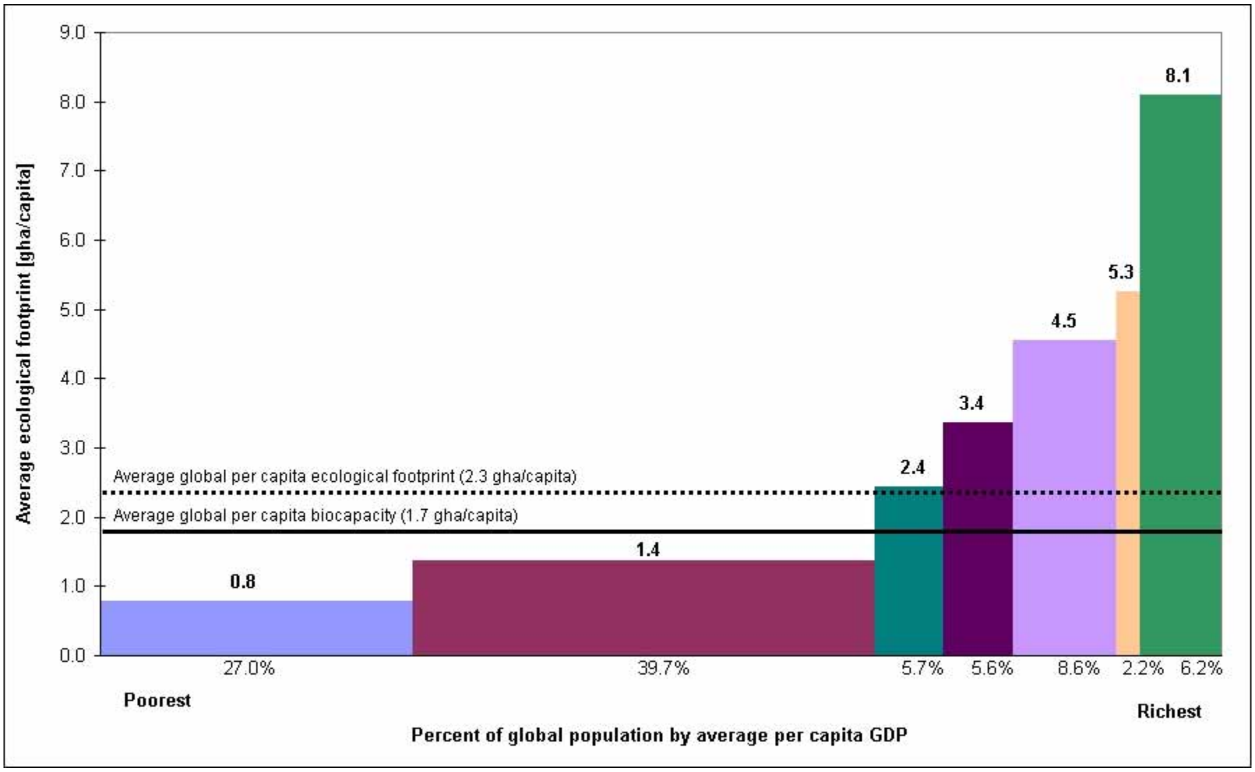
Source: Based on the 1999 ecological footprint calculations from the *Living Planet Report 2002*.

A finite amount of bioproductive capacity implies that if certain populations overuse resources, there will be less available for others. Raising the living standards and consumption levels of the world's poor without curbing excess consumption in the industrialized world would put an intolerable strain on the Earth's resources and waste assimilation capacity.

The resource consumption disparities are vast: Globally, the 20% of the world's people in the highest-income countries account for 86% of total private consumption expenditures, while the poorest 20% account for a mere 1.3%.

- *The richest one-fifth consume 45% of all meat and fish, the poorest fifth consume just 5%;*
- *The richest one-fifth consume 58% of total energy, the poorest fifth less than 4%;*
- *The richest one-fifth consume 84% of all paper, the poorest fifth 1.1%; and*
- *The richest one-fifth own 87% of the world's vehicle fleet, the poorest fifth less than 1%.*

Figure 5. Global Ecological Footprint Breakdown, 1999



Source: Based on the 1999 ecological footprint calculations from the *Living Planet Report 2002*.

The excessive consumption by wealthy individuals and the wealthier regions of the globe clearly occurs at the expense of the poorer regions and of millions living in absolute poverty. Current resource consumption by the world's poorest citizens is frequently insufficient to meet basic needs. Of the 4.4 billion people in developing countries, nearly three-fifths lack basic sanitation. Almost a third have no access to clean water. A quarter do not have adequate housing. A fifth have no access to modern health services. A fifth of children do not attend school to grade five. And a fifth do not get enough dietary energy and protein. Millions still die annually from chronic hunger and malnutrition.[50]

It is clear that in a world of limited resources, excess consumption by the rich directly undermines the prospects for the poor. Despite our expressed concern to raise the living standard of the world's poorest, we actually *need* a billion human beings to live in absolute poverty without sufficient resources to sustain life and health in order to retain current consumption patterns in industrialized countries.

This is an admittedly crude way of expressing the stark reality that raising global living standards to current levels in the wealthy countries would put an intolerable strain on the Earth's resources. *If everyone in the world were to consume at Canadian levels, we would need 4.6 planets Earth to provide the necessary resources and waste assimilation capacity. If*

[50] Statistics Canada, 1997. See footnote 4.

***everyone in the world were to consume at PEI levels, we would need 4.7 planets Earth to provide the necessary resources and waste assimilation capacity*.[51] Ecological footprint analysis therefore makes it clear that global ecological sustainability depends on the affluent reducing their present share of consumption so that those in poverty can meet their basic human needs.**[52]

6. The Connection Between Sustainability and Consumption

Comparing the ecological footprints of various countries effectively communicates the comparative impacts of different levels of consumption on the environment. Figure 6 demonstrates that the average Canadian person has an ecological footprint over 11 times greater than that of the average Indian or Chinese person and almost 17 times greater than that of an average Bangladeshi. This suggests that the average Canadian places the same demand on the planet's resources and waste assimilation capacities as 11 individuals from India or China and 17 individuals from Bangladesh.

This reality sheds a completely different light on the world's "population problem." While there tends to be a global consciousness that sustainability requires the need to address overpopulation, ecological footprint analysis highlights the fact that sustainability is very much a consumption issue and that the impact of population growth is dependent on consumption patterns. For example, the average U.S. citizen has an impact on the environment 18 times greater than that of the average Bangladeshi. The current Bangladesh footprint is 0.53 ha/capita, while the U.S. footprint is 9.7 ha/capita (Figure 6).

Put another way, every additional American puts a strain on the world's resources equivalent to 18 additional Bangladeshis. Theoretically, the population of Bangladesh, which was 134 million in 1999, could total 5.13 billion before it would place the same human load on the Earth as the U.S. did in 1999 with its population of 280.4 million.

Even this is a conservative estimate. Erlich et al., using a different methodology, estimate that the average U.S. citizen has an impact on the environment that is 70 times greater than that of the average Bangladeshi. This suggests that the population of Bangladesh could reach 19.1 billion people before placing the same human load on the Earth as the U.S.[53, 54]

---

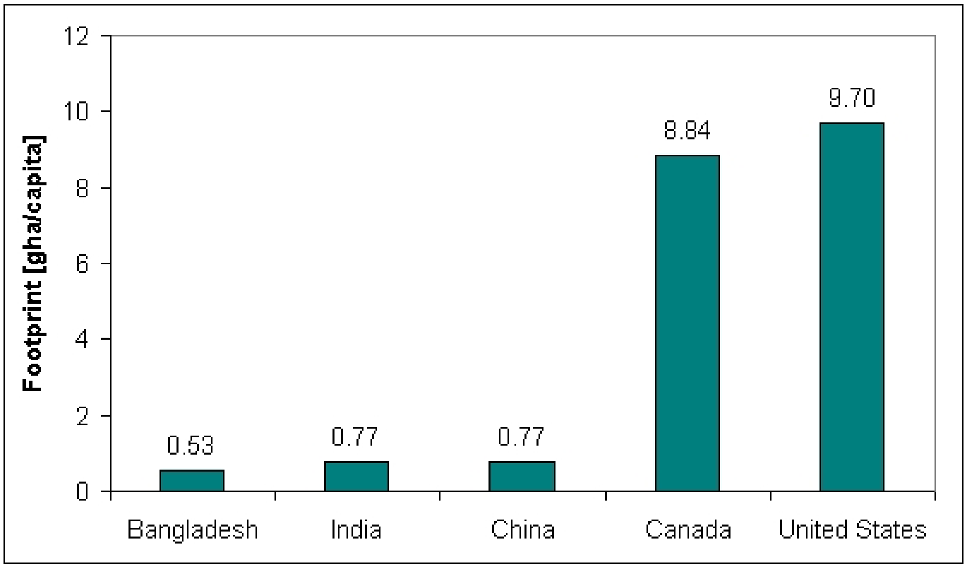
[51] The 1999 average ecological footprint of Canadians (8.84 ha/capita) multiplied by the global population (5,979.8 million) equals a total world biocapacity needed of 52.9 billion hectares. Compared to a total world biocapacity of 11.4 billion hectares, this means that 4.64 planets earth would be required if everyone in the world were to consume at the 1999 Canadian rate. The 1999 average ecological footprint of Prince Edward Islanders (8.98 ha/capita) multiplied by the global population (5,979.8 million) equals a total world biocapacity needed of 53.7 billion hectares. Compared to a total world biocapacity of 11.4 billion hectares, this means that 4.71 planets earth would be required if everyone in the world were to consume at the 1999 PEI rate.

[52] For more information on ecological footprints and sustainability, see Wackernagel and Rees (1996. See footnote 7 above).

[53] Erlich, P.R., Ehrlich, A.H., and G.C. Daily (1995). *The Stork And The Plow.* G.P. Putnam's Sons, New York. Erlich et al. use I=PAT estimates to assess human impact on the environment. The IPAT model assumes that Impact = Population x Affluence x Technology.

Simply put, every baby born in Canada or the U.S. will deplete the Earth's capacity to support human life far more rapidly than many babies born in developing nations. While we are used to describing the population explosion as a problem of developing countries, ecological footprint analysis demonstrates that reducing the population of industrialized nations would have a far greater impact on conserving resources than controlling population in Africa, Asia and the Pacific region.

Figure 6. Per Capita Ecological Footprint of Selected Countries, 1999



Source: *Living Planet Report 2002*.

7. Global Sustainability Deficit

Sustainability requires that human activity remain within the carrying capacity of nature. It was noted earlier that dividing all the biologically productive land and sea on this planet by the human population results in an average of 1.9 hectares per person in the year 1999. It was also noted that setting aside 12% of the ecologically productive land for biodiversity preservation, as recommended by the Brundtland report, shrinks the available bioproductive space per person from 1.9 hectares to just under 1.7 hectares. The ecological footprint can therefore function as a benchmark of sustainability by comparing the actual per capita consumption of a defined population with the global per capita share of 1.7 ha. Consumption in excess of 1.7 ha per capita implies that a particular population is using resources and services at an unsustainable rate.

This excess consumption in relation to the per capita global area available is called the "global sustainability deficit."[55] The global sustainability deficit, which expresses the ecological

[54] United Nations Population Fund (1998). *State of World Population 1998*. www.unfp.org.
[55] The global sustainability deficit is based on the ecological deficit calculated in *The Ecological Footprint Of Nations* Study (footnote 11), the *Living Planet Report 2000* (footnote 12), and the *Living Planet Report 2002* (footnote 13).

footprint area above 1.7 ha, is calculated by subtracting a region's per capita footprint from the available global ecological capacity per capita. Global sustainability deficits are presented in Tables 1 and 2 and Figures 7 and 8. If a region's per capita footprint is less than 1.7 ha, then the global sustainability deficit is negative, which is denoted by a plus sign in Tables 1 and 2.

Table 1. Global Sustainability Deficit of Selected Countries[56]

	Ecological Footprint [gha/cap]	Global Sustainability Deficit [gha/cap]
Canada	8.8	-7.2
United Arab Emirates	10.1	-8.5
United States	9.7	-8.0
Australia	7.6	-5.9
Sweden	6.7	-5.1
Japan	4.8	-3.1
Ireland	5.3	-3.7
China	1.5	+0.1
India	0.8	+0.9
Bangladesh	0.5	+1.1
Global Average	2.3	**-0.6**
Global Availability	**1.7**	

Source: Deficit calculations are based on data from the *Living Planet Report 2002*.

Table 2. Global Sustainability Deficit by Region

Region	Ecological Footprint [gha/cap]	Global Sustainability Deficit [gha/cap]
North America	9.6	-7.9
Western Europe	5.0	-3.3
Central & Eastern Europe	3.7	-2.0
Latin America & Caribbean	2.2	-0.5
Middle East & Central Asia	2.1	-0.4
Asia - Pacific	1.4	+0.3
Africa	1.4	+0.3
Low Income Countries	0.8	+0.8
Middle Income Countries	2.0	-0.3
High Income Countries	6.5	-4.8
Global Average	**2.3**	**-0.6**
Global Availability	**1.7**	

Source: Deficit calculations are based on data from the *Living Planet Report 2002*.

56 The ecological footprint figures do not include space set aside to preserve biodiversity because they represent actual consumption patterns. The global availability (available land and sea area), however, assumes that 12% of ecologically productive space is set aside to preserve biodiversity, as recommended by the Brundtland Commission. In other words, the "availability" figure represents a target that accounts for the necessity to preserve biodiversity.

Figure 7. Global Sustainability Deficit of Selected Countries, 1999

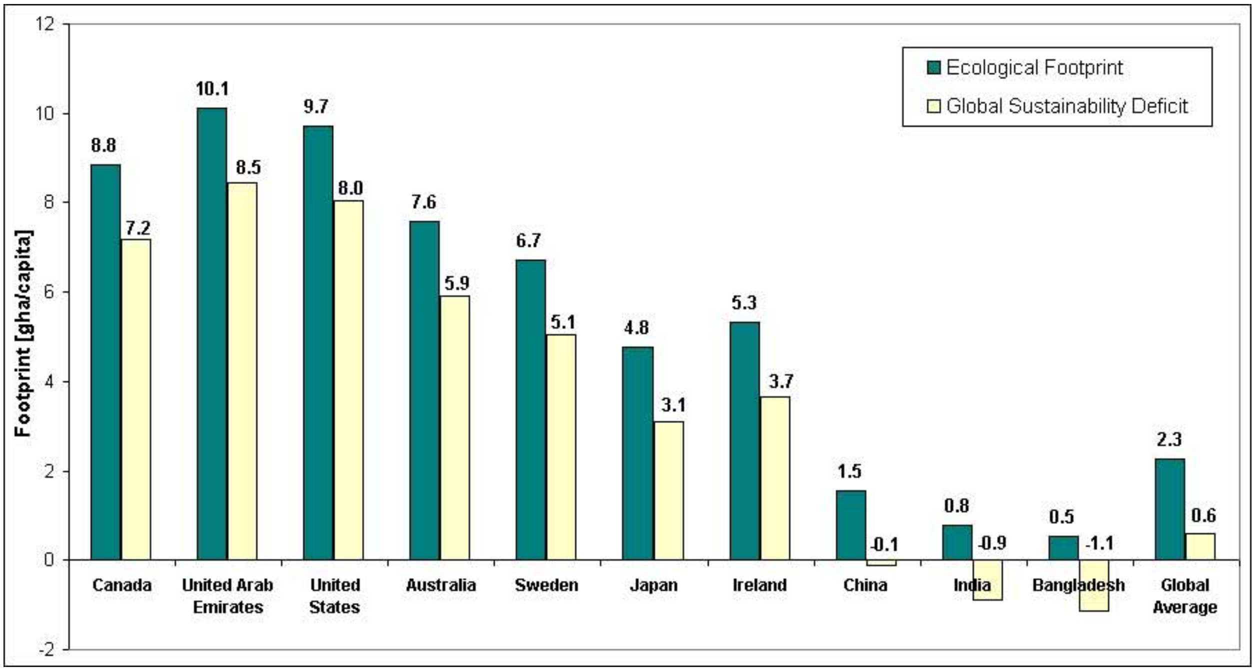
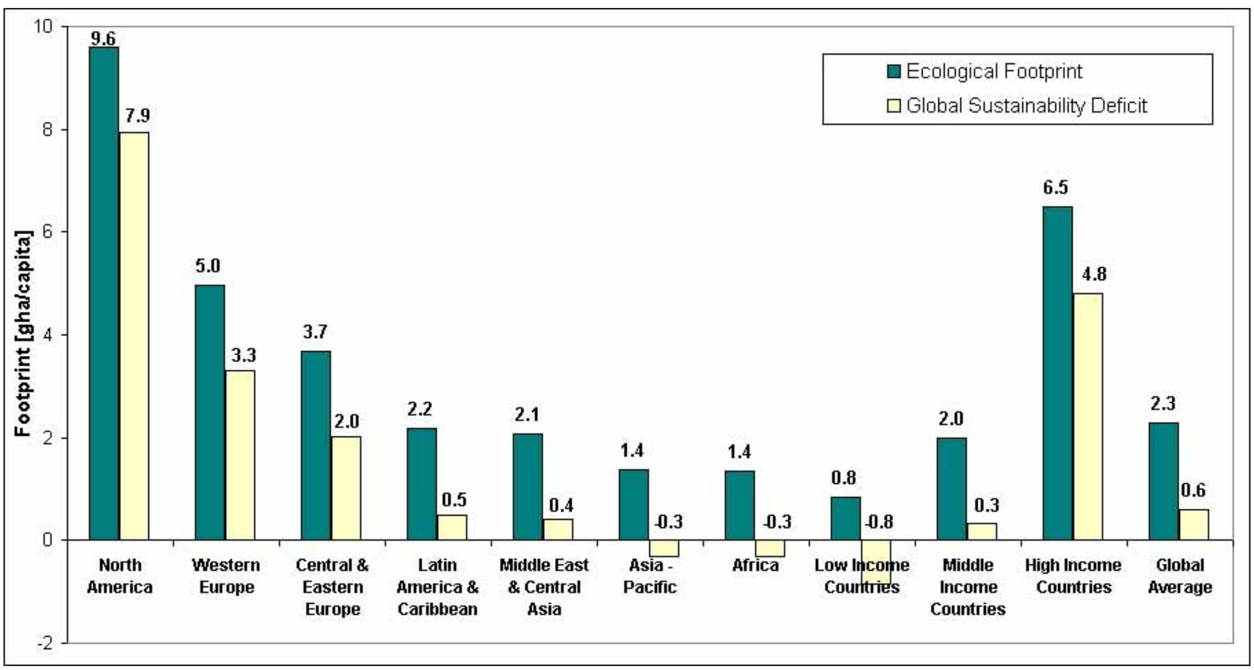


Figure 8. Global Sustainability Deficit by Region, 1999



Tables 1 and 2 and Figures 7 and 8 show that the lifestyle of the average Canadian, with a footprint of 8.8 ha per capita, is clearly not sustainable on a global scale, and requires that we are explicitly willing to allow millions of our fellow global citizens to live in poverty. As noted above, if everyone in the world had an ecological footprint as large as the average Canadian ecological footprint, it would require 4.6 planets Earth to sustain that level of consumption.

As seen in Table 1, Canada has a footprint size significantly greater than the 1.7 ha available per person that would ensure global sustainability. In other words, Canadians are consuming resources at a rate that is 5.2 times greater than what is sustainable from a global perspective. Only the United Arab Emirates and the U.S. have larger footprints and therefore larger global sustainability deficits than Canada. Out of seven regions listed in Table 2, North America has the largest average footprint at 9.6 ha/cap and the largest global sustainability deficit at –7.9 ha/capita. In other words, North Americans are consuming resources at a rate that is 5.65 times greater than what is globally sustainable.

8. Protected Areas

Ecological footprint analysis indicates the level of ecological deficit reduction that is needed, and it can point towards the actions required to reduce that deficit. An essential policy option recommended in *The Living Planet Report 2002* to help reduce the current ecological deficit is the conservation of natural and managed ecosystems in order to maintain ecological services. This would include, among other actions, the establishment and maintenance of networks of protected areas covering all terrestrial, freshwater, and marine ecosystem types.

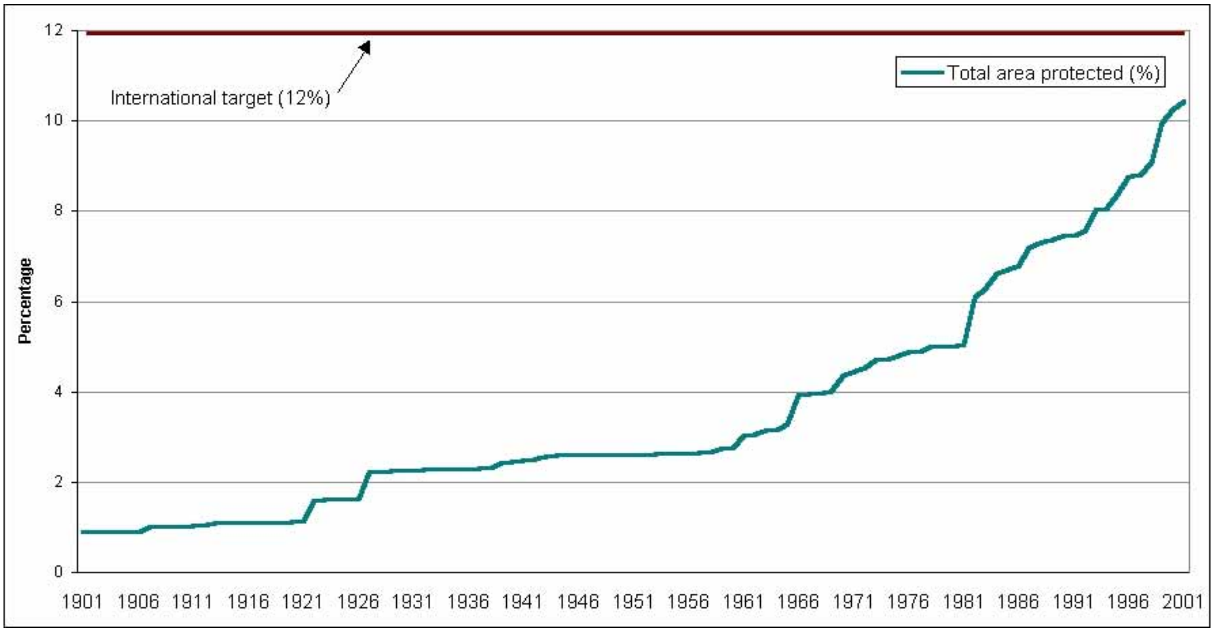
Figure 9 shows the proportion of protected areas in Canada as a percentage of total land area over a one hundred year period. While the steady increase seen since the 1970s is promising, the average percentage of protected land area in Canada in 2001 was 10.5% – still less than the 12% target recommended by the Brundtland Commission. Figure 10 shows the proportions of protected land by province in 2001.[57] Only Alberta, British Columbia, and the Yukon have more than 12% of their land area designated as protected. The remaining provinces are all below 12%. In PEI, only 4.2% of the province's total land area was under protection in 2001, according to international standards.

Some questions for Canadians:

- How much land area should Canadians set aside for protection?
- Why has Canada not yet met the 12% international target for protection recommended by the Brundtland Commission?
- Is the 12% minimum set-aside recommended by the Brundtland Commission really enough to maintain biodiversity and ecosystem health?
- In a country that is well-endowed with natural spaces and relatively sparsely populated in relation to total land mass, do we have an obligation to protect more?

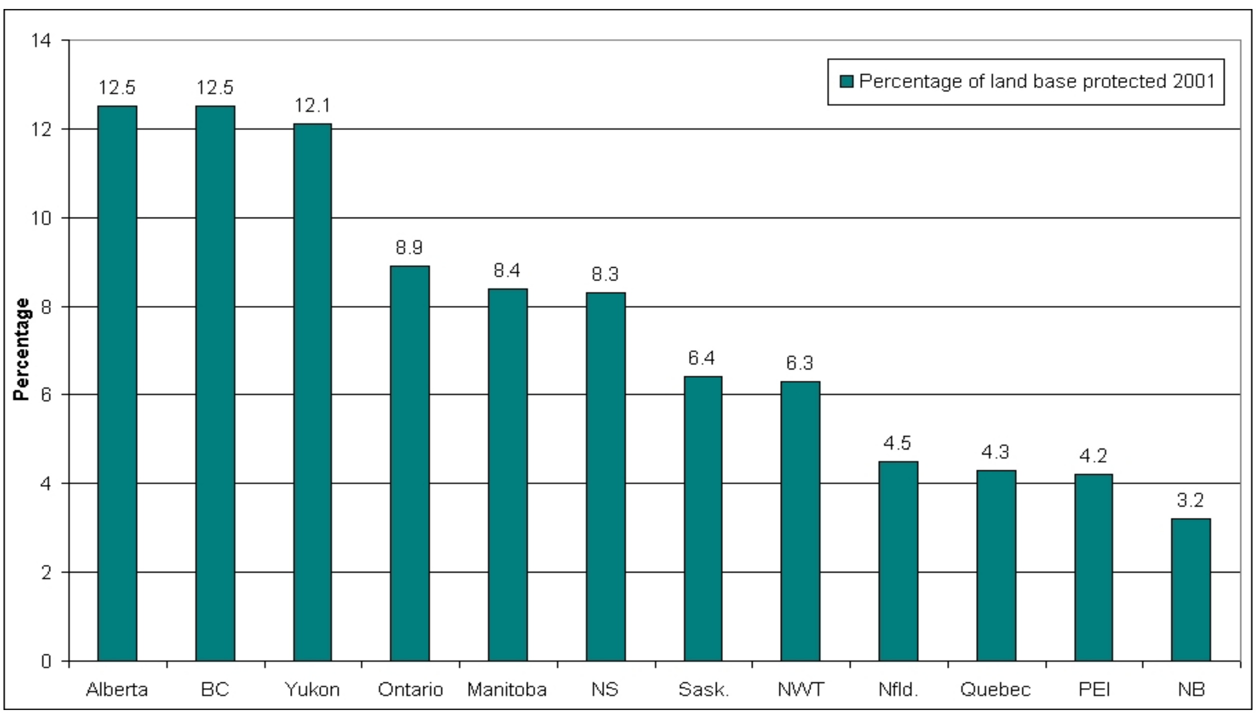
[57] All provincial governments signed on to the Endangered Spaces Campaign, a World Wildlife Fund initiative that ran from 1989 to 2000, and sought to ensure the completion of a protected network of Canada's terrestrial regions by the start of the new millennium. The goal of the campaign was to ensure that none of Canada's designated landscape and habitat types become extinct.

Figure 9. Proportion of Total Protected Land in Canada, as a Percentage of Total Land Area, 1901-2001



Source: Environment Canada (2003). *Environmental Signals. Canada's National Environmental Indicator Series 2003*. Available at http://www.ec.gc.ca/soer-ree/English/default.cfm. Based on data from the Canadian Council on Ecological Areas, Canadian Wildlife Service, Environment Canada.

Figure 10. Proportion of Total Protected Land by Province, 2001



Source: Government of British Columbia, State of Environment Reporting. *Across Canada Comparison of Protected Areas*. Available at: http://wlapwww.gov.bc.ca/soerpt/1protectedareas/gcomparison.html.

9. Summary: Exceeding Global Sustainability Limits

As indicated, sustainability from a global perspective requires that humanity live within the resources and waste assimilation capacity provided by an average of 1.7 hectares per global citizen. Yet the current average global ecological footprint of 2.3 hectares per person already exceeds this amount, and Canadians exceed the limit more than five-fold. We are currently able to maintain this ecological overshoot by:

- Depleting stocks of non-renewable natural capital;
- Depleting current ecological capacity in the form of renewable capital at the expense of future generations; and
- Appropriating the ecological carrying capacity of other places at the expense of those regions' populations.

PART III
THE PRINCE EDWARD ISLAND ECOLOGICAL FOOTPRINT

10. How Big is the Prince Edward Island Ecological Footprint?

The 1999 ecological footprints of Canada and Prince Edward Island are presented in Table 3. The area required to sustain Prince Edward Island resource use and waste production (total ecological footprint) in 1999 was 8.98 hectares per person.[58] This corresponds to the size of 11 football fields[59] or almost ten city blocks[60] per person.

Table 3. Ecological Footprint, Canada and Prince Edward Island, 1999

Canada: Footprint Area	Canada: Total Footprint [gha/cap]	Prince Edward Island: Footprint Area	Prince Edward Island: Total Footprint [gha/cap]
Food Footprint			
total arable land	2.16	total arable land	2.86
total pasture land	0.31	total pasture land	0.38
total sea	0.19	total sea	0.24
total food footprint	**2.66**	total food footprint	**3.49**
Other Crops Footprint			
total other crops footprint	**0.02**	total other crops footprint	**0.01**
Forest Footprint			
total forest footprint (excluding fuel wood)	**1.12**	total forest footprint (excluding fuel wood)	**0.93**
Energy Footprint			
residential energy use	0.82	residential energy use	0.73
commercial energy use	0.61	commercial energy use	0.45
industrial energy use	1.92	industrial energy use	1.69
transportation energy use	1.40	transportation energy use	1.44
total CO_2 absorption land	**4.74**	total CO_2 absorption land	**4.30**
Built-Up Footprint			
total built area footprint	**0.31**	total built area footprint	**0.26**
Total Ecological Footprint – Canada	**8.84**	**Total Ecological Footprint – Prince Edward Island**	**8.98**

Note: Numbers may not add to totals due to rounding.

[58] The 1999 Ecological Footprint estimate for Prince Edward Island is calculated based on differences in per capita disposable income and consumption expenditures between Canada and PEI. Because the most recent year for which a detailed footprint has been calculated for Canada is 1999, data for 1999 consumption patterns is used to adjust this footprint to PEI, and PEI footprint results in this report are for the year 1999 (with the exception of historical and projected trends which are calculated using 1999 as the base year). Calculation spreadsheets are available by contacting **GPI***Atlantic* at info@gpiatlantic.org.
[59] Assuming a Canadian football field size of 65x150 yards (0.815 ha).
[60] Assuming a typical city block size of 100,000 square feet (0.929 ha).

In 1999, Prince Edward Island had a population of 137,980, and a land area of 5,684.39 km^2 (568,439 hectares).[61] With an average per person footprint of 8.98 hectares, Prince Edward Islanders required 1,239,060 hectares of land to support their consumption levels in 1999. This means that the citizens of Prince Edward Island used the productive output of a land area 2.2 times larger than the geographical area of the province to sustain themselves.

To maintain their levels of consumption in 1999, Prince Edward Islanders not only used the ecological capacity from within their own province but appropriated additional ecological capacity elsewhere on the planet through trade of goods and services that are derived from natural capital.[62] In fact, if we look closely at the products Islanders consume, we will quickly see that the vast majority of materials from which these products are made come from outside the province. In order to maintain 1999 levels of consumption, Prince Edward Islanders therefore are dependent both on the natural capital of their own land base and, to a much larger extent, upon the resources and natural capital assets of other regions.

By maintaining a constant supply of goods, trade disguises the negative consequences of over-consumption and unsustainable resource use by transferring the impacts to other regions. Ecological footprint analysis exposes this discrepancy by attributing the consequences of a given population's consumption directly to that population, no matter where on the planet the impacts occur. For example, one can imagine a society that enjoys high material standards based on the knowledge industries and high-end service sector jobs, and that boasts excellent population health, high levels of education, and seemingly sustained growth in its manufactured capital and even natural capital stocks. By most standard national or provincial measures and criteria, this society would represent the essence of sustainability. However, if local gains in natural, economic, or social capital accumulation come at the expense of accelerating ecological damage and social disintegration elsewhere, then local prosperity comes at a cost to global sustainability.

The same is true in reverse. For example, the accelerated rate of forest harvesting and the loss of old forests in Canada are the consequence of the *global* demand for pulp, paper and other timber products. In this case Canadians are experiencing the local impacts of global consumption patterns, just as there are global impacts from our local consumption patterns. In short, ecological footprint analysis enables consumers to assess the impacts of their consumption patterns no matter where those impacts occur. This report therefore addresses the impact of consumption both locally, in Prince Edward Island, and globally, and thus provides a more complete picture of the consequences of PEI consumption habits and demands than natural resource accounts for the Island alone could provide.

Sustainability requires that human activity remain within the carrying capacity of nature. It was noted earlier that dividing all the biologically productive land and sea on this planet by the human population results in an average of 1.9 hectares per person. It was also noted that setting aside 12% of the ecologically productive land for biodiversity preservation, as recommended by the Brundtland report, shrinks the available bioproductive space per person from 1.9 hectares to

[61] **Population:** Statistics Canada, Cansim II, Table 051-0001: Estimates of population, by age group and sex, Canada, provinces and territories, annual. **Land area:** Statistics Canada (2001). *Land Area in Square Kilometres, 2001*. Available at: www.statcan.ca. Square kilometres are converted to hectares by multiplying by 100.
[62] Wackernagel et al. (1999). See footnote 8.

just under 1.7 hectares. The ecological footprint can function as a benchmark of sustainability by comparing the actual per capita consumption of a defined population with the global per capita share of 1.7 ha. Consumption in excess of 1.7 ha per capita (sustainability deficit) implies that a particular population is using resources and services at an unsustainable rate.

Tables 1 and 2 (Chapter 4 above) show that the lifestyle of the average Prince Edward Islander, with a footprint of 8.98 ha per capita, is clearly not sustainable on a global scale, unless Islanders are explicitly willing to allow millions of their fellow global citizens to live in poverty. PEI has a footprint size significantly greater than the 1.7 ha available per person that would ensure global sustainability. PEI, in fact, has a global sustainability deficit of 7.3 ha per capita. In other words, Islanders are consuming resources at a rate that is over five times greater than what is sustainable from a global perspective.

11. How Does Prince Edward Island Compare to Canada?

Prince Edward Island's ecological footprint of 8.98 ha per person is 1.6% larger than the Canadian ecological footprint of 8.84 ha per person. Table 3 and Figure 11 show that Prince Edward Islanders have a 31% larger per capita food footprint than the Canadian average. Islanders consume more fish, seafood, meat, fats and oils, and sugars and sweeteners than the Canadian average. All of these foods have high footprint intensities. PEI's other crops footprint, built area footprint, energy footprint, and timber footprint are all smaller than the Canadian average.

Figure 11. Ecological Footprints of Prince Edward Island and Canada, 1999

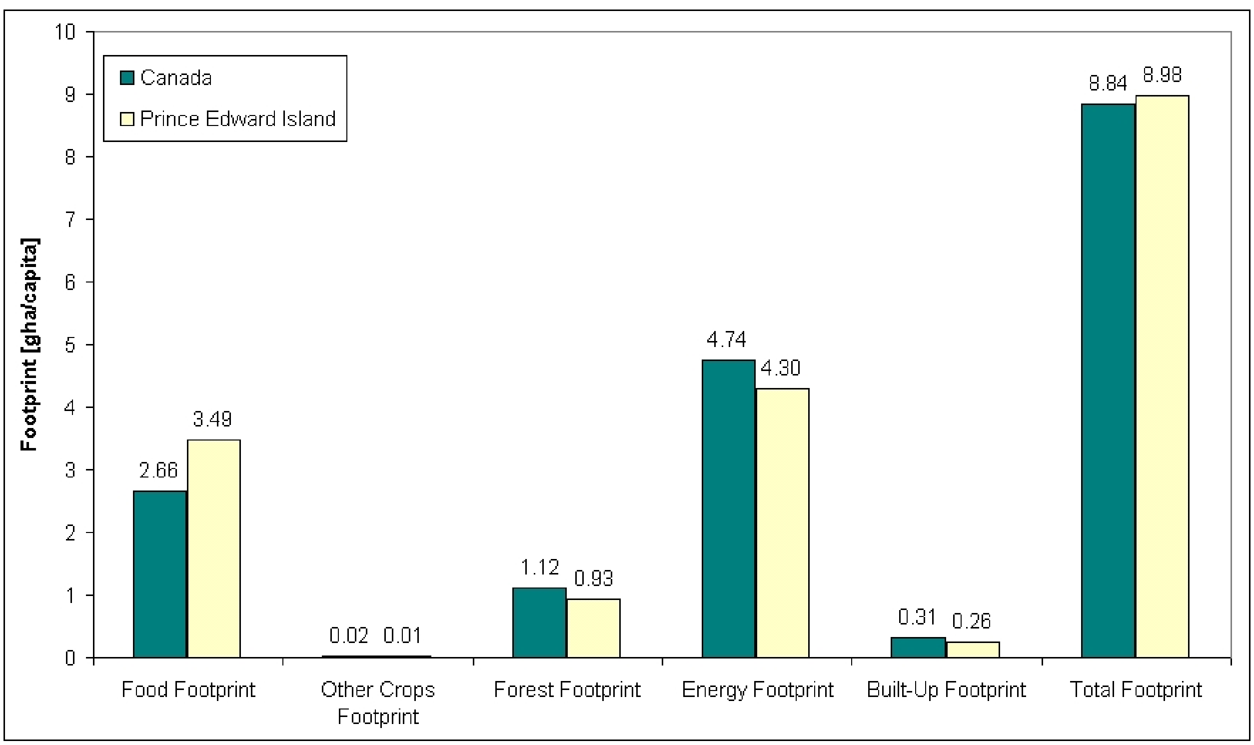


Table 4. Prince Edward Island and Canada: Income, Consumption and Footprint

	Prince Edward Island	Canada	Prince Edward Island vs. Canada
Average household income before tax (C$2002)	$38,323	$48,010	20% less
Average per person income before tax (C$2002)	$14,627	$18,609	21% less
Disposable income per person (C$2002)	$15,730	$18,943	17% less
Consumption per household (C$2002)	$27,664	$33,264	17% less
Consumption per person (C$2002)	$10,559	$12,893	18% less
Per capita energy demand (gigajoules/year)	165	232	29% less
CO_2 equivalent emissions per capita (tonnes)	21.4	22.7	5.7% less
Vehicles per capita	0.66	0.80	18% less
Ecological Footprint (gha/capita)	8.98	8.84	1.6% more

Note: CO_2 equivalent emissions per capita are 2000 estimates. Motor vehicles per capita are based on 2002 motor vehicle registrations. Ecological footprint estimates are based on 1999 data. All other values are for 1998. Dollar values were converted to constant 2002 dollars using Statistics Canada's Consumer Price Index.

Sources: **Population**: Statistics Canada, Cansim Matrix 6367-6377. **Income, consumption, household size**: Statistics Canada (2000). *Spending Patterns in Canada 1998*. Catalogue No. 62-202-XPE. **Consumer price indices**: Statistics Canada Cansim II, Table 326-0002: Consumer price index (CPI), annual. **Energy demand**: Statistics Canada Cansim II, Table 128-0002: Supply and demand of primary and secondary energy; Total primary and secondary energy; Energy use, final demand. **CO_2 emissions**: Natural Resources Canada (1999). *Canada's Emissions Outlook: An Update*. Available at: http://www.nrcan.gc.ca/es/ceo/update.htm. **Motor vehicles**: Statistics Canada Cansim II, Table 405-0004: Road motor vehicles, registrations, annual.

As indicated in Table 4, Prince Edward Island's per capita and per household income, per capita and per household consumption, per capita energy use, and per capita greenhouse gas emissions are all less than the Canadian averages (by between 5.7% and 29%). Yet Prince Edward Island's per capita ecological footprint is 1.6% larger. This is primarily due to differences in the food and energy footprints discussed below.

If the ecological footprint is largely a consumption issue and per capita average consumption in Prince Edward Island is 18% lower than the Canadian average, why is the average PEI ecological footprint 1.6% greater than the average Canadian ecological footprint? In addition to the overall quantity of consumption, two other very important consumption and production patterns affect the size of a region's ecological footprint:

What is being consumed?
Which *technologies* are in use?

What is being consumed?

When an individual makes a consumption choice, alternative forms of the product or service being consumed often exist, which may have differential environmental impacts and thus increase or decrease an ecological footprint. For example, coal is much more carbon intensive than hydroelectricity; organic and locally grown foods are less degrading to nature and less energy-intensive than foods imported and transported from far distances and grown with large chemical and energy inputs such as fertilizers, pesticides, and heavy machinery. There are also fuel-efficient car models, alternative transportation options, and energy saving household appliances on the market that allow reductions in a household's energy footprint. Choosing to live in a single detached home as opposed to a home in a multiple unit complex, and making choices such as turning the heat down at night or insulating the attic can significantly affect household energy use. Consumption "choices" therefore influence the impact that our levels of consumption have on our overall ecological footprint.

These choices are even more significant at a societal level. For example public investment in mass transit and integrated land use/transportation planning, rather than public dollars spent on roads and highway construction, can substantially reduce a society's transportation footprint. Thus, planning policies that encourage the revitalization of urban centres rather than policies that encourage suburban and ex-urban sprawl can have a significant impact on footprint size. In fact, without such "societal" choices to support more sustainable household consumption practices, it becomes difficult for households to reduce their footprints to sustainable levels. Existing patterns of automobile dependence, urban sprawl, dependence on non-renewable energy sources, and reliance on imported foods and consumer items hamper even the most dedicated individual efforts to reduce our personal ecological footprint.

Prince Edward Island and Canadian energy sources

PEI's energy footprint makes up almost 48% of the Island's total ecological footprint. A significant factor influencing PEI's ecological footprint size compared to that of Canada is the source of energy used in PEI. Although Prince Edward Islanders consume 29% less energy per person than the Canadian average, the PEI per person energy footprint is only 9% less than the Canadian average. The reason for this is PEI's heavy dependence on residential heating oil and commercial and industrial heavy fuel oil, both of which have a more substantial impact on the environment than hydroelectricity, for example. However, it should be noted that hydroelectricity is not a practical option in PEI.

On a per capita basis, Prince Edward Islanders use over six times the Canadian average residential heating oil and less than half the Canadian average residential electricity. The ecological footprint for 100 Gigajoules per year of energy derived from petroleum-based fossil fuels is more than 1 ha compared to just 0.1 ha for the same amount of hydroelectricity. The difference in energy intensity is accounted for in the ecological footprint analysis using conversion ratios for different fuel sources (Table 5).[63]

Switching to renewable energy sources can dramatically reduce the energy footprint. Solar, wind, biomass, and hydrogen fuel cell energy have virtually no ecological footprint. National Energy Board projections show, however, that the use of renewable energy as a percentage of

[63] The footprint conversion ratios are based both on the land required to sequester the carbon emitted by the fuel source and on the built-up land required to support the energy type. Further explanation of the footprint conversion ratios is available in Wackernagel and Rees (1996. See footnote 7 above).

overall end use energy consumption in Atlantic Canada is expected to increase only marginally from 10.8% in 1996 to 13.2% in 2025 (see Table 6).

The popularity of wood for space heating in Atlantic Canada, and the use of hog fuel and pulping liquor as energy sources in the pulp and paper industry, account for the relatively large proportion of renewable fuels consumed in the region. Nevertheless, a dramatic decrease in the energy footprint will require an energy mix that includes a significant increase in renewable energy sources to accompany a substantial decrease in dependence on petroleum-based fossil fuels.

Table 5. Footprint Conversion Ratios for Fuel Source

Energy Type	Gigajoules [ha/capita] ratio
Coal consumption	0.0178
Liquid fossil fuel consumption	0.0137
Fossil gas consumption	0.0105
Nuclear energy consumption (thermal)	0.0137
Energy embodied in net imported goods	0.0137
Hydroelectricity consumption	0.0010

Source: Wackernagel and Rees (1996). *Our Ecological Footprint: Reducing Human Impact on the Earth*.

Table 6. Projected Renewable Energy Use for Atlantic Canada

	1996	2000	2005	2010	2015	2020	2025
Steam (petajoules)	4.8	4.1	3.1	1.9	2.0	2.1	2.0
Hog Fuel, Pulping Fuel, Wood (petajoules)	66.2	70.6	70.7	71.8	72.9	74.2	74.4
Solar	-	-	-	-	-	-	-
Percent of total end use energy consumption	10.8%	11.5%	12.2%	13.2%	13.4%	13.1%	13.2%

Source: National Energy Board (1999). *Canadian Energy Supply and Demand to 2025*.

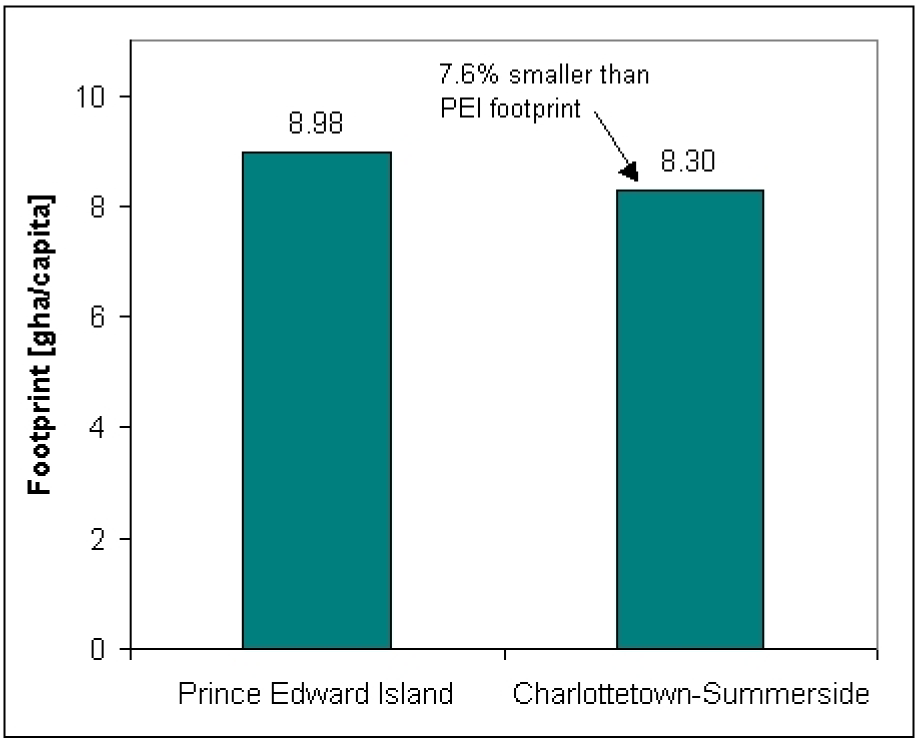
Technologies in use

Similarly, different technologies can substantially influence footprint size, beyond what might be indicated by a simple societal comparison of per capita consumption. The level and type of technology used in food production, wood harvesting, building design, and manufacturing will help determine a population's footprint size. Energy, for example, can be derived from petroleum, coal, natural gas, windmills, biomass, solar panels, or fuel cells, all of which have very different impacts on the environment. Denmark's increasing reliance on wind energy will reduce that country's ecological footprint even if total energy consumption does not drop.

12. The Charlottetown-Summerside Ecological Footprint

Charlottetown-Summerside's ecological footprint is 8.30 hectares per person (over ten football fields, or almost nine city blocks[64]), 7.6% smaller than the PEI average footprint of 8.98 ha per person (Figure 12). The citizens of Charlottetown-Summerside require an area of 618,831 hectares to satisfy current consumption levels.[65] This is 1.1 times the area of the entire province, and 6.8 times larger than the area occupied by the population of Charlottetown-Summerside (915km^2 or 91,500ha).[66] Cities are able to prosper by appropriating the carrying capacity of an area vastly larger than the spaces they physically occupy (Table 7). Cities appropriate the life support functions of distant regions all over the world both through trade and by exploiting the environmental commons.[67, 68]

Figure 12. Ecological Footprints of Charlottetown-Summerside and Prince Edward Island, 1999



[64] Assuming a Canadian football field size of 65x150 yards (0.815 ha) and a typical city block size of 100,000 square feet (0.929 ha).
[65] Calculated using a total Charlottetown-Summerside population of 74,558 (Charlottetown population = 58,358; Summerside population = 16,200). Statistics Canada 2001 Census, Population, Dwellings and Geography Data tables. Available at: http://www12.statcan.ca/english/census01/products/standard/popdwell/tables.cfm.
[66] Statistics Canada (2001). *Land Area in Square Kilometres, 2001*. Available at: www.statcan.ca. The total land area (915 km^2) is derived by adding the land area for Charlottetown (823 km^2) and Summerside (92 km^2). Square kilometres are converted to hectares by multiplying by 100.
[67] Folke, C., Jansson, Å., Larsson, J. and Costanza, R.1997. Ecosystem Appropriation by Cities. *Ambio*, **26(3)**, 167-172.
[68] Onisto et al. (1998). See footnote 10.

Table 7. Ecological Footprint of Cities

Region	Area Occupied By Population	Land Area Required To Sustain Population
Charlottetown-Summerside	915 km^2	6.8 times area of city
Halifax Regional Municipality	5,580 km^2	5 times area of city
Toronto	630 km^2	287 times area of city
London, England	1,580 km^2	125 times area of city
Santiago, Chile*	900 km^2	300 times area of city
Largest 29 cities of Baltic Europe	1% of Baltic Sea drainage basin	75% to 1.5 times the whole Baltic Sea drainage area

* Santiago metropolitan area contains 791,581 ha of which 701,619 ha are ecologically protected and not occupied by the population. Therefore the ecological footprint is assessed only for the non-protected portion of Santiago.

Sources: **Charlottetown-Summerside**: calculated by adjusting the PEI ecological footprint based on differences in consumption and expenditures between Charlottetown-Summerside and PEI. **Halifax Regional Municipality:** Angus Schafenburg, Halifax Regional Municipality Planning Services Office, personal communication, 2000. The HRM footprint is calculated based on income and consumption patterns in Statistics Canada's *Family Expenditure in Canada* and *Canadian Statistics, Households*. Available at: www.statcan.ca. **Toronto:** Onisto et al., (1998. See footnote 10 above). **London:** Green Channel, 2000. *Reducing London's Ecological Footprint*. Available at: www.greenchannel.com. **Santiago de Chile:** Wackernagel (1998. See footnote 26 above). **Largest 29 cities of Baltic Europe**: Folke et al. (1997. See footnote 67 above).

Cities can, however, contribute significantly towards the overall sustainability of a region. This is possible because the high-density populations of cities offer the potential for more efficient land and infrastructure use as well as reduced transportation and residential heating requirements. In contrast to the potential footprint savings that cities offer, there tends to be a greater concentration of wealth with a corresponding greater amount of consumption in urban centres, which partly offsets ecological footprint gains due to economies of scale. The Charlottetown-Summerside ecological footprint, for example, is 8.3 hectares, 7.6% smaller than the provincial average ecological footprint per person. Charlottetown-Summerside's per capita consumption is 11% less than the Canadian average, but is 9.5% greater than the provincial average, so there is some ecological offset produced by the efficiencies of higher density living (Table 8).

In urban areas, larger populations can more easily support public transportation options. It is also far easier to implement policies that discourage personal vehicle use, such as high occupancy vehicle lanes, high parking costs and user-pay roads. Annual transit ridership in Canada has been increasing since 1998, reaching 1.5 billion in 2000, with service available to approximately 95% of urban residents and 61% of the 30 million residents of Canada.[69] However, transit usage (passenger trips per capita) has not kept pace with population growth over the years. In Prince Edward Island, only 0.2% of Charlottetown residents and 0.1% of Summerside residents use public transportation as a mode of transportation to work, in comparison to the Canada metropolitan area average of 10.5% (Figure 13). However, there is no significant public transportation in PEI, compared to other metropolitan areas in Figure 13.

[69] Transport Canada (2002). *Urban Transport in Canada: Taking Stock*. Available on the Transport Canada web site: http://www.tc.gc.ca/programs/environment/urbantransportation/transitstudies/urban.htm.

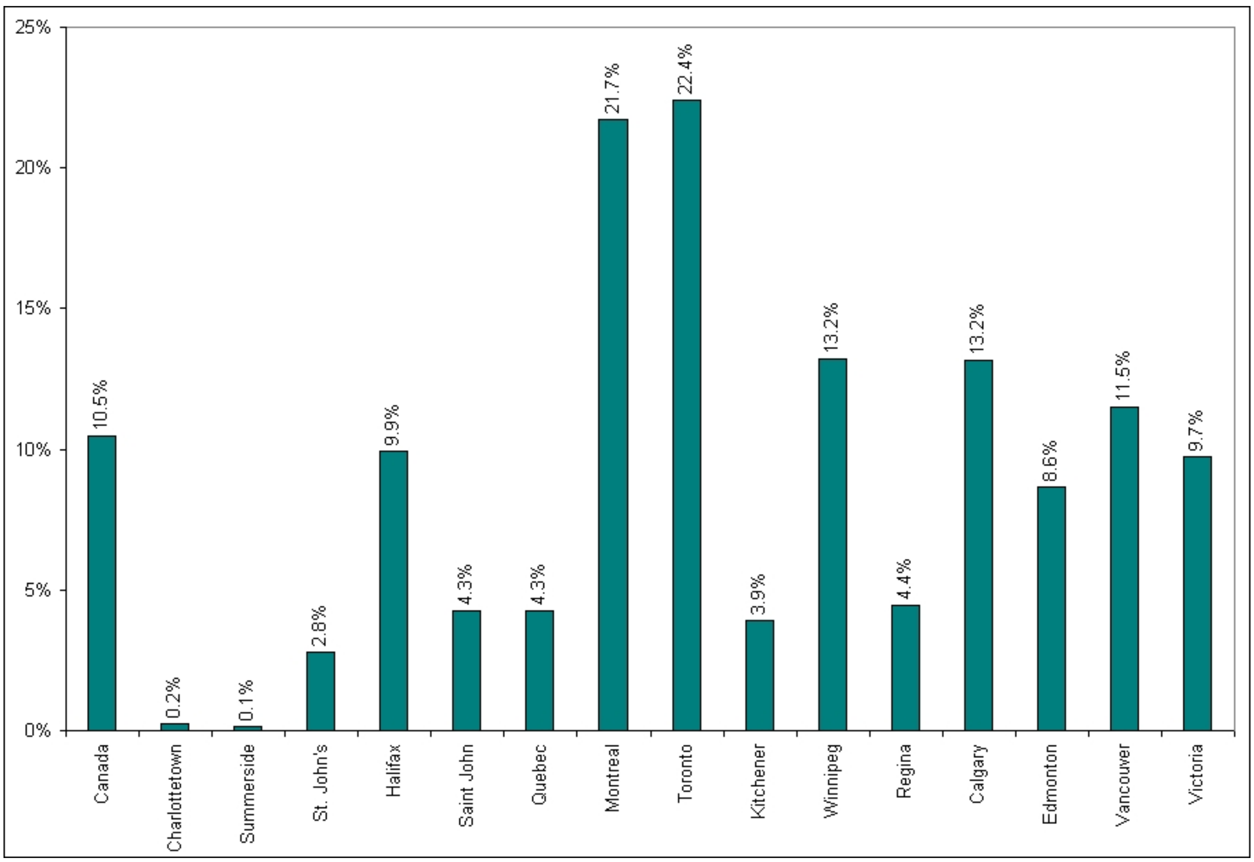
High-density housing and typically smaller homes found in urban areas reduce residential energy requirements. The higher density population also makes it easier to implement other sustainability initiatives such as compost and recycling programs that can sharply reduce pressure on landfills.[70] In short, the economics of scale in urban areas potentially allow considerably smaller ecological footprints than in more rural areas. Unfortunately, the trend toward suburban and ex-urban sprawl in urban centres impedes the ability to realize these potential footprint reductions and efficiencies.

Table 8. Ecological Footprint and Consumption Expenditure for Canada, Prince Edward Island, and Charlottetown-Summerside, 1999

	Canada	Prince Edward Island	Charlottetown-Summerside
Consumption (C$2002/capita)	$12,893	$10,559	$11,562
Ecological Footprint (ha/capita)	8.84	8.98	8.30

Source: **Consumption**: Statistics Canada (2000). *Spending Patterns in Canada 1998*. Catalogue No. 62-202-XPE.

Figure 13. Metropolitan Area Public Transit Use in Commuting to Work, 2001



Source: Statistics Canada, 2001 Census, Commuting to Work. Catalogue No. 97F0015XCB01002.

[70] For more information on the ecological footprint of cities please see Rees, W. (1997). "Is Sustainable City an Oxymoron?" *Local Environment,* **2**, 303-310.

13. Not All Prince Edward Islanders Have Equal Footprint Sizes

Not everybody in Prince Edward Island has the same footprint size. Although the average footprint is large, there is considerable income disparity in the province, which is reflected in different consumption patterns and footprint sizes. In order to assess the difference between the ecological footprints of higher and lower income Islanders, the average individual (per capita) disposable incom[71] of each income quintile[72] in Prince Edward Island has been adjusted according to the average Canadian individual consumption level by quintile.[73, 74] Because the ecological footprint is a function of consumption patterns, which in turn vary according to income, this method is a reasonable proxy that can be used to adjust the average provincial footprint for different income groups.

Table 9 and Figure 14 show that the poorest 20% of Prince Edward Islanders (1st quintile) consumed about 15% less energy, food, and other goods than the average Islander in 1999, while the richest 20% consumed about 27% more. Assuming consumption is proportional to ecological footprint, it can be estimated that the poorest 20% of Prince Edward Islanders had a footprint of 7.63 ha per person while the wealthiest 20% of Islanders had a footprint of 11.4 ha per person. This means that the average wealthy Islander had almost one and a half times the impact on the environment of the average low-income Islander. Although their footprint is larger, wealthy Prince Edward Islanders, by having greater spending options, have more potential control over consumption choices that affect ecological footprint size.

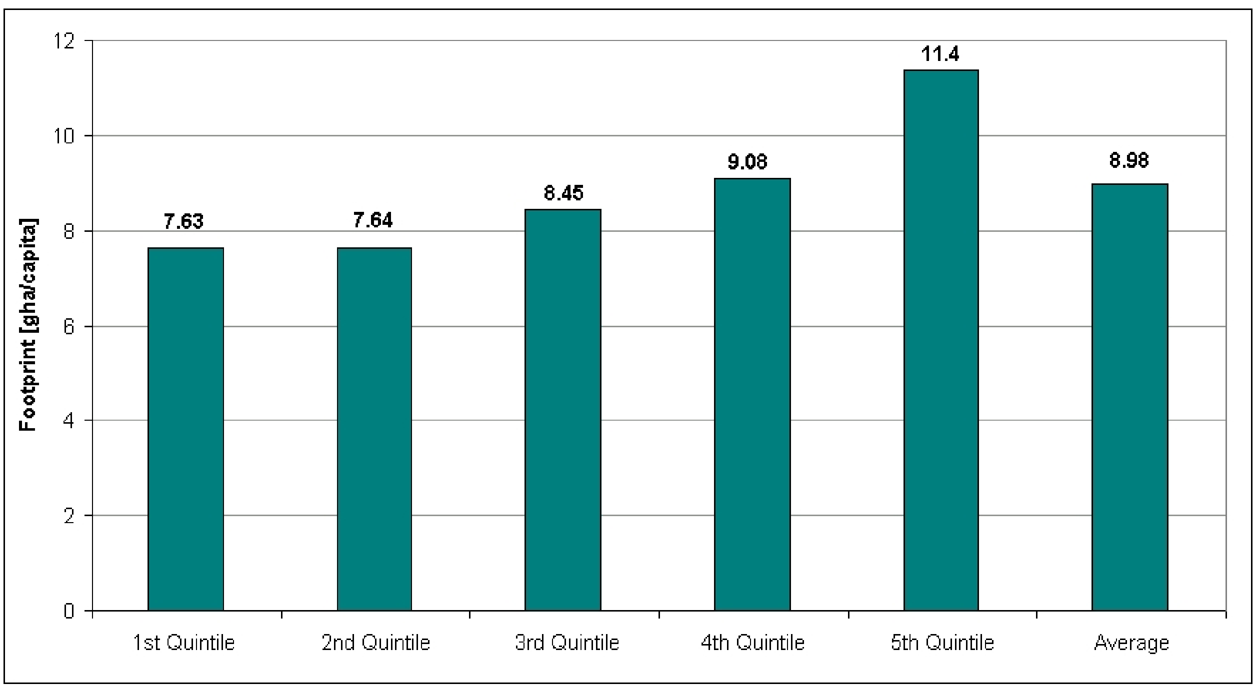
[71] "Disposable income" is the amount of income left over after income taxes and social security contributions have been paid. This is different from total income, which is calculated before income taxes are deducted. Disposable income statistics are reported by Statistics Canada on a per household basis. Individual disposable income was calculated using the average number of people per household by quintile. Using household size by quintile data provides for the difference in household size by income group.
[72] 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 groups. Thus the bottom one-fifth of incomes is referred to as the "first quintile," the top one-fifth as the "fifth quintile," and the middle 20% of incomes as the "third quintile."
[73] "Consumption" refers to expenses incurred for food, shelter, household operations, household furnishings and equipment, clothing, transportation, health care, personal care, recreation, reading materials, education, tobacco products and alcoholic beverages, games of chance, and a miscellaneous group of items. Consumption statistics are also reported by Statistics Canada on a per household basis. Individual consumption was calculated using the average number of people per household by quintile.
[74] Data sources: Statistics Canada (2000). *Income in Canada, 1998*. Catalogue No. 75-202-XIE; Statistics Canada (2000). *Spending Patterns in Canada, 1998*. Catalogue No. 62-202; and Statistics Canada Cansim II, Table 326-0002: Consumer Price Index. Detailed calculation spreadsheets are available by contacting **GPI***Atlantic* at info@gpiatlantic.org.

Table 9. Prince Edward Island Ecological Footprint by Income Quintile, 1999

	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile	Average
Average household size, Canada	1.60	2.23	2.63	3.06	3.37	2.58
Per capita consumption, Canada (C$2002)	$9,022	$10,296	$11,906	$13,141	$17,034	$12,893
Per capita disposable income, Canada (C$2002)	$5,713	$8,987	$11,581	$14,547	$23,182	$14,129
Ratio of consumption per capita to disposable income per capita, Canada	1.58	1.15	1.03	0.90	0.73	0.91
Per capita disposable income, PEI (C$2002)	$7,250	$10,007	$12,330	$15,084	$23,227	$14,766
PEI consumption based on Canadian ratio of consumption to disposable income (C$2002/capita)	$11,448	$11,465	$12,676	$13,626	$17,067	$13,475
Ecological Footprint (ha/capita)	**7.63**	**7.64**	**8.45**	**9.08**	**11.4**	**8.98**

Sources: Statistics Canada (2000). *Income in Canada, 1998*. Catalogue No. 75-202-XIE; and Statistics Canada (2000). *Spending Patterns in Canada, 1998*. Catalogue No. 62-202. Dollar values were converted to constant 2002 dollars using Statistics Canada's Consumer Price Index.

Figure 14. Ecological Footprint by Income Quintile, Prince Edward Island, 1999



14. Ecological Footprint – A 40 Year Perspective

Using 1999 as the base year, the ecological footprints for Canada and Prince Edward Island were calculated for 1981-1998 and 2000. To construct this timeline, the food, forest, and other footprints were adjusted for changes in consumption expenditures, the built-up footprint was adjusted for changes in population, and the energy footprint was adjusted for changes in energy demand over this period. The assumptions underlying these adjustments are described below:

1) Based on the assumption that consumption is proportional to ecological footprint, as noted in the previous section, historical data on average disposable income were adjusted to reflect changes in consumption levels, based on a four-year average ratio of consumption to disposable income. One reason this adjustment to the income data is necessary is that there is likely to be a higher rate of savings at higher levels of disposable income, whereas at lower levels, households are likely to spend a higher portion of their incomes. Because historical consumption expenditure data are not available prior to 1997,[75] consumption data for 1997-2001 were used to adjust the available historical disposable income data to reflect consumption expenditures for both Canada and PEI. The adjusted disposable income data were then used to adjust the 1999 food, other crop, and forest footprints, according to the difference between adjusted per capita disposable income in 1999 and each respective year.[76]
2) Assuming that population is proportional to built-up area footprint, the built-up area footprints were calculated based on the difference between the population in 1999 and each respective year.[77]
3) Assuming that per capita energy demand is proportional to energy footprint, historical per capita energy demand data were used to adjust the 1999 energy footprint according to the difference between per capita energy demand in 1999 and each respective year.[78]
4) The above data were then combined to estimate the Canadian and Prince Edward Island footprints for each year.

As indicated in Table 10, Prince Edward Island's total ecological footprint grew between 1981 and 2000 by 65%, increasing from 5.79 hectares per capita to 9.53 hectares per capita. During

---

[75] Until 1996, the *Family Expenditure Survey* was held every four years. Beginning with the 1997 reference year, a new annual survey, the *Survey of Household Spending*, was conducted. The *Survey of Household Spending* has a sample size approximately 50% larger than that of the *Family Expenditure Survey*. The number of questions about household spending in the *Family Expenditure Survey* is considerably lower than in previous surveys, with the result that, for some expenditure categories, less detailed information is presented. Therefore, data from the *Survey of Household Spending* and the *Family Expenditure Survey* are not directly comparable. In order to use the most up-to-date consumption data for this report, 1997-2001 consumption data for both Canada and PEI were used to calculate a four-year average ratio of consumption to disposable income which was then applied to historical disposable income data for Canada and Prince Edward Island.
[76] Data sources: Statistics Canada Cansim II, Table 384-0012: Sources and disposition of personal income; Personal disposable income. Statistics Canada, Cansim II, Table 203-0001: Household current consumption. Individual consumption was calculated from household consumption using the average number of people per household. Detailed calculation spreadsheets are available by contacting **GPI***Atlantic* at info@gpiatlantic.org.
[77] Statistics Canada, Cansim Matrix 6967-6977.
[78] Statistics Canada, Cansim II, Table 128-0002: Supply and demand of primary and secondary energy; Total primary and secondary energy; Energy use, final demand. Detailed calculation spreadsheets are available by contacting **GPI***Atlantic* at info@gpiatlantic.org.

the same period the Canadian ecological footprint grew by 32% from 6.97 hectares per capita to 9.18 hectares per capita. The food and "other footprint" (which includes the other crop, forest, and built-up footprints) categories, representing general purchases and overall consumption levels, saw the greatest increase between 1981 and 2000. PEI's food footprint increased by 135% and PEI's other footprint grew by 91% between 1981 and 2000. The Canadian food and other footprints increased by 115% between 1981 and 2000.

Table 10. Percentage Increases in Footprint Size, Prince Edward Island and Canada, 1981-2000

	Prince Edward Island	Canada
Energy Footprint	29%	0%
Food Footprint	135%	115%
Other Footprint (other crop, forest, and built-up area footprints)	91%	115%
Total Ecological Footprint	**65%**	**32%**

Table 11 and Figure 15 reveal that Prince Edward Island's ecological footprint was highest in 2000 with a total footprint of 9.53 hectares per person. In 1981, PEI's energy footprint made up 3.57 hectares per capita, or 62% of the total ecological footprint per person. In 2000, PEI's energy footprint of 4.59 hectares per capita was 48% of the Island's total ecological footprint per person. In 1981, Canada's energy footprint of 4.86 hectares per capita made up 70% of the national average total ecological footprint per person. The Canadian ecological footprint reached its highest level in 2000 with a footprint of 9.18 hectares per capita including an energy footprint of 4.86 hectares per capita, or 53% of the total ecological footprint per person (Table 11 and Figure 16).

Table 11. Historical Ecological Footprint Highlights

Prince Edward Island

	1981	2000	Smallest footprint	Largest footprint
Energy Footprint	3.57	4.59	3.16 (1983)	4.59 (2000)
Food Footprint	1.57	3.68	1.57 (1981)	3.68 (2000)
Other Footprint (other crop, forest, and built-up area footprints)	0.66	1.26	0.66 (1981)	1.26 (2000)
Total Ecological Footprint	**5.79**	**9.53**	**5.79 (1981)**	**9.53 (2000)**

Canada

	1981	2000	Smallest footprint	Largest footprint
Energy Footprint	4.86	4.86	4.41 (1983)	4.86 (2000)
Food Footprint	1.31	2.81	1.31 (1981)	2.81 (2000)
Other Footprint (other crop, forest, and built-up area footprints)	0.71	1.52	0.71 (1981)	1.52 (2000)
Total Ecological Footprint	**6.97**	**9.18**	**6.77 (1983)**	**9.18 (2000)**

Figure 15. Historical Ecological Footprints, Prince Edward Island, 1981-2000

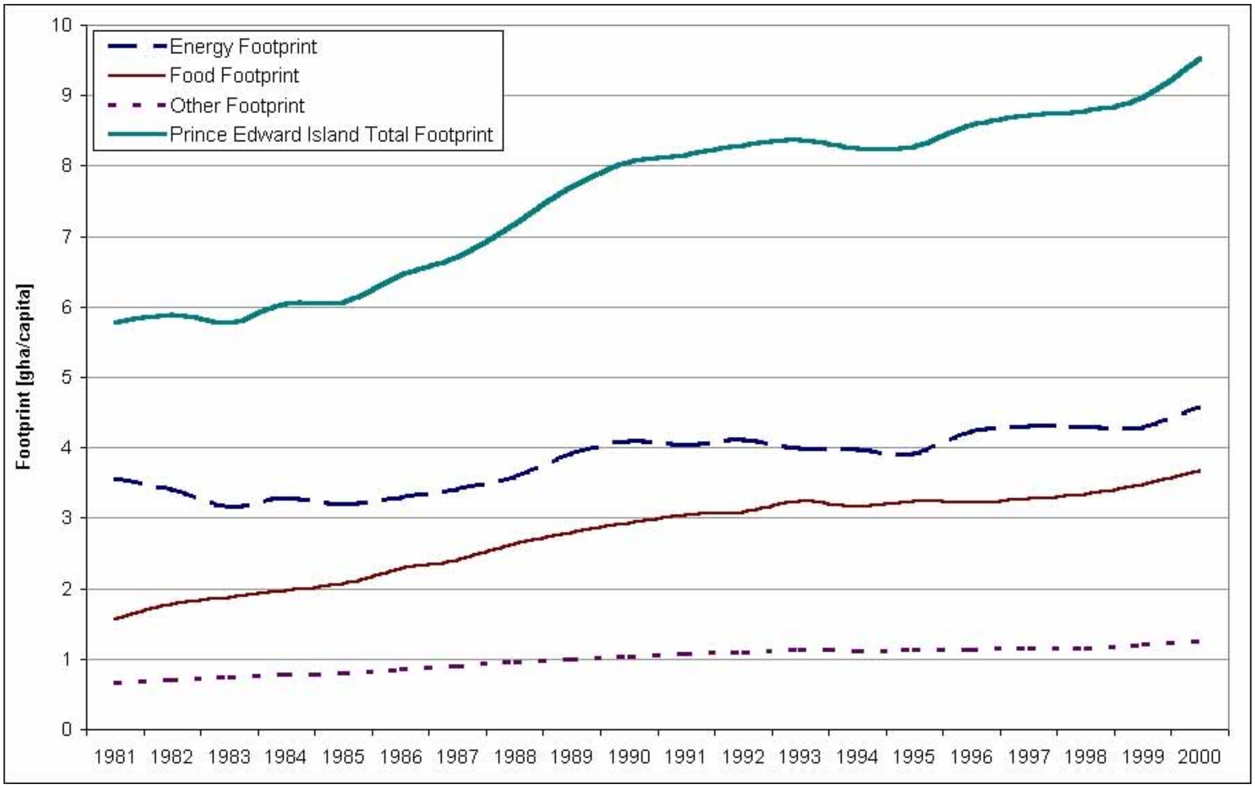
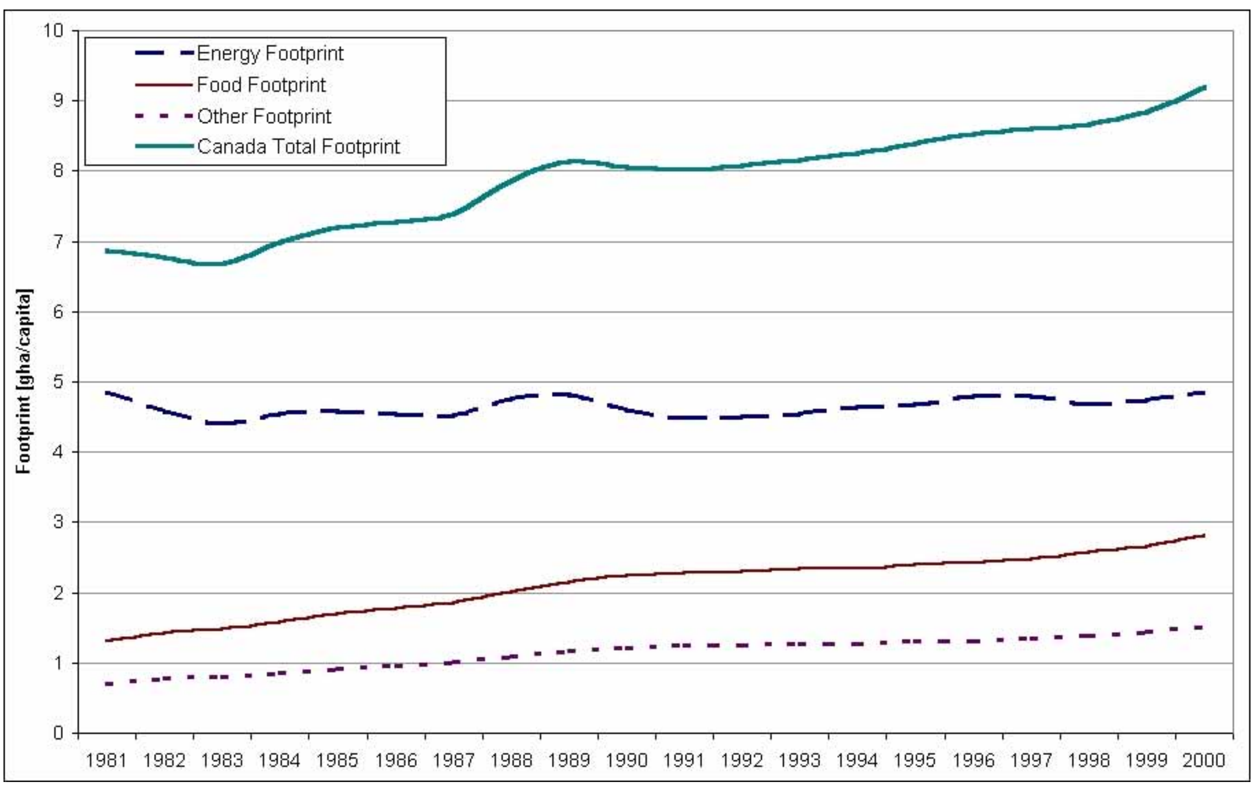


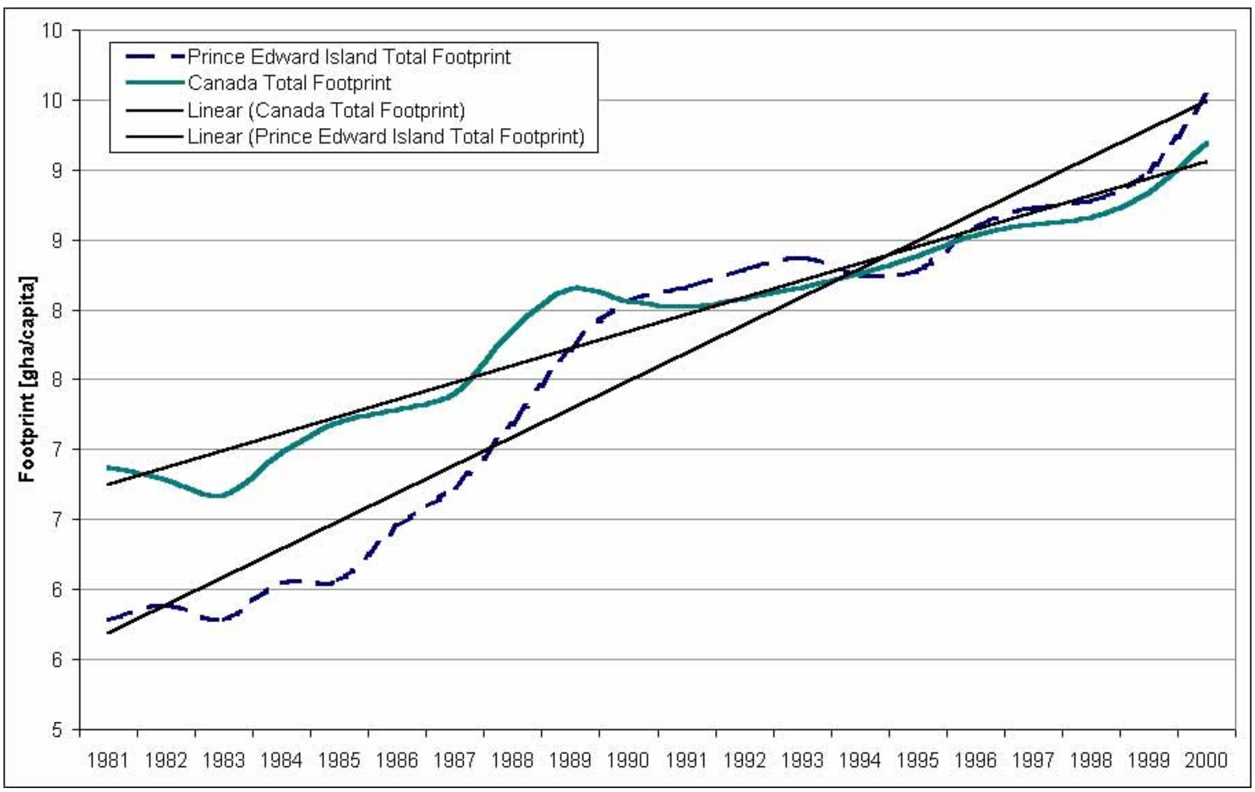
Figure 16. Historical Ecological Footprints, Canada, 1981-2000



Between 1981 and 2000, the PEI energy footprint grew by 29%, reflecting greater fossil fuel consumption, while the Canadian energy footprint did not increase in the same time period, due to greater reliance on hydroelectric and nuclear power rather than fossil fuels. According to historical data, Prince Edward Island and Canadian energy demand (and therefore energy footprint sizes) showed a slight decrease in the early 1980s, primarily due to higher energy prices, improved energy efficiency, more fuel-efficient automobiles, improved building materials and insulation, and other conservation measures. As well, the recession of the early 1980s reduced consumption spending. Increased consumption of energy in Canada in the 1990s, however, has outstripped the nation's early energy efficiency gains.

Although the average PEI total ecological footprint per person was smaller than the average Canadian ecological footprint per person between 1981 and 1990, the PEI footprint was larger than the Canadian footprint in eight of the ten years between 1991 and 2000 (Figure 17). This change is due largely to the increase in PEI's energy footprint, while Canada's energy footprint has remained stable. This reflects PEI's continued reliance on fossil fuels, compared to Canada's increased reliance on hydroelectric and nuclear power. However, it should be noted that hydroelectricity is not a practical option for PEI, due to limited space for hydroelectric facilities.

Figure 17. Ecological Footprint, Prince Edward Island and Canada, 1981-2000



Using 1999 as the base year, the ecological footprints for Canada and Prince Edward Island were projected for five-year periods from 1995 to 2020. These estimates are also based on the assumptions that per capita consumption is proportional to the food, other crop, and forest footprints, that population is proportional to the built-up area footprint, and that per capita energy demand is proportional to the energy footprint. Projected disposable income data for Canada and PEI were adjusted based on a four-year average ratio of Canadian and PEI consumption expenditures to disposable income. The projected consumption expenditures were then used to adjust the 1999 food, other crop, and forest, and footprints, according to the projected changes in adjusted per capita disposable income in 1999 and each respective year.[79] Projected built-up area footprints were estimated using Statistics Canada population projections.[80] Projected per capita energy demand data were used to adjust the 1999 energy footprint according to the difference between per capita energy demand in 1999 and each respective year.[81]

The Prince Edward Island ecological footprint will continue to increase unless there is a significant commitment to a sustainable future and major changes both in personal choices and in social and political decision-making patterns. Based on current trends, the Prince Edward Island per capita footprint is projected to grow by an additional 20% from 8.98 ha per person to 10.76 ha per capita between 1999 and 2020 (Figure 18). Figure 18 shows that, while the province's energy footprint is expected to stabilize due to natural gas conversion in the region, consumption of goods and services is expected to increase.

Prince Edward Island's per capita ecological footprint is projected to grow at a similar rate to the Canadian footprint, due primarily to similar projected growth in consumption, disposable income, and energy demand (Figures 18 and 19). By 2020 the Canadian ecological footprint is expected to total 10.81 ha per person (Figure 19), almost identical to the projected Prince Edward Island footprint.

These GPI estimates are close to other Canadian ecological footprint projections. Studies by Onisto et al. (1998) suggest that the Canadian footprint could total 11.8 ha/capita by 2015, compared to our projected Canadian footprint of 10.48 ha (11% smaller) per person in 2015 (Figure 19).[82] It should be noted that the projections for PEI and Canada presented in Figures 18 and 19 are more conservative than the actual historical footprint trends, based on historical data, shown in Figures 15 through 17. For example, the historical footprint for PEI in 2000, based on actual energy, population, income, and consumption data for that year, is 9.53 ha per person. The projected footprint for 2000, based on the assumptions about growth in energy demand, population, and consumption described earlier, is 8.95 ha per person, 6% less than the historical footprint. The same is true for the Canadian footprint, with the projected footprint 3% less than the historical footprint. In sum, the projections in Figures 18 and 19 below are likely to be low-end estimates, and the potential footprints may actually grow at a considerably more rapid rate than indicated here, unless concerted action is taken in a timely way.

---

[79] Natural Resources Canada (1999). *Canada's Emissions Outlook: An Update*. Available at: http://www.nrcan.gc.ca/es/ceo/update.htm.
[80] Statistics Canada, Cansim Matrix 6900, Projected Population by Sex and Age Group, Projection 2 for Canada, and Cansim Matrix 6902, Projected Population by Sex and Age Group, Projection 2 for PEI.
[81] National Energy Board (1999). *Canadian Energy Supply and Demand to 2025*. Appendix 3: Demand. Tables A3.9a: End Use Demand by Fuel, Case 1, Atlantic Provinces, PEI; and A3.1a: Demand, Case 1, Canada. Case 1 (Current Demand Trends Case) refers to a business as usual scenario for economic growth, and an average growth in energy demand of 1.4% per year.
[82] Onisto et al., (1998). See footnote 10.

Figure 18. Projected Ecological Footprints, Prince Edward Island, 1995-2020

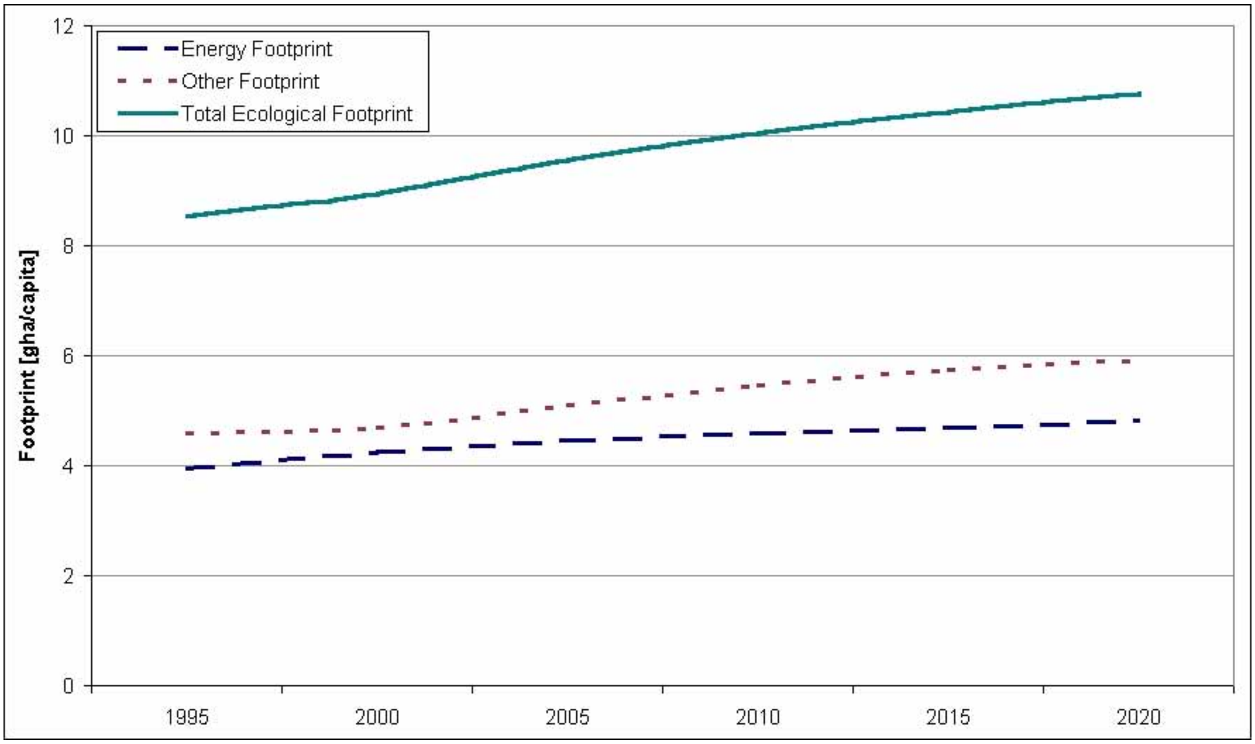
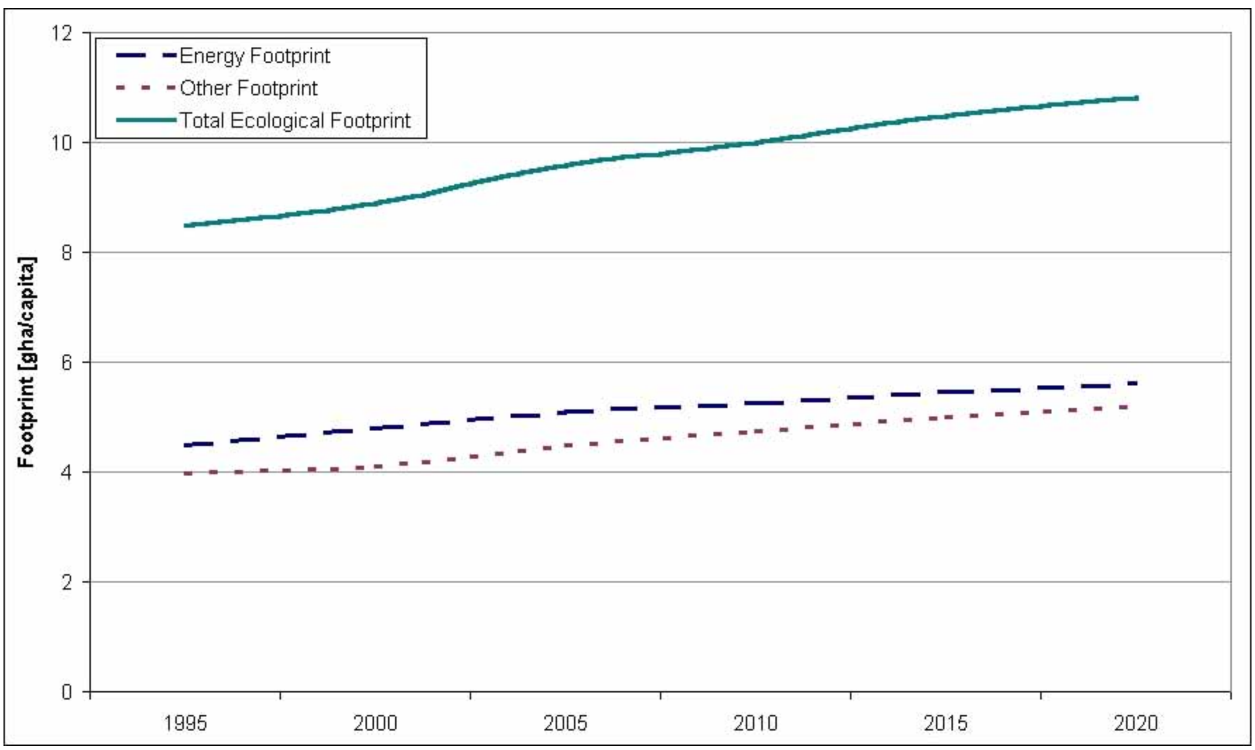


Figure 19. Projected Ecological Footprints, Canada, 1995-2020



15. Ecological Footprint and Gross Domestic Product

Conventionally, GDP *growth* is taken as the primary indicator of how "well off" we are as a society, with a higher per capita GDP denoting higher consumption levels and greater wellbeing. From the GPI perspective, on the other hand, a *smaller* ecological footprint denotes less impact on the environment and correspondingly greater long-term wellbeing and sustainability.

Whether a smaller footprint is indeed a sign of progress clearly depends on each nation's circumstances. In the case of Prince Edward Island, with an average footprint of 8.98 ha per person in 1999, a smaller footprint is essential to sustainability and to ensure the wellbeing of future generations. On the other hand, many countries with exceptionally small footprints, such as Bangladesh and India, will be able to increase both per capita GDP and their ecological footprints in order to secure basic human needs, without exceeding the 1.7 ha per person ecological "bottom line." As indicated earlier, in a world of finite resources, large footprints by some depend on smaller footprints for others, so the paths to sustainability are correspondingly different, according to different circumstances and conditions.

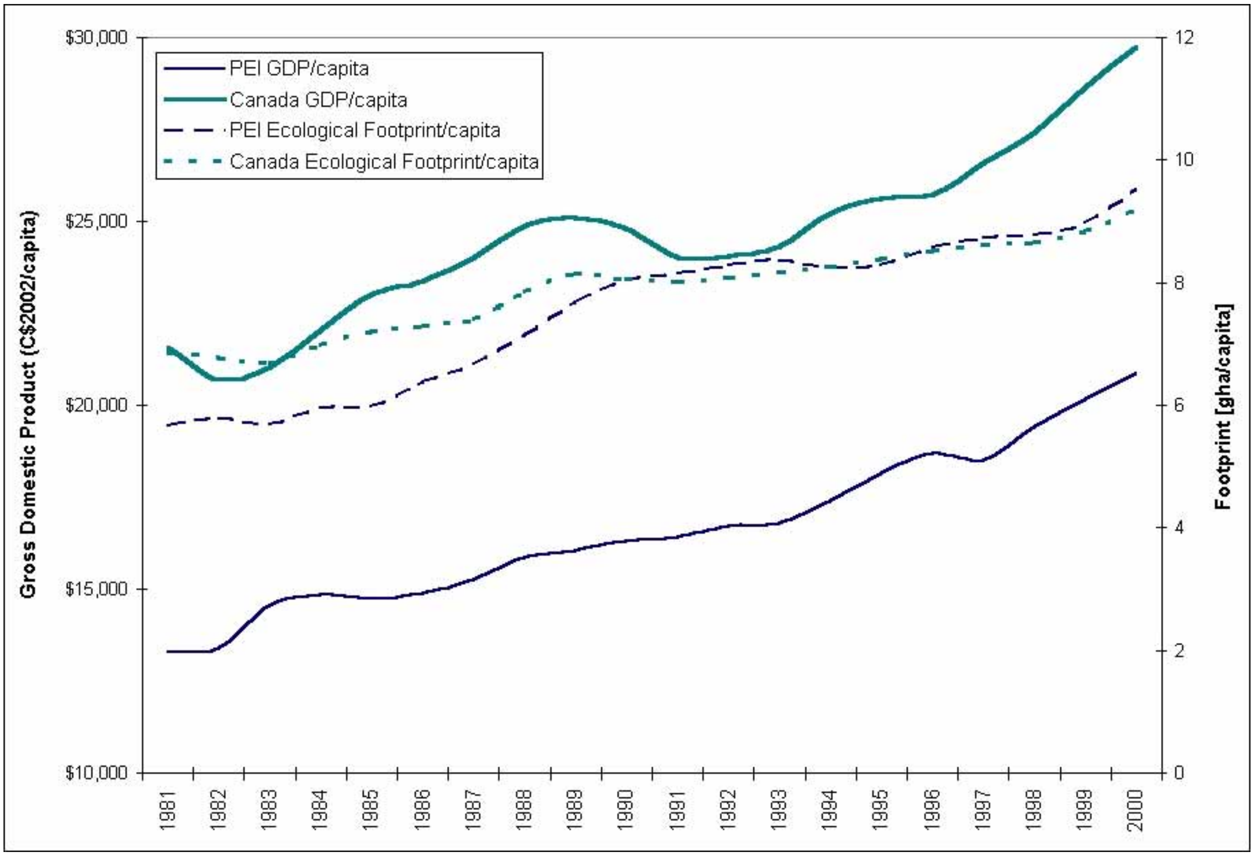
The GDP and the ecological footprint, however, are not simply *separate* indicator sets pointing towards contrasting assessment and measurement systems. Economic growth is the primary driver of ecological footprint growth, because it generally denotes higher consumption levels. Figure 20 indicates that ecological footprint growth has largely followed per capita GDP growth.

The Prince Edward Island GDP per person grew by 57% between 1981 and 2000 from $13,281 to $20,844 (C$2002).[83] In conventional terms it is almost heresy to suggest that this growth is not inherently a "good" thing. Ecological footprint analysis, however, suggests that the more complex relationship between economic growth, increased consumption, environmental degradation, waste production, and the rate of resource depletion must at least be considered if as much value is placed on the wellbeing of future generations as is placed on the current generation.

Just as excess spending can leave a massive legacy of debt, so continued growth and consumption today are likely to leave a serious environmental debt that the next generation will be forced to pay. By valuing natural wealth as well as human-made wealth, and by recording natural capital depletion as a cost in the same way that human-made capital depreciates and is used up, the GPI can provide an antidote to the over-simplistic equation of GDP growth with wellbeing. The suggestive alignment of GDP growth with ecological footprint growth further challenges us to explore alternative ways of enhancing wellbeing other than by increased material accumulation and consumption.

[83] Statistics Canada, Cansim II, Table 384-0002: Gross Domestic Product, expenditure-based. Dollar values were converted to constant 2002 dollars using Statistics Canada's Consumer Price Index.

Figure 20. Gross Domestic Product and Ecological Footprint, 1981-2000



Source: Statistics Canada, Cansim II, Table 384-0002: Gross Domestic Product, expenditure-based. Dollar values were converted to constant 2002 dollars using Statistics Canada's Consumer Price Index.

PART IV
REDUCING PRINCE EDWARD ISLAND'S ECOLOGICAL FOOTPRINT

In 1999, energy (including transportation and household energy use) and food consumption accounted for 7.78 hectares per person or 87% of the average Prince Edward Islander's ecological footprint. It is within these two areas that Prince Edward Islanders can make the greatest reductions in their personal footprint and help lead Prince Edward Island toward a healthy, sustainable future. These two areas should also be the primary focus of social and economic policy attention to guide Prince Edward Island toward sustainable transportation, land use, and consumption patterns.

The PEI energy footprint alone, at 4.3 hectares per person, is over 2½ times greater than the total global sustainability threshold of 1.7 ha per global citizen. Within the energy sector, social and personal decisions and actions concerning transportation and household energy use will have the most significant impact both on an individual's personal footprint and on the provincial footprint as a whole.

The following sections therefore explore the Prince Edward Island transportation footprint, household energy footprint and food footprint separately, and conclude with reviews of Prince Edward Island's tourism industry and solid waste management practices, and their potential impact on the Island's ecological footprint. These sections propose concrete actions can be taken as individuals and as a society to reduce the impact of the lifestyles of Islanders on the Earth and thereby to ensure a more secure future for future generations.

16. Transportation Footprint

An expanding transportation footprint

In 1999, Prince Edward Island's average transportation footprint totaled an area of 1.44 ha per person, or 16% of PEI's total ecological footprint. The transportation footprint consists primarily of direct fossil fuel combustion in driving; indirect energy consumption for car manufacturing and road maintenance; and the physical built space occupied by roads.

Between 1990 and 2020, the total energy demand for road transportation is expected to grow by 33% in the province, average vehicle kilometres travelled (VKT) are projected to increase by 8.4%, and the number of passenger vehicles is projected to increase by 41% (Table 12). As indicated in Table 12, the average Prince Edward Island car travelled 26,200 kilometres a year in 1990. Natural Resources Canada estimates that this will increase to 28,402 kilometres a year by 2020. Factors contributing to VKT growth include suburban and ex-urban sprawl, longer commutes to the workplace, and an increase in domestic road vacations. These trends are expected to increase the province's transportation footprint by 24% between 1990 and 2020, compared to an increase of 21% in the national transportation footprint (Figure 21).[84]

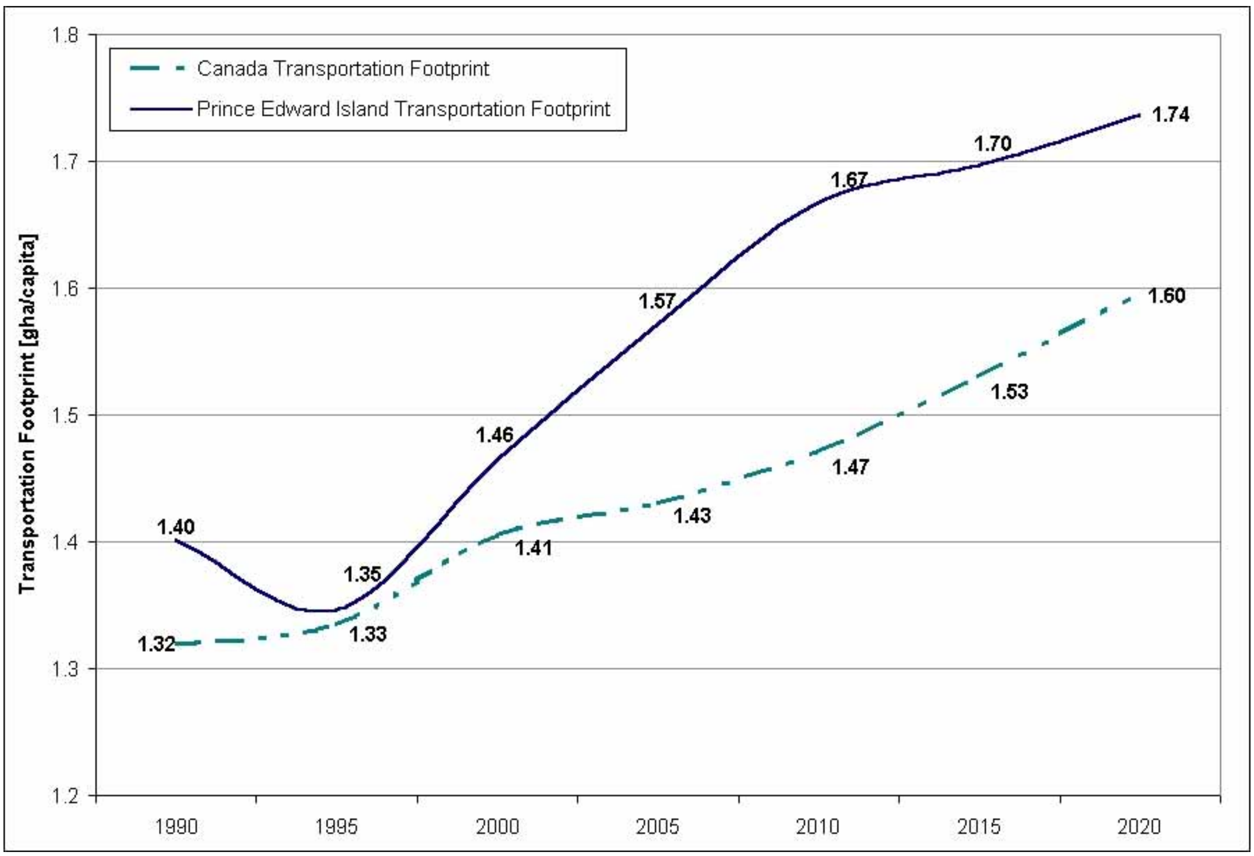
[84] The transportation footprints for 1990-1998 and 2000-2020 were calculated by adjusting the 1999 transportation footprint according to the change between per capita transportation energy demand in 1999 and in each respective year. Natural Resources Canada (1999). *Canada's Emissions Outlook: An Update*. Available at: http://www.nrcan.gc.ca/es/ceo/update.htm. Detailed calculation spreadsheets are available by contacting **GPI***Atlantic* at info@gpiatlantic.org

Table 12. Transportation Energy Demand, Prince Edward Island, 1990 and 2020

	1990	2020	Percentage Increase
Passenger car stock (number of cars)	39,000	55,000	41%
Passenger cars per household	0.87	0.94	8.0%
Average vehicle kilometres travelled (VKT/vehicle)	26,200	28,402	8.4%
Transportation energy demand (petajoules)	9.9	13.2	33%
Transportation energy demand per capita (gigajoules/capita)	75.6	77.5	2.5%
Transportation footprint (ha/capita)	1.40	1.74	24%

Sources: Natural Resources Canada, 1999, *Canada's Emissions Outlook: An Update*.

Figure 21. Estimated Transportation Footprint, Prince Edward Island, 1990-2020



Note: Projected transportation footprint from 2000 to 2020 increase assumes a 1.0% annual increase in transportation energy use based on Natural Resources Canada forecasts.

In addition to the burden of increased energy consumption, an increase in VKT and a larger vehicle fleet will have significant impacts on overall ecological footprint in other ways. This will occur from the need for more road infrastructure and maintenance, increased pollution and waste production, and reduced wildlife habitat. Other more subtle and indirect costs of transportation and automobile dependence, such as reduced community interaction, decreased mobility for nondrivers, and the extra burden placed on the health care system due to road accidents, also have impacts on quality of life and community wellbeing.[85]

How does Prince Edward Island compare to Canada?

Prince Edward Islanders depend heavily on their vehicles, driving an average of 27,310 kilometres in 2000 per vehicle and spending an average of $6,988 a year per household on transportation costs (Table 13). In comparison to other Canadians, Prince Edward Islanders have slightly more registered vehicles per person, and drive slightly more kilometres per passenger vehicle, while having shorter mean commuting distances to their places of work.

Table 13. Transportation Use, Prince Edward Island and Canada, 2000

	Prince Edward Island	Canada
Passenger car stock (number of cars)	43,000	10,874,000
Motor vehicle registrations per capita	0.56	0.54
Average vehicle kilometres travelled (VKT/vehicle)	27,310	19,995
Transportation energy demand (petajoules)	10.9	2,476.5
Transportation energy demand per capita (gigajoules/capita)	79.0	80.4
Amount spent on transportation per household (C$2002)	$6,988	$7,596
% of household budget spent on transportation	15%	13%
Mean commuting distance to workplace (kilometres)	5.5	7.2
Transportation footprint (ha/capita)	1.44	9.19

Sources: **Passenger car stock, average vehicle kilometres travelled, and transportation energy demand**: Natural Resources Canada, 1999, *Canada's Emissions Outlook: An Update*. **Motor vehicle registrations**: Statistics Canada, Cansim II, Table 405-004. **Transportation expenditures**: Statistics Canada, Cansim II, Table 203-001. **Commuting distance**: Statistics Canada, Commuting Distance, 2001 Census, Catalogue No. 97F0015XCB01001.

Prince Edward Islanders spend less per household on transportation than the Canadian average, but slightly more when transportation costs are considered as a percentage of the total household budget. Both Prince Edward Islanders and Canadians spend more on transportation than any other expenditure category (including food) with the exception of shelter and taxes.[86] Note that these transportation costs are direct internal costs only borne by households, and do not include "external" social and environmental costs like road maintenance, accidents, and pollution.

[85] Burchell, et al. (1998). *The Costs of Sprawl – Revisited*, TCRP Report 39, Transportation Research Board. Available at: www.nas.edu/trb; Johnson, E. (1993). *Avoiding the Collision of Cities and Cars*, American Academy of Arts and Sciences, Chicago; and Appleyard, D. (1981). *Livable Streets,* University of California Press, Berkeley.
[86] **PEI household expenditure breakdown 2002**: 17% personal income tax, 18% shelter, 15% transportation, 13% food. **Canada household expenditure breakdown 2002**: 21% personal income tax, 19% shelter, 13% transportation, 11% food. Source: Statistics Canada, Cansim II, Table 203-001: Average household expenditures, provinces and territories.

Reducing Prince Edward Island's transportation footprint

The footprint of commuting

In their landmark book *Our Ecological Footprint, Reducing Human Impact on the Earth*, Wackernagel and Rees (1996) estimated the footprint of commuting. A person living 5 kilometres from work requires an extra 122 square metres of ecologically productive land for bicycling, 301 square metres for busing, and 1,442 square metres for driving alone by car.[87] The land for the cyclist is needed to grow extra food, while most of the land needed to support bus passengers and car drivers is used for absorbing CO_2.

Commuting alone by car contributes **12 times** more than cycling and over **4 times** more than taking the bus to the footprint of commuting. Table 14 shows how the footprint of commuting can be reduced by car-pooling, taking the bus, or cycling – one, three, or five days per week. Rethinking how we travel to and from work can dramatically reduce the commuting footprint. For example, a small change like car-pooling once a week with one other person results in a 10% reduction in commuting footprint. Cycling to work and back every day instead of driving alone corresponds to a 92% reduction in the impact of commuting on the environment.

Table 14. Reduction in Commuting Footprint

Change:	1 day a week	3 days a week	All the time
From 1 person per vehicle to 2	10% reduction	30% reduction	50% reduction
From 1 person per vehicle to 4	15% reduction	45% reduction	75% reduction
From driving alone to taking the bus	16% reduction	47% reduction	79% reduction
From driving to cycling	18% reduction	55% reduction	92% reduction

Note: The reductions indicated in this Table are not reductions in the overall ecological footprint, but in the commuting portion of that footprint.

Source: Wackernagel and Rees, 1996, p. 107. See footnote 7.

As indicated in Figure 22, 91.5% of Prince Edward Islanders travel to work by car, truck, or van while only 0.2% use public transit. The best way to reduce the footprint of commuting is to live near one's place of work. If this is not an option, car-pooling or taking public transportation can reduce commuting footprint by up to 79%. The average car in a Canadian city carries 1.3 persons. A standard bus can replace up to 50 cars in rush hour.[88] There is no significant public transportation in PEI and the development of a public transportation system would help to reduce the ecological footprint of the province.

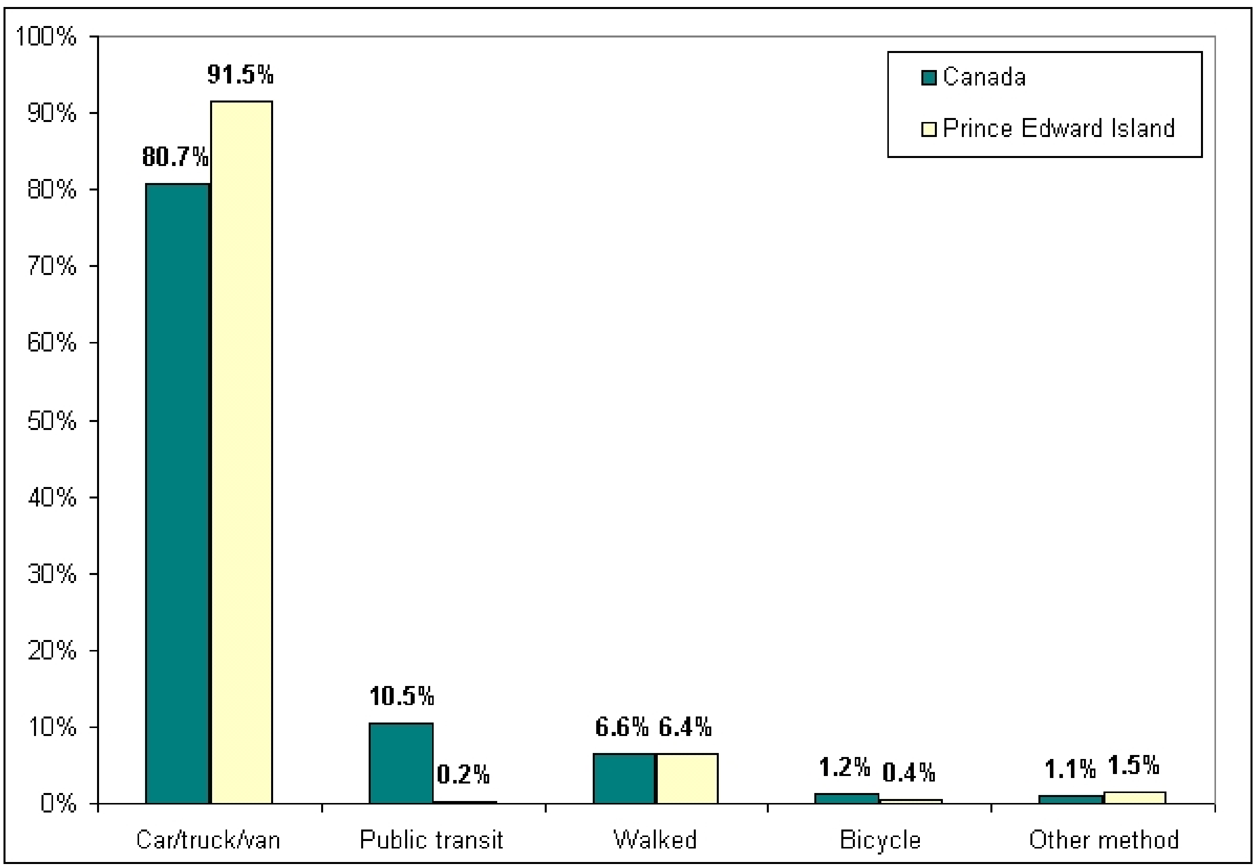
PEI commuters, with a median commuting distance to work of 5.5 kilometres, have a relatively short median commuting distance when compared to other provinces and the Canadian median (Figure 24). Almost 50% of PEI commuters travel less than 5 kilometres to their place of work,

[87] Wackernagel and Rees (1996), p. 107. See footnote 7.
[88] Adapted from Canadian Urban Transit Association (1995). *The Environmental Benefits of Urban Transit.*

compared to 38% of Canadians (Figure 25). This indicates that cycling to work is a viable option for a larger proportion of Islanders than for most other Canadians. Yet Islanders are currently only one-third as likely to cycle to work as other Canadians. Figures 22 through 24 indicate that the relatively shorter commuting distances of Islanders somewhat ameliorate their impact on the environment compared to other Canadians, and provide greater opportunities for cycling. But this advantage is currently offset by Islanders' greater dependence on cars, trucks, and vans for commuting purposes.

Concerted policy planning is required to bring about any substantial shift in commuting patterns. To influence how people travel to and from work, it is key that alternatives to automobile use be made available. Without adequate access to public transit or a safe environment for biking and walking, it will be difficult to encourage individuals to forego driving to the workplace. Coordinated land use/transportation planning is essential to turn around current suburban and ex-urban sprawl trends and thereby reduce the Prince Edward Island commuting footprint.

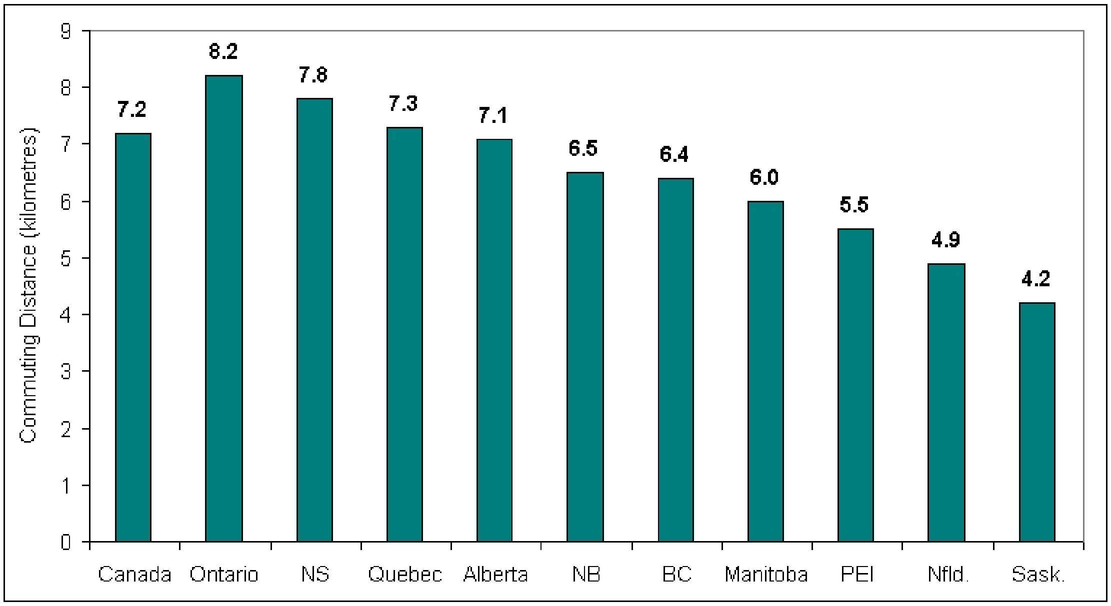
Figure 22. Mode of Transportation to Work, Prince Edward Island and Canadian Commuters, 2001



Note: "Other" includes motorcycle, taxicab, and all other modes of transportation. The car/truck/van category includes drivers and passengers.

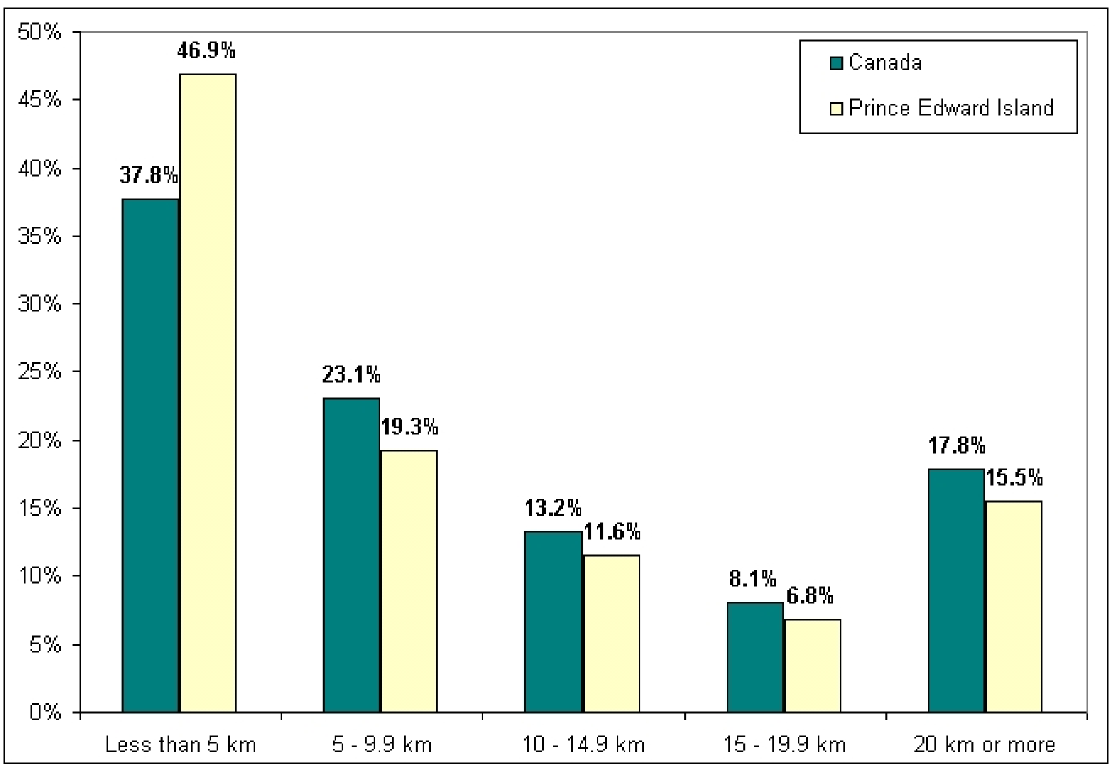
Source: Statistics Canada, 2001. *Mode of Transportation to Work*, Catalogue No. 97F0015XCB01002. Available at: http://www12.statcan.ca/english/census01/release/index.cfm.

Figure 23. Median Commuting Distance, Canada and Provinces, 2001



Source: Statistics Canada, 2001. *Commuting Distance*, Catalogue No. 97F0015XCB01001. Available at: http://www12.statcan.ca/english/census01/release/index.cfm.

Figure 24. Commuting Distances of Prince Edward Island and Canadian Commuters, 2001



Source: Statistics Canada, 2001. *Commuting Distance*, Catalogue No. 97F0015XCB01001. Available at: http://www12.statcan.ca/english/census01/release/index.cfm.

Choosing to walk or cycle to work not only offers environmental benefits but also contributes to better health and lowers health care costs. The Heart and Stroke Foundation reports that 66% of Canadians are not active enough to maintain good health, and that devoting 30 minutes per day to moderate exercise such as walking or cycling has been medically demonstrated to contribute to good health and wellbeing.[89]

Changes in driving style and driver education

Simple changes to driving style and driver education can result in overall fuel economy savings. That, in turn, can produce a reduction in the transportation footprint, since almost all of that footprint is related to energy consumption and fossil fuel combustion. Strategies to greener driving recommended by the U.S. Department of Energy, the U.S. Environmental Protection Agency (USEPA), and Natural Resources Canada include:[90,91]

- **Servicing vehicles regularly.** A vehicle that is not properly maintained can increase fuel consumption by 50% and pollution emissions by 20%.
- **Avoiding idling.** Idling for 15 seconds requires more gas than restarting a car.
- **Accelerating and braking smoothly**. Smooth accelerating and braking can bring fuel savings of 10%.
- **Using the correct gears for the speed**. Correct gear use can bring fuel savings of up to 25%.
- **Not carrying unnecessary weight.**
- **Checking tire pressure regularly**. Proper tire pressure can bring fuel savings of up to 3%.
- **Using air conditioning less frequently.**
- **Using a timer that will turn on the block heater just before driving.**

Fuel efficiency and vehicle footprint

The transportation footprint of vehicles is directly related to their fuel efficiency. Most of the environmental impacts associated with motor vehicles are a result of exhaust emissions and the pollution associated with supplying the fuel. The breakdown of life cycle ("cradle to grave") energy use for a typical automobile reveals that nearly 90% of energy use is due to fuel consumption.[92] The USEPA estimates that light vehicles, including cars, SUVs, vans, and pick-

---

[89] Heart and Stroke Foundation (2000). *The Changing Face of Heart Disease and Stroke in Canada, 2000.* To obtain this publication and for more information about heart disease and stroke in Canada, visit the Heart and Stroke Foundation web site at www.heartandstroke.ca.
[90] U.S. Department of Energy and USEPA Fuel Economy web site. Available at: http://www.fueleconomy.gov/feg/index.htm.
[91] Natural Resources Canada (2003). *Driving and Maintaining Your Vehicle*. Available at: http://oee.nrcan.gc.ca/vehicles/tips/tips_driving.cfm.
[92] American Council for an Energy Efficient Economy (2001). *Automobiles and the Environment*, February 8, 2001. Available at: www.greenercars.org/news.html.

up trucks, account for approximately 40% of all petroleum consumption in the U.S. and contribute about 20% of all carbon dioxide emissions in that country.[93]

Several web sites provide vehicle fuel efficiency information to help guide consumer product choice, including the *AutoSmart* web site sponsored by Natural Resources Canada at www.autosmart.nrcan.gc.ca/ and the U.S. Department of Energy web site at www.fueleconomy.gov. Fuel economy and its subsequent impact on the environment vary dramatically from vehicle to vehicle. For example, the model 2001 Honda Insight hybrid vehicle gets 61 miles per gallon (mpg) in city driving and 68 mpg in highway driving, with greenhouse gas emissions of 3.1 tons per year based on average vehicle miles travelled.[94] By contrast, the model year 2001 Lincoln Navigator sport utility vehicle (SUV) gets 12 mpg in city driving and 16 mpg in highway driving with greenhouse gas emissions of 14.3 tons per year.[95] On average, **one SUV has about three times the impact on the environment of a small car**.

There is a significant discrepancy even within vehicle classes. For example, among model year 2001 family sedans, the Honda Accord gets 25 mpg city driving and 32 mpg highway driving, with average greenhouse gas emissions of 7.0 tons per year. By comparison, the Ford Taurus gets 18 mpg city driving and 27 mpg highway driving, with greenhouse gas emissions of 8.9 tons per year.[96]

The *Light-Duty Automotive Technology and Fuel Economy Trends 1975 through 2000* report, published by the USEPA, notes that, despite advances in automotive technologies, fuel economy remains at a 20-year low in the U.S., due to a sharp increase in less fuel efficient vehicles such as minivans, SUVs, vans, and pickup trucks.[97] Since 1988, average new light vehicle fuel economy in the U.S. has declined by 1.9 mpg, or more than 7%.[98] Given that the U.S. has stricter fuel economy standards than Canada and similar vehicle sales trends, it can safely be assumed that U.S. fuel economy trends apply equally to Canada.

The increasing market share of SUVs and light trucks, which have significantly lower average fuel economy than cars, accounts for much of the decline in fuel economy in the overall new light vehicle fleet. SUV sales in the U.S. have increased 17-fold since 1975 and increased their market share by more than a factor of ten, from less than 190,000 in 1975 (under 2% of the overall new light vehicle market) to over 3.2 million in 2000 (20% of the market). Over the same period, the market share for vans doubled from 4.5% to 9%, and for pickup trucks from 13% to 17%. This means that SUVs, vans, and pick-up trucks together now comprise 46% of all light

---

[93] Light vehicles include those vehicles that the USEPA and the U.S. Department of Transportation (DOT) classify as cars or light-duty trucks (sport utility vehicles, vans, and pickup trucks with less than 8,500 pounds gross vehicle weight ratings). Heavenrich, R.M. and K.H. Hellman (2000). *Light-Duty Automotive Technology and Fuel Economy Trends, 1975 Through 2000.* USEPA, Office of Transportation and Air Quality. Available at: www.epa.gov/otaq/fetrends.htm.

[94] Greenhouse gas emission estimates are based on 45% highway driving, 55% city driving, and driving 24,200 kilometres annually (15,000 annual miles). Greenhouse gas emissions are expressed in CO_2 equivalents. Estimates are based on the full fuel cycle and exclude vehicle manufacture processes (U.S. Department of Energy, GREET Model, Argonne National Laboratory). See: www.fueleconomy.gov.

[95] Idem.

[96] Idem.

[97] Heavenrich and Hellman (2000). See footnote 93.

[98] Idem.

vehicle sales. Between 1975 and 2000, the market share for new passenger cars and wagons decreased correspondingly from 81% to 54%.[99]

The number of SUVs has doubled in the U.S. since 1992 alone. In 1999, nearly half of the passenger vehicles sold in the U.S. were SUVs or light trucks.[100] In Canada, SUVs, vans, and light trucks made up 39% of the light vehicle fleet (vehicles under 4.5 tonnes) in 2002.[101] In Canada, SUVs and light trucks are forecast to increase in number by 46% between 1997 and 2020 and will likely make up almost 20% of the *entire* vehicle fleet within 20 years.[102]

From an environmental perspective, this sharp increase in SUV, light truck and minivan sales in the 1990s is clearly of deep concern. SUVs generally have very poor fuel efficiency. The more fossil fuels that are burned, the greater the quantity of greenhouse gases and other air pollutants that are released, and the greater the long-term costs of non-renewable resource depletion. The Range Rover, Navigator, Yukon, Durango, and Expedition all get 12 mpg city driving and 17 mpg or less highway driving and emit 15 to 16.6 tons of greenhouse gases per year (Table 15).[103] Fortunately, even within the SUV class, alternatives do exist. For example, the Toyota RAV 4, which is an electric vehicle, gets 117 mpg in city driving and 91 mpg in highway driving, emitting 4.1 tons of greenhouse gas emissions per year (see Table 15).

Table 15. Sport Utility Vehicle Fuel Efficiency and Greenhouse Gas Emissions

Model (2001 year)	City miles per gallon	Highway miles per gallon	Annual greenhouse gas emissions (tons)
Lincoln Navigator	12	16	14.3
Land Rover Range Rover	12	15	14.3
GMC K1500 Yukon	12	16	14.0
Dodge Durango	12	17	13.7
Ford Expedition	12	17	16.6
Suzuki Vitara 2-door	25	28	7.2
Toyota RAV 4 (electric)	117	91	4.1

Source: U.S. Department of Energy and USEPA, 2001. *Fuel Economy* web site. Available at: www.fueleconomy.gov.

Every gallon of gasoline that vehicles burn puts an average of 20 pounds of carbon dioxide into the atmosphere. So even small differences in fuel efficiency can have a significant impact on an individual's personal contribution to global climate change and to ecological footprint. Choosing a vehicle that gets 25 rather than 20 mpg will prevent 10 tons of carbon dioxide from being released over the lifetime of the vehicle.[104] In sum, if an individual does need to purchase a

[99] Heavenrich and Hellman (2000). Executive Summary, p.3. See footnote 93.
[100] USPIRG (2000). *SUV Report*. Available at: www.uspirg.org.
[101] Statistics Canada (2003). *Canadian Vehicle Survey, Annual 2002*. Available at: http://www.statcan.ca/english/freepub/53-223-XIE/53-223-XIE02000.pdf.
[102] Natural Resources Canada (1999). AutoSmart web site. Available at: www.autosmart.nrcan.ca.ca/.
[103] U.S. Department of Energy, GREET Model, Argonne National Laboratory. Available at: www.fueleconomy.gov.
[104] Idem. See "Why is Fuel Economy Important?"

vehicle, that individual's transportation footprint and fuel costs can be reduced by selecting one that meets their needs with the best fuel economy available. That choice also has the added benefit of substantial savings in fuel costs.

Summary: Reducing Prince Edward Island's transportation footprint

Personal transportation accounts for almost 20% of the average Islander's ecological footprint. There are many opportunities for consumers to make transportation choices that reduce the impact of transportation on the environment: the mode of transportation, the type of vehicle, the type of fuel, driving style, and proper vehicle maintenance. The most effective way to reduce the footprint of transportation is to drive less, walk and cycle more, use public transportation, and car-pool. Living near one's place of work and near amenities such as grocery stores, shopping establishments, schools, and recreational facilities can significantly reduce dependency upon cars.

There is probably no public policy factor that more significantly impacts the capacity of a society to reduce transportation footprint and car dependency than how a society designs its cities. Suburban and ex-urban sprawl necessitates substantially greater travelling distances. Business districts and shopping venues located far from residential areas also encourage car use. Where travelling distance precludes walking or cycling, adequate public transportation facilities are essential to offset the substantial environmental impacts of automobile use. Individuals need not only to choose to drive less, but, as citizens, demand that planners, builders, and policy makers promote the conditions necessary to ensure sustainable communities. Even the most dedicated personal efforts to reduce transportation footprint require a favourable and supportive social and public policy environment to create viable alternative transportation options.

17. Residential Energy Footprint

Canadians are heavy consumers of residential energy

Prince Edward Island's residential energy footprint was 0.73 ha per person in 1999, over 8% of the province's total ecological footprint. This was approximately 11% smaller than the Canadian average (0.82 ha per person). On average, Canadians consume 43.4 GJ/capita/year of residential energy, compared to 38.4 GJ/capita/year in Prince Edward Island.[105]

The lower average residential energy demand and residential energy footprint in Prince Edward Island in comparison to Canada are due primarily to a more moderate climate and lower heating fuel needs. Despite a more moderate climate, however, PEI households are prone to a large residential energy footprint in other ways. For example, PEI has a greater number of older and larger dwellings compared to the Canadian average. Almost a quarter (23%) of the dwellings in

[105] Natural Resources Canada, Office of Energy Efficiency, *National Energy Use Database*. Available at: http://oee.nrcan.gc.ca/neud/dpa/data_e/database_e.cfm.

PEI were built before 1946 compared to only 14% in Canada.[106] Modern homes tend to be significantly more energy efficient, due to improvements in building materials and insulation, and therefore contribute to a smaller energy footprint. Many older homes have little or no insulation, which can increase heating costs by up to 70%.[107]

Dwellings in Prince Edward Island are also, on average, slightly larger than in the rest of Canada: 6.7 rooms in comparison to 6.3 rooms, due primarily to a lower level of urbanization.[108] Larger dwellings use more material inputs and have greater space heating requirements, which in turn increases the residential energy footprint. In addition, 73% of PEI's dwellings are single detached houses – a rate that is 16% higher than the Canadian average.[109] Single detached dwellings require more material inputs and energy to heat than apartment dwellings, because of the greater number of exterior walls.

Reducing Prince Edward Island's household energy footprint

There are a number of practical choices available to households that could significantly reduce the province's residential energy footprint. Indeed, household energy consumption choices are one of the simplest ways that ordinary citizens can reduce their ecological footprint *and* save money. A few intelligent energy choices can reduce household energy consumption by 50% and save significantly on household energy costs (Table 16).

Table 16 provides practical suggestions for how home energy consumption can be reduced in various ways without having to make real sacrifices to lifestyle. Other major savings can be made by:

- turning lights and appliances off when they are not needed;
- limiting the use of air conditioners;
- reducing time spent watching TV; and
- having shorter showers.

Perhaps the most effective way to reduce household energy footprint is simply by raising one's level of daily awareness. If a conscious effort is made to evaluate the energy use of households on an ongoing basis, numerous creative ways to reduce energy consumption can be found that match particular needs and circumstances. Longer-term changes in technology can also assist efforts to reduce household energy footprint. Advances in building materials have already significantly decreased the heat loss in homes, and available technologies could reduce this even further.[110]

[106] Statistics Canada, 2001 Census, Period of Construction for Occupied Private Dwellings, Catalogue No. 95F0325XCB01004.
[107] *Residential Energy Efficiency Database* (2000). Available at: www.its-canada.com/reed.
[108] Statistics Canada, 2001 Census, Household Size and Number of Rooms for Occupied Private Dwellings, Catalogue No. 95F0323XCB01004.
[109] Statistics Canada, 2001 Census, Structural Type of Dwelling for Occupied Private Dwellings, Catalogue No. 95F0321XCB01004.
[110] Pembina Institute (2000). *Climate Change Solutions*. Available at www.climatechangesolutions.com.

Table 16. Reducing Household Energy Consumption

Action	Energy Savings
Switch to a time based-programmable **thermostat** (from a standard non-programmable thermostat)	30%
Turn down the thermostat at night to 17 degrees (based on average household temperature of 21 degrees)	8%
Switch from standard incandescent **bulbs** to • Halogen bulbs • Compact fluorescent bulbs (assumes 150 operating hours per month)	 55% 75%
Install a low flow **shower head** (assumes a household of four)	50%
Clothes Washer (assumes 34 loads per month) • Switch to energy efficient model • Wash clothes in cold water instead of hot water	 26% 93%
Clothes dryer (assumes 34 loads per month) • Switch to energy efficient model • Hang clothes to dry	 31% 100%
Dish washer (assumes 34 loads per month) • Switch to energy efficient model	 40%
Refrigerator (responsible for 15% of household energy use) • Switch to energy efficient model	 47-53%
Air Conditioner (assumes 3 month use period) • Switch to an energy efficient model • Switch to a fan • Open windows	 50% 60% 100%
Add an **insulating blanket** to hot water heater (assumes a household of three)	5%
Clean **furnace filter** regularly	15%

Note: Percentage energy savings refer to savings *compared to* conventional non-energy efficient methods and models within each category. For example, switching from a conventional non-efficient dishwasher to an energy efficient dishwasher can save 40% of the energy costs normally associated with washing dishes. In other words, the percentages in the second column do not refer to percentage savings of the total energy budget.

Sources: Adapted from Wilson et al. (2001).

Reducing household energy consumption on an individual and household level can certainly produce a major reduction in PEI's average household energy footprint. The planning policies and building codes in effect today will have a significant impact on future ecological footprint, as they influence both the type of homes and the type of communities in which people will live in the future as well as future transportation needs. It is fair to say that current building codes and planning policies rarely consider energy footprint consequences, and even encourage detached single-family home construction that limits personal energy reduction efforts. Higher density housing could encourage development of district heating models that can produce significant energy savings.

When the size of the 1999 PEI footprint (8.98 ha per person) is considered against the background of the bioproductive land and sea actually available for human resource use and waste assimilation (1.7 ha per person), it is clear that dedicated individual efforts alone will not prevent a continued ecological overshoot that imperils the wellbeing of future generations. A collective political and social will and coordinated public policy planning are essential to reduce ecological footprint and the impact of consumption on the environment substantially, and to take on real responsibility for the wellbeing of future generations.

Fortunately, there are excellent examples and models of community and social efforts to reduce energy consumption and live more efficiently and responsibly. The forthcoming **GPI***Atlantic* transportation component, for example, notes the innovative transportation, planning and design options of Curitiba, Brazil, which has consciously designed itself as an "ecological city."[111]

On the residential energy and planning front, one of the most effective and exciting models is the Danish co-housing experiment, which has been so successful that it has become a mainstream real estate option in that country. Recreating the modern equivalent of a traditional village, 20-25 families typically live in much smaller dwellings but share a "common house" with a wide range of common facilities and appliances, and in which they prepare and eat dinners together. The arrangement facilitates car-pooling, shared child-care, bulk buying, and other patterns of community interaction that significantly reduce per capita energy consumption and transportation, while at the same time fostering community.[112]

The Danish co-housing model has spread to the Netherlands, Germany and Sweden, and has now begun to spawn similar experiments in North America.[113] Tax incentives and building codes in Canada that promote the type of co-housing development that has proved so successful in Europe would encourage the kind of longer-term structural changes to Canadian housing stock that are necessary to reduce the energy-intensity of current living patterns. The fact that these new housing options can build community and strengthen social supports at the same time that they increase efficiency and reduce energy consumption and costs indicates that there are creative ways of reducing ecological footprint that enhance quality of life and wellbeing.

18. Food Footprint

Prince Edward Islanders are formidable food consumers

The average PEI food footprint was 3.49 ha per person in 1999, which amounts to 39% of the total provincial ecological footprint. Food consumption is the second largest footprint component after energy. The food footprint is the area of arable land, pasture land, and sea required to grow

---

[111] C.R. dos Santos, Open University of the Environment, Curitiba, Brazil, presentation to "*Halifax in Motion: Transportation and Land Use*," public forum, Halifax City Hall, March 7-8, 2001.
[112] McCamant, K. and C. Durrett (1988). *Cohousing: A Contemporary Approach to Housing Ourselves,* Habitat Press, Berkeley.
[113] Fromm, D. (1991). *Collaborative Communities: Cohousing, Central Living, and other New Forms of Housing with Shared Facilities.* Van Nostrand Reinhold, New York.

and produce the food and raise the animals and fish that is consumed. If we factor in the energy used within the food system, which is estimated to be approximately 13.8% of total energy end use, the total footprint devoted to feeding ourselves averages 3.97 ha per person, or 44% of the 1999 total ecological footprint of the Island.[114] PEI's food footprint is clearly unsustainable. A food footprint of 3.49 ha for the average Prince Edward Islander is over two times larger than the bioproductive space available per global citizen (1.7 ha/capita), if we assume equal distribution of the Earth's biocapacity.

Prince Edward Islanders had a 31% larger per capita food footprint in 1999 than the Canadian average (2.66 ha/capita). Islanders consume more fish, seafood, meat, fats and oils, and sugars and sweeteners than the Canadian average. All of these foods have high footprint intensities. The ecological space that Prince Edward Islanders occupy just to feed themselves is 480,170 hectares, or 84.5% of the total provincial land area of PEI.[115] The actual area in food-producing crops in PEI is only 175,488 ha (31% of the provincial land area), or 36.5% of the area required to support the PEI food footprint.[116] Prince Edward Island is able to adjust for this deficit by importing food through trade. Not only does this make PEI enormously dependent on the ecological capacity of other regions, but it also contributes significantly to the large food footprint.

Why is the food footprint so large?

Canadians are overeating[117]

On average, each Canadian eats 3,119 calories worth of food each day (see Table 17).[118] The recommended caloric intake for an active young man (19-24) is only 3,000 calories per day, with average optimal energy requirements just 2,500 calories for men and 1,900 calories for women (Table 17).[119] Canadians and Prince Edward Islanders are not only eating more than they need for good health, but they are also eating too much of the wrong kinds of food. For example, Canadian per capita consumption of fats and oils increased 44.3% between 1990 and 2001,

---

[114] Wackernagel, M. (1994). *Ecological Footprint and Appropriated Carrying Capacity: A Tool For Planning Toward Sustainability.* Ph.D thesis, The University of British Columbia. Wackernagel bases the 13.8% estimate on a number of sources, including Canadian agriculture statistics, U.S. Federal Energy Administration and U.S. Department of Agriculture studies, as well as studies done in Switzerland. Estimates of energy used in the food system from these sources range from 12 to 20% of total energy use.

[115] 3.48 hectares per person x 137,980 (1999 population estimate for PEI) = 480,170 hectares. This assumes 3.48 ha per person which is the area of arable land, pasture land, and sea required to grow the food and raise the animals that we eat. It does not include the associated land required for the energy that can be attributed to the food system. The total provincial land area of Prince Edward Island is 568,439 hectares.

[116] Statistics Canada, 2001 Census of Agriculture, Total area of farms, land tenure and land in crops.

[117] For more information on the connections between food footprint, health, and the genuine progress index, see Appendix C of this report.

[118] Food and Agriculture Organization of the United Nations (1997). *Statistical information*. Available at: www.fao.com.

[119] Nova Scotia Heart Health Program (1993). *Report of the Nova Scotia Nutrition Survey*. Nova Scotia Heart Health Program, Nova Scotia Department of Health, and Health and Welfare Canada.

compared to an increase in consumption of fresh vegetables of 10.9% and an increase in consumption of fresh fruit of only 3.4%.[120]

Table 17. Caloric Intake World Wide, 1997

	Calories			Protein (grams)	Fat (grams)
	Total	Vegetable	Animal		
Canada	3,119	73%	27%	97.7	126.3
United States	3,699	73%	27%	112.3	142.8
India	2,496	93%	7%	59.1	44.5
World	2,782	84%	16%	73.9	32.6
Average daily food energy requirements*	Male 2,500			70.6	82.5
	Female 1,900			61.3	62.7

* Average estimates used. Optimal daily food energy requirements vary according to sex, age category, genetics, and level of activity.

Sources: **Caloric Intake:** Food and Agriculture Organization of the United Nations, 1997. *Statistics*, www.fao.com. **Average daily food energy requirements:** Health and Welfare Canada, 1990. *Nutrition Recommendations*.

Aside from increasing the size of the food footprint, overeating and eating too much of the wrong kinds of food are contributing causes to obesity and to a wide range of illnesses. Numerous studies have linked overweight and obesity to a wide range of health problems, especially cardiovascular disease, diabetes, hypertension, and some forms of cancer.[121]

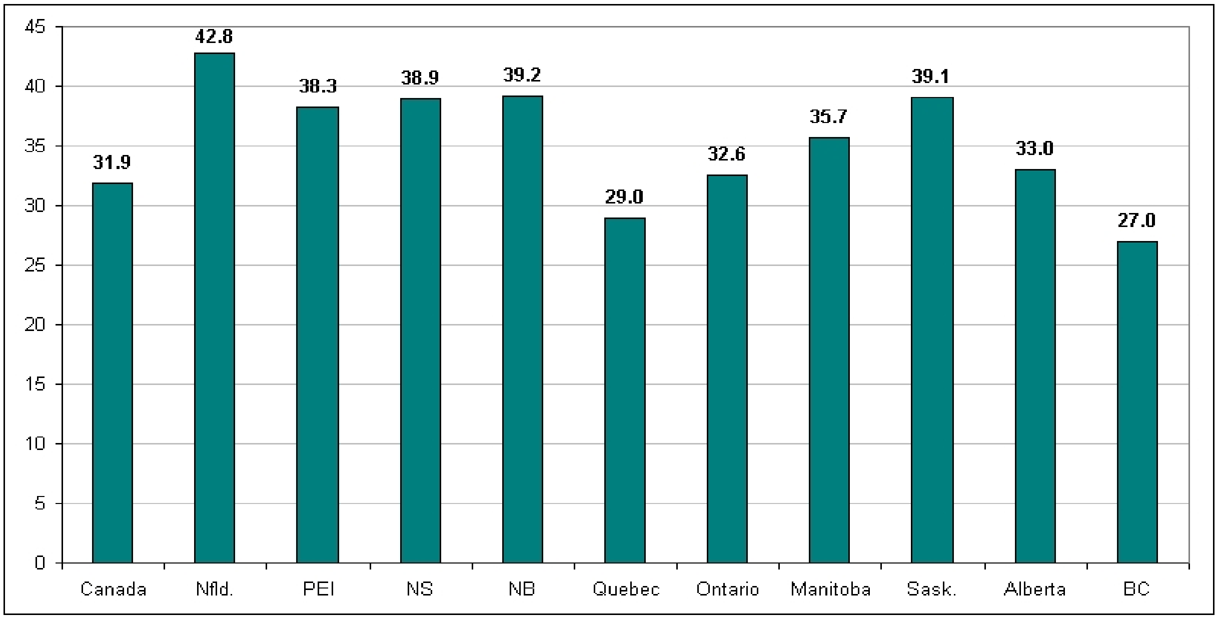
Atlantic provinces have substantially higher rates of overweight than the Canadian average, with Newfoundland and Labrador registering the highest rates of overweight for both men and women. Counting men and women together, 43% of Newfoundlanders are overweight, as are 38% of Prince Edward Islanders, 39% of Nova Scotians and New Brunswickers, and 32% of Canadians (Figure 25).

Paradoxically, overeating contributes to economic growth many times over, and thereby to our assessment of how "well off" we are. All the excess food grown, processed, transported, warehoused and sold makes the GDP grow. The food industry contributes $33 billion a year in advertising to the U.S. and Canadian economies, more than any other industry, much of it promoting the very foods that cause obesity. Fast food, candy, and sweetened cereals account for more than half of food advertising expenditures. The diet and weight loss industries contribute $35 billion more to the U.S. and Canadian economies, and obesity-related illnesses $60 billion

[120] Statistics Canada, Cansim II, Table 002-0019: Per capita consumption of major food groups. Canadian annual consumption of fats and oils 1990: 22.1kg; 2001: 31.9kg. Canadian annual consumption of fresh vegetables 1990: 129.7kg; 2001: 143.9kg. Canadian annual consumption of fresh fruit 1990: 61.3kg; 2001: 63.4kg. For more information on Canadian and PEI consumption of fruits and vegetables, see Appendix C of this report.
[121] Health Canada (1999). *Statistical Report on the Health of Canadians*. Health Canada, Ottawa, p. 264.

more. The five-fold increase in diabetes and the burgeoning demand for insulin have become a "growth market" for the pharmaceutical industry.[122]

Figure 25. Percentage of Overweight Canadians, Canada and Provinces, 2000/01



Note: "Overweight" is defined as individuals with a Body Mass Index (BMI ≥ 27) aged 20 to 64, and excludes pregnant women. BMI, which relates weight to height, is a common method of determining if an individual's weight is in a healthy range based on their height. For a detailed definition of BMI, see Appendix C.

Source: Statistics Canada, Canadian Community Health Survey, 2000/01, Health File. Available at: http://www.statcan.ca/english/freepub/82-221-XIE/01002/toc.htm.

By contrast, the GPI classifies the costs of overeating and obesity as a cost rather than a gain to the economy, because excess food consumption taxes our natural resource base, our bodies, our health care systems, and our pocketbooks. Lower rates of obesity, a reduction in obesity-related illnesses, and a smaller food footprint are signs of genuine progress in the GPI.

The direct costs of obesity to the Canadian health care system for 10 specific illnesses are estimated at $1.8 billion.[123] When other illnesses such as osteoarthritis are included, and when adjustments are made for demonstrated under-reporting of weight, it is likely that obesity costs the Canadian health care system as much as $3.2 billion. **GPI***Atlantic* estimates of the economic costs of obesity for eight provinces are presented in Table 18. Based on the GPI estimates from eight provinces, the direct costs of obesity are almost $3 billion annually. When the indirect costs are added, the total costs of obesity are between $6 billion and $6.6 billion annually.

[122] Gardner and Halweil (2000). See footnote 198; Critser, Greg, "Let Them Eat Fat: The Heavy Truths About American Obesity," *Harper's Magazine,* March 2000.
[123] Birmingham et al. (1999). See footnote 201. The total direct costs include expenditures on hospital care, physician services, services by other health professionals, drugs, other health care costs, and health research.

Table 18. Annual Direct and Indirect Economic Costs of Obesity in Canada

	Direct Costs (health care)		Indirect Costs (lost productivity)	Total Costs	
	C$1997 millions	Percent of Provincial Health Care Budget	C$1997 millions	C$1997 millions	Percent of Provincial GDP
NS	$120	6.8%	$140	$260	1.3%
NB	$96	7.5%	$90-110	$186-206	1.4%
Quebec	$700	5.8%	$800	$1,500	1.0%
Ontario	$1,100	5.3%	$1,100-1,400	$2,200-2,500	0.7-0.8%
Manitoba	$140	7.3%	$130-165	$270-305	1.0%
Sask.	$120	7.3%	$110-140	$230-260	1.0%
Alberta	$320	5.9%	$300-380	$620-700	0.7-0.8%
BC	$380	4.5%	$350-450	$730-830	0.8-0.9%
TOTAL	**$2,976**		**$3,020-3,585**	**$5,996-6,561**	

Note: Direct costs are direct health care costs of ten obesity-related illnesses (hypertension, type 2 diabetes, coronary artery disease, gall bladder disease, stroke, hyperlipidemia, pulmonary embolism, colorectal cancer, postmenopausal breast cancer, and endometrial cancer). The indirect costs include costs of productivity losses due to obesity (premature death, absenteeism, and disability).

Source: **GPI***Atlantic* provincial costs of obesity reports. For more information, see the **GPI***Atlantic* web site: www.gpiatlantic.org/pubs.shtml.

In sum, if Canadians stop overeating, and eat less foods that are harmful to our health, we can not only reduce our food footprint substantially, but contribute to our health and wellbeing as individuals and as a society. We can also save millions of dollars annually in taxpayer-funded health care costs. Unlike measures of progress based on the GDP in which "more" is always "better," this is one example where "less" is clearly "better."

Disparities in access to food

Despite the ample food available in Canada, there are disparities in access to food and nutritional wellbeing. The 2002 HungerCount survey indicated that 2,800 Prince Edward Islanders (2% of the provincial population) and almost 750,000 Canadians (2.4% of the national population) rely on food banks.[124] In Canada, the provinces reporting the highest percentages of food bank usage were Newfoundland at 5.7% and Manitoba at 3.7%. The lowest usage was reported for the Yukon at only 0.8%. Although the average Canadian food footprint is large, it is clear we do not all contribute to it equally.

The same disparities exist globally. One-fifth of U.S. children are now overweight or obese, a 50% increase since 1980, at the same time that a 1998 U.S. Department of Agriculture Study found that nearly one-fifth of American children are "food insecure" – either hungry, on the edge of hunger, or worried about being hungry. The Worldwatch Institute reports that for the first time

[124] Canadian Association of Food Banks (2002). *HungerCount 2002: Canada's Annual Survey of Emergency Food Programs*.

in history the number of overweight people in the world now equals the number of underfed people, with 1.1 billion in each group, and with both groups suffering from different forms of "malnutrition." Among U.S. adults, 55% are now classified as overweight, while 56% of children in Bangladesh are underweight.[125]

The global disparities in access to food and nutritional wellbeing indicate that the responsibility for food footprint reduction rests squarely on the shoulders of the over-consumers. Theoretically, there is sufficient food for all human beings in the world to meet their daily nutritional requirements (Table 19). However, over 800 million people – or more than 13% of the global population – are chronically undernourished, and are not eating enough to meet minimal energy requirements. In addition, millions more suffer from acute malnutrition during transitory or seasonal food insecurity.[126]

Table 19. Per Capita Global Food Availability

		World	Industrialized Countries	Developing Countries
Total food available*		3939 kcal	6964 kcal	3007 kcal
Optimal energy requirements**	male	2500 kcal	2500 kcal	2500 kcal
	female	1900 kcal	1900 kcal	1900 kcal

*Food availability figures are total grown in the world, in industrialized countries, and in developing countries, divided by the population of the world, the industrialized countries, and developing countries respectively.

**Optimal energy requirements vary according to sex, age category, genetics and level of activity.

Source: Patriquin, D. (1999). Available at: http://is.dal.ca/~dp/reports/facts.html.

The Canadian agriculture system is energy intensive and becoming more so

Between 1981 and 1996, energy inputs within the Canadian agriculture system increased 7%, and fertilizer inputs grew by 26% (an annual growth rate of 1.4%).[127] These dramatic increases in fertilizer and energy inputs reflect both the increasing mechanization of agriculture and also the fact that more inputs are needed to maintain yields over time as soils become depleted of nutrients. In addition, over this period, pesticide inputs increased by 20%.[128]

Total Canadian agricultural energy demand increased by 17% between 1990 and 2000, from 199 petajoules (PJ) to 232 PJ.[129] In PEI, total agricultural energy demand increased by 14% between 1990 and 2000, from 1.4 PJ to 1.6 PJ.[130] More intensive PEI agriculture affects the food footprint of all who consume PEI agricultural products – on and off the Island. The average energy input

[125] Gardner and Halweil (2000), pp. 60-62. See footnote 198.
[126] FAO (1997). *Statistical Information*. Available at: www.fao.com.
[127] MacGregor, R.J., in McRae, T., Smith, C., and Gregorich, L (eds.) (2000). *Environmental Sustainability of Canadian Agriculture: Report of the Agri-Environmental Indicator Project*. Agriculture and Agri-Food Canada. Draft report. Chapter 17: "Energy Use Time Series: 1981-1996."
[128] Idem.
[129] Natural Resources Canada, Office of Energy Efficiency, *National Energy Use Database*. Available at: http://oee.nrcan.gc.ca/neud/dpa/data_e/database_e.cfm.
[130] Idem.

into the Canadian agriculture system between 1992 and 1996 was 18.2 PJ. The energy output was 8.1 PJ – a loss of 55% per unit of input.[131] In 1910, the input/output ratio was 1 to 1.[132] A study of energy inputs and outputs in Danish agriculture found that from 1939 to 1990, the ratio of food produced to fossil energy input declined from 3.9 to 1.0 mainly because of a large increase in the use of fertilizer, fuel, and electricity.[133]

For example, the increasing reliance on synthetic nitrogen fertilizer, made from fossil fuels through an industrial nitrogen fixation process, is one factor in the energy intensity of Canadian agriculture. In addition to the energy intensity and direct greenhouse gas emissions associated with nitrogen fertilizer *use*, the production and transportation of nitrogen fertilizer itself is energy-intensive and contributes to carbon dioxide emissions. For every kilogram of synthetic nitrogen fertilizer used on farms, one kilogram of carbon (or 3.7 kg of CO_2) is released into the atmosphere.[134] In these ways, increasingly intensive fertilizer, fuel, electricity, and pesticide inputs have sharply increased the size of the food, energy, and overall ecological footprints of consumers throughout the industrialized world.

Organic food production systems that integrate livestock and crop production on the same farm, which use manure as fertilizer, and which use no synthetic fertilizers and pesticides, are much less energy intensive, and dramatically reduce the overall external inputs into agriculture in comparison to conventional food production systems. They come much closer to a balanced energy input versus energy output ratio, while maintaining or increasing the long-term fertility of soils. Organically grown food may also be higher in nutritional value. For example, studies show decreased levels of vitamin C and protein, and increased nitrate levels in chemically fertilized crops when compared to their organic counterparts.[135] Not only do organically grown foods reduce ecological footprint by requiring fewer energy inputs, but they may also be healthier – another example of the potential for ecological footprint reduction to increase rather than compromise wellbeing.

In Prince Edward Island (2001), 23 farms reported production of certified organic products, accounting for only 1.3% of the total number of farms in the province.[136] In Canada, 0.9% of farms produce certified organic products.[137] PEI's new Sustainable Resource Policy and its new FoodTrust brand may increase the proportion of organic and sustainably farmed produce in the province.[138]

---

[131] McRae, et al. (2000). Op. cit., Chapter 18: "Regional Analysis of Environmental Sustainable Agriculture."
[132] Pembina Institute (2000). Available at: www.cliamtechangesolutions.com.
[133] Schroll, H. (1994). "Energy-flow and ecological sustainability in Danish agriculture," *Agriculture, Ecosystems and Environment*, **51**, 301-310.
[134] Janzen, H., Desjardins, R., Asselin, J., and Grace, B. (eds). 1998. *The Health of Our Air: Toward Sustainable Agriculture in Canada.* Research Branch, Agriculture and Agri-Food Canada Publication 1981/E. Ottawa: Minister of Public Works, p.21.
[135] Jennifer Melanson (NSOGA@gks.com), Coordinator, Nova Scotia Organic Growers Association (2000). Personal communication with Jeff Wilson.
[136] Statistics Canada, 2001 Census of Agriculture. Farms classified by certified organic products produced; and Farms classified by total farm area.
[137] Idem.
[138] For more information, see the Government of Prince Edward Island web site: http://www.gov.pe.ca/af/agweb/index.php3?number=72033; and the Prince Edward Island FoodTrust web site: http://www.foodtrustpei.com/.

Public policy can create a more favourable environment for individual food choices that can make it easier for consumers to make ecologically conscious choices. Although it is more environmentally benign and protects natural soil wealth more successfully, organic agriculture is still a relatively marginal activity partly because locally grown organic produce is generally more expensive than conventionally grown imported produce. Tax incentives structured in proportion to lower energy and chemical inputs would make organic food more affordable, while tax penalties for higher chemical and energy-intensive inputs would discourage more unsustainable farming methods.

Much of Canada's food is imported and exported[139]

The total value of food imports into Canada from the U.S. grew by 81% between 1990 and 1997. Imports from other countries increased by 60% in the same period. Canada imported a total of $15.8 billion in food products in 1997, including $9.4 billion from the U.S. and $6.4 billion from other countries. The U.S. supplies almost all Canadian imports of meat, poultry and potatoes, while more than 80% of Canada's imports of wine and cheese are from countries other than the U.S.[140]

Between 2000 and 2002, the total value of food imports into Prince Edward Island was just $8.2 million.[141] PEI imported the lowest amount of food of the four Atlantic provinces from 2000-2002: New Brunswick imported $783 million, Nova Scotia imported $555 million, and Newfoundland imported $46 million. During this same time period, PEI exported a total value of $833 million worth of food, making the province a net exporter of food products to the tune of almost $825 million.

Of the $833 million in exports, $609 million (73%) were frozen prepared or preserved potatoes. Almost 50% of the potatoes grown on PEI are used by the processing industry.[142] Most are processed into frozen potato products, mostly french fries, which are available across Canada and are exported to close to 30 countries around the world.[143] The benefits of this industry include rural employment, relatively stable markets, and transfer of technology. However, the reliance on French fry exports also indicates a highly concentrated industry that produces highly processed foods, relies heavily on the use of pesticides, and results in the planting of fewer varieties of potatoes – outcomes that have implications for environmental sustainability, bio-diversity, soil quality, and human health.

---

[139] The authors are grateful to Jennifer Scott, author of **GPI***Atlantic*'s *Soils and Agriculture Accounts*, for providing many of the data sources and much of the information in this section of the report.
[140] Morin, N. (1999). *Have American food products invaded the Canadian market?* Available at: http://www.statcan.ca/english/kits/agric/market.htm.
[141] Import and export values used in this paragraph were obtained from Agriculture and Agri-Food Canada, Trade Service, Trade Statistics. Available at: http://ats-sea.agr.ca/stats/stats-e.htm.
[142] Prince Edward Island Potato Board (2003). *Why PEI Potatoes?* Available at: http://www.peipotato.org/why_pei.asp.
[143] Idem. See also Agriculture and Agri-Food Canada (2000). *1999/2000 Canadian Potato Situation and Trends.* Available at: http://www.agr.gc.ca/misb/hort/potato_eng.html.

In Canada, the average food item travels about 2,000 kilometres to get to the dinner table.[144] Importing and exporting a high percentage of our food has a significant impact on the food footprint. The transportation costs of shipping food long distances contribute to increased burning of fossil fuels, greenhouse gas emissions, and increased transportation infrastructure costs. On a regional scale, increased reliance on imported food also undermines support of local farmers and rural communities and increases our reliance on other regions of the globe. Similarly over-reliance on single crops like potatoes and on food exports rather than diverse production for local markets renders farmers and rural communities vulnerable to commodity price fluctuations, crop disease, and import bans.

If the true costs of transportation and energy (including current taxpayer subsidies), as well as the costs of air pollution, greenhouse gas emissions, and resource depletion were factored into market prices – in other words, if imported food were made to pay its full costs – then a conventionally grown California lettuce would not be cheaper at the supermarket checkout counter than a locally grown organic lettuce. A core purpose of the GPI full cost accounting methods is to factor in social and environmental costs that are currently invisible in conventional market and accounting mechanisms, and thus to make ecological footprint reduction "profitable" rather than costly for the consumer. Sound economic practice and a truly efficient market would support sustainable practices that ensure the maintenance of natural wealth and a reliable flow of goods and services for future generations.

When the grain trade is removed from calculations, Canada is a net importer of agricultural products. Until just after World War II, Canada was self-sufficient in the production of basic fruits (plums, peaches, apricots, strawberries, pears), and vegetables, but by 1980, 28% to 57% of these five fruits were being imported.[145] By 1987, Canada was only 71% self-sufficient in the production of fresh vegetables, and 45% in all fruits and berries.[146] Reliance on imported foods not only increases the food footprint of an area by expending additional energy in transportation, but may also undermine long-term food security. Part of Canada's dependency on food imports is due to the limitations of the Canadian growing season, but a significant percentage of the crops that comprise this growing deficit could be produced and stored here if a strong domestic agriculture sector were a policy priority.[147, 148]

The growing dependency on imported food sources in Canada has been accompanied by a decrease in the total area of farmland. The total Prince Edward Island area in farms in 1981 was 283,024 hectares. By 2001 the total area in farms had shrunk by over 8% to 261,482 hectares (Table 20). During the same period, the number of farms on the Island declined by 42%,

---

[144] National Round Table on the Environment and the Economy (1997). *The Road to Sustainable Transportation in Canada,* Renouf Publishing Co., Ottawa.
[145] Toronto Food Policy Council (1994). *Health, Wealth and the Environment: the impact of the CUSTA, NAFTA and GATT on Canadian food security*, pp. 20-24.
[146] Idem.
[147] Kneen, B. 1992. "Feeding the family, trading the leftovers." *The Ram's Horn*, **91**, 1-4.
[148] Warnock, J.W. (1984). *Canadian grain and the industrial food system*. Presentation to Learned Societies Conference, Guelph, ON. 10 June, 1984.

indicating increasing concentration, and the population increased by 9.5%.[149] With farmland decreasing in the province, Prince Edward Island is gradually becoming more dependent on trade to satisfy the food needs of the population.

Table 20. Total Number and Area of Farms in Prince Edward Island, 1981-2001

Year	Prince Edward Island	
	Number of Farms	Area in Farms (hectares)
1981	3,154	283,024
1986	2,833	272,433
1991	2,361	258,875
1996	2,217	265,217
2001	1,845	261,482

Source: Statistics Canada, 2001 Census of Agriculture, Total area of farms, land tenure and land in crops.

Diet changes

Many foods that are energy intensive and have a large ecological footprint in energy intensity are also detrimental to health. For example, major food sources of excess fats are meats, poultry, eggs, milk, cream and a wide range of processed foods. Although further work is needed on the footprints of particular foods, it is likely that a reduction in fat intake could significantly reduce the food footprint because of the high energy demands of feedlot grain-fed meat as well as industrial food processing and transportation.

A change in food consumption toward more grains, vegetables, fruits and natural foods may therefore lead to a healthier diet as well as a reduced food footprint. A healthier diet, in turn, can reduce the current high incidence of cardiovascular disease, type 2 diabetes, hypertension, gall bladder disease and cancer, and improve the wellbeing and quality of life of Prince Edward Islanders. Researchers at the World Cancer Research Fund and the American Institute for Cancer Research report that changes in diet alone could prevent 30% to 40% of all cancers world-wide, at least as many cases as could be prevented by a cessation of smoking.[150]

A healthy diet and sustainable agricultural policy that reduce food footprint do not have to eschew meat products. In an optimal food production system, raising livestock can in fact upgrade human edible energy and protein output, and provide natural manure to fertilize vegetable crops.[151] Livestock can consume food grown on lands not suitable for human food, feed not fit for human consumption such as vegetable culls, grains that do not meet standards, and apple pomace from cider pressings.[152] Optimal food production requires finding the most

---

[149] Statistics Canada, Cansim II, Table 051-0001: Estimates of population, by age group and sex, Canada, provinces and territories, annual. See also Statistics Canada, 2001 Census of Agriculture, Total area of farms, land tenure and land in crops.

[150] Birmingham, et al., 1999. See footnote 201; Colman, 2000, op. cit., page 18.

[151] Scott, J. (2002). *GPI Agriculture Accounts, Part Two: Resource Capacity and Use: The Value of Agricultural Biodiversity*. **GPI***Atlantic*, Halifax.

[152] Idem.

appropriate uses for different types of land and creating a multi-use food landscape. Unfortunately, current production choices are frequently not determined by careful distinctions based on differential soil quality and land use.[153]

Reducing Prince Edward Island's food footprint

If the causes of PEI's large food footprint are understood, intelligent choices can be made that will substantially reduce that footprint and the impact of food consumption patterns on the environment. In particular, Islanders can:

- Maintain a healthy weight, reduce the tendency to overeat, and not waste food;
- Eat the amount of daily calories that are appropriate for one's age and level of activity;
- Eat locally produced foods and support local farmers, thus reducing high transportation and energy inputs into PEI's food system; and
- Eat organically grown and sustainably farmed foods, thus reducing footprint-intensive energy and synthetic, petroleum-based inputs into agriculture.

Public policy that supports local agriculture, organic farming methods, and the best use of land, that mandates high quality nutritional education, and that otherwise helps create a social environment conducive to these consumption choices will produce the greatest and most effective food footprint reductions. As with PEI's transportation and residential energy footprints, personal choices regarding food are limited by incomplete market mechanisms that do not account for social and environmental costs and benefits, and that therefore send misleading price signals to consumers. A core goal of the GPI full-cost accounting mechanisms is to make ecological footprint reduction the natural and economically sound path for society to follow, for the benefit of future generations.

Canada could feasibly reduce its food footprint through public policy measures that encourage sustainable farming practices. One example is given here. The increasing energy intensity of farm inputs, such as synthetic nitrogen fertilizer, is partly responsible for the size of our food footprint. But a 15-year study comparing three maize/soybean systems in the U.S. found that legume-based cropping systems reduced energy use by 50% compared to conventional nitrogen fertilizer-based systems that relied on maize/soybean rotations only.

Legumes reduce carbon and nitrogen losses and increase soil nitrogen storage, thereby reducing the amount of nitrogen that must be applied to maintain yields.[154] While both natural (legume) and industrial nitrogen fixation processes require energy, the first is a virtually "free" service of nature and does not use up non-renewable resources, while the second is expensive and based primarily on the depletion of non-renewable resources.

[153] Scott, J. (2002). *GPI Agriculture Accounts, Part Two: Resource Capacity and Use: Soil Quality and Productivity*. **GPI***Atlantic*, Halifax.
[154] Drinkwater, L., Wagoner, P., and Sarrantonio, M. (1998). "Legume-based cropping systems have reduced carbon and nitrogen losses," *Nature* **396**, 262-265.

The study found that application of legume-based cropping practices in the major maize/soybean growing region in the U.S. would increase soil carbon sequestration by an amount equivalent to 1% to 2% of the estimated annual carbon released into the atmosphere from fossil fuel combustion in the U.S. This saving is in *addition* to the lower CO_2 emissions from the legume-based farming systems that are due to their 50% reduction in energy use. Even though the U.S. has refused to ratify the Kyoto Accord, such a shift in agricultural practices would be a significant contribution to the U.S.' original Kyoto commitment to reduce CO_2 emissions by 7% by 2008-2012.

Best of all, the 15-year U.S. study found no loss in economic viability associated with the shift from conventional synthetic fertilizer-based production using strict maize/soybean rotations to far less energy intensive legume-based cropping methods. Ten-year averages for 1986-1995 maize yields were 7,140, 7,100 and 7,170 kg/ha respectively for legume systems with manure, legume systems without manure, and conventional systems with fertilizer. In other words, the shift to more sustainable, lower impact, and less energy-intensive farming produced no significant loss in yields. For the past ten years of the experiment, economic profitability from the three systems has been comparable. In the longer term, it is possible that the legume systems will produce higher yields than conventional systems that are more likely to degrade soil quality over time.

The results show the potential for more sustainable farming systems to contribute greatly to a reduction in the size of our ecological footprint. From that perspective, government financial incentives and tax breaks to facilitate the transition to more sustainable farming methods would be an outstanding investment in a sustainable future. This is even truer when other environmental co-benefits are considered. For example, the fixed nitrogen currently used in agricultural activities is responsible for a 60% increase in global levels of biologically active nitrogen 22.[155]

A full cost-benefit analysis that considered such environmental values in addition to reductions in energy intensity would likely judge financial incentives for sustainable agriculture highly cost-effective. Most importantly, for the purposes of this study, the example of legume-based cropping methods described above demonstrates the necessity for joint government-citizen initiatives to reduce excess ecological footprint. Farmers and ordinary citizens will take the necessary actions to reduce their footprints if public policy encourages and rewards such actions.

19. The Footprint of Tourism

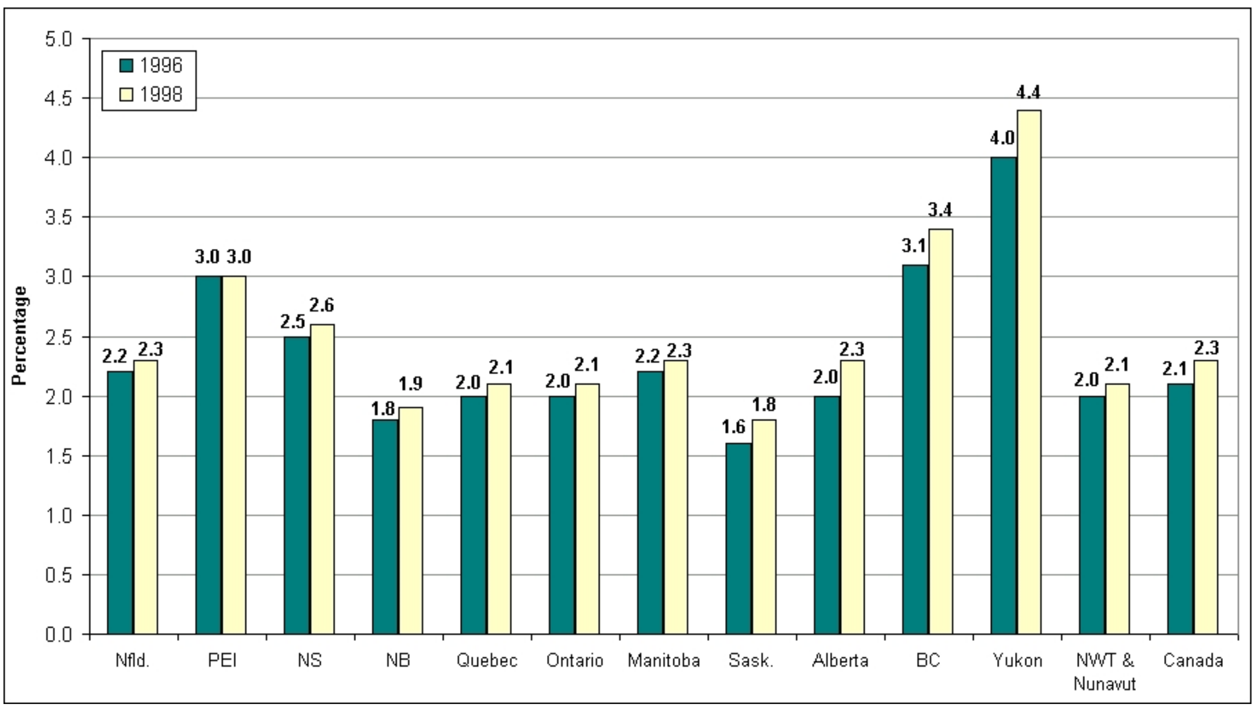
The number and activities of tourists can significantly affect ecological footprint calculations for a particular region. It is therefore necessary to consider the tourist population when estimating per capita consumption, in order to avoid inflating the actual consumption of residents. It is therefore necessary to reduce the per capita consumption of residents by the per capita consumption of tourists.

[155] Jennifer Scott, author of **GPI***Atlantic*'s *Soils and Agriculture Accounts*, personal communication.

While adjusting the PEI footprint to account for the consumption of tourists, it is also necessary to account for the impact of PEI residents when they travel outside the province. Time and resources did not permit such a comparative impact analysis, and we have therefore assumed in this report that the impact of visitors to PEI on the PEI footprint is roughly equivalent to the impact of Islanders on the footprints of other jurisdictions when they visit other regions. This is consistent with the approach taken in the *Living Planet Report 2002*, which considers only consumption within national boundaries.[156] Whether or not the consumption of tourists is attributed to PEI or to the visitors' regions of origin, the crucial issue from a policy perspective is that there are significant opportunities for reducing the tourism footprint in PEI and thereby minimizing the environmental impact of the tourism industry on the province.

Tourism is an important contributor to Prince Edward Island's economy, with almost 1.3 million people visiting the Island in 1999 and almost 1.2 million visitors in 2000.[157] Tourism accounted for 3% of the provincial GDP in 1996 and 1998. Tourism shares of GDP in PEI rank third highest among Canadian provinces, surpassed only by the Yukon and British Columbia in both years (Figure 26).[158]

Figure 26. Tourism Shares of Gross Domestic Product, Canada and Provinces, 1996 and 1998



Source: Statistics Canada (2003). *The provincial and territorial tourism satellite accounts for Canada, 1998.* Catalogue No. 13-604-MIE - No. 040.

[156] See footnote 13.
[157] Prince Edward Island Business Development, PEI Economic Statistics, 2001. Available on the Government of Prince Edward Island web site at: http://www.peibusinessdevelopment.com/index.php3?number=60483.
[158] Statistics Canada (2003). *The provincial and territorial tourism satellite accounts for Canada*, 1998. Catalogue No. 13-604-MIE - No. 040.

The tourism industry share of employment is also significant in PEI. Tourism employment is defined as the sum of all employees contributing to tourism production, consisting of both full- and part-time employment of self-employed persons, employees, and unpaid family workers. In 1996, 4.7% of employment in PEI was in the tourism industry, decreasing slightly to 4.6% in 1998 (Figure 27). PEI again ranks third highest among Canadian provinces for tourism shares of employment, surpassed only by the Yukon and British Columbia.[159]

Tourism contributes to the economy through several different commodity groups. A tourism commodity is a good or service for which a significant part of the overall demand comes from visitors. Therefore, air passenger transportation is considered a tourism commodity, while groceries – although occasionally bought by tourists – are considered non-tourist commodities. Most tourism commodities are purchased while travelling; however, goods and services bought solely for the purpose of travel are also included.[160] Tourism commodities include:

Transportation

- Passenger air, rail, and water
- Interurban, charter and tour buses
- Taxis
- Vehicle rental, and repairs, parts, and fuel for rental vehicles

Accommodation

- Hotels, motels, camping, other accommodation (includes outfitters, commercial cabins and cottages)

Food and beverage services

- Meals and alcoholic beverages from accommodation and restaurants
- Meals and alcoholic beverages from other tourism industries

Other tourism commodities

- Recreation and entertainment
- Travel agency services
- Convention fees
- Pre-trip expenditures (includes tents, camping goods, sleeping bags, luggage, motor homes, trailers and semi-trailers of the caravan type for camping)

Non-tourism commodities purchased by tourists

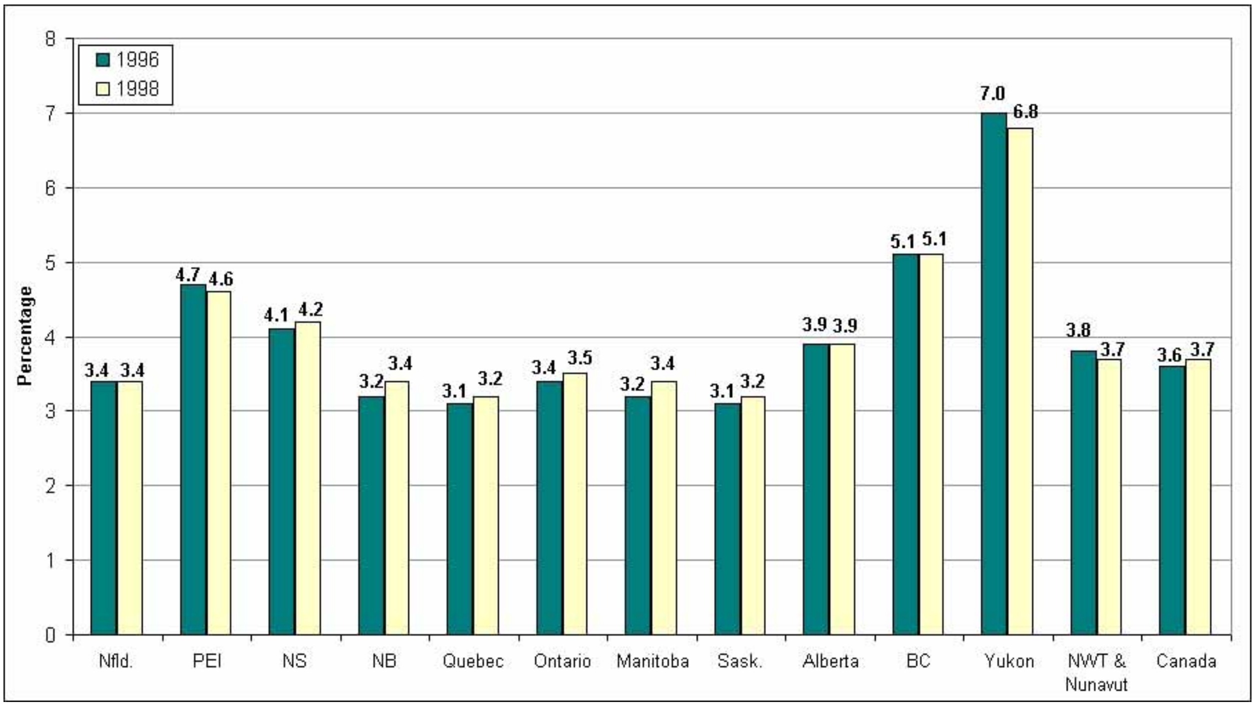
- Groceries
- Beer, wine and liquor from stores
- Urban transit and parking
- Miscellaneous commodities (includes tobacco products, clothing, maps, and souvenirs)

[159] Idem.
[160] Idem.

It is estimated that 1.27 million pleasure and business tourists visited PEI during the 1999 tourism season (May 15th to October 31st).[161] During the 2000 tourism period, fewer pleasure and business tourists (1.18 million) visited the Island.[162] The estimated number of visitors increased slightly during the 2001 tourism season, to 1.185 million.[163]

Total tourism demand is defined as the spending of Canadian and non-resident visitors on domestically produced commodities. Total tourism demand within a particular province is therefore the sum of domestic demand (includes expenditures associated with tourism activity within a given province by residents of that province), international demand (expenditures by non-residents of Canada on tourism in Canada), and inter-provincial demand (expenditures by Canadian tourists made in a province or territory in Canada where they are not a resident).

Figure 27. Tourism Shares of Employment, Canada and Provinces, 1996 and 1998



Source: Statistics Canada (2003). *The provincial and territorial tourism satellite accounts for Canada, 1998*. Catalogue No. 13-604-MIE - No. 040.

Tourism expenditures for PEI in 1998 by commodity are presented and summed as total tourism demand in Table 21. The most significant commodity groups include transportation ($54.6 million; 30% of total tourism demand), accommodation ($54.2 million; 29.8% of total tourism demand), and food and beverage services ($38.7 million; 21.3% of total tourism demand). Each of these commodity groups affect the provincial ecological footprint.

[161] Prince Edward Island Tourism Policy, Planning and Research (1999). *Economic Impact: Tourism 1999*.
[162] Prince Edward Island Tourism Policy, Planning and Research (2000). *Economic Impact: Tourism 2000*.
[163] Prince Edward Island Tourism Policy, Planning and Research (2001). *Economic Impact - Tourism 2001*.

For example, transportation, the largest expenditure commodity group, contributes to PEI's ecological footprint in a number of different ways. As noted in Chapter 3, the footprint created by the burning of fossil fuel is calculated as the biologically productive area that would be needed to sequester enough CO_2 emissions to avoid an increase in atmospheric CO_2. Whether fuel is consumed by residents of PEI or by visitors, fuel consumed within the province therefore contributes to the ecological footprint in the form of land used for CO_2 absorption. Transportation also contributes to the built-up area footprint since transportation requires the use of land for roads and other infrastructure associated with transportation.

Accommodations used by visitors to PEI also contribute to the provincial energy and built-up area footprints. Tourists at hotels, motels, campgrounds and other accommodations consume energy for heating or air conditioning, electricity, hot water, etc. Hotels, motels and campgrounds all occupy built-up land.

Again, whether consumed by residents or visitors to PEI, food and beverages contribute to the ecological footprint of the province. Food and beverages that are produced locally or imported require the use of cropland, pasture land, and sea area, all of which contribute to PEI's food footprint. In addition, the production and transportation of food consumed by visitors in PEI contribute to the province's energy footprint.

Table 21. Tourism Expenditures by Commodity, Prince Edward Island, 1998

	Total Tourism Demand (C$1998 millions)	Percent of Total
Transportation	$54.6	30.0%
Accommodation	$54.2	29.8%
Food and Beverage Services	$38.7	21.3%
Other Tourism Commodities	$27.2	15.0%
Non-Tourism Commodities Purchased by Tourists	$38.1	21.0%
Total Tourism Expenditures - All Commodities	**$181.6**	

Source: Statistics Canada (2003). *The provincial and territorial tourism satellite accounts for Canada, 1998.* Catalogue No. 13-604-MIE - No. 040.

Reducing the footprint of tourism

Tourism is important to the economy of PEI. The Island reaps the benefits of the influx of tourist dollars, but these benefits must also be considered within the larger environmental and social context indicated by ecological footprint analysis. In 1998, 52.3% of visitors to PEI were from other provinces/territories in Canada and 33.1% were international visitors.[164] Reducing the ecological footprint of tourism is more challenging than reducing other components of the ecological footprint of PEI, although some actions designed to reduce the footprint of residents will also reduce the footprint of visitors to the province.

[164] Statistics Canada (2003). *The provincial and territorial tourism satellite accounts for Canada, 1998*. Catalogue No. 13-604-MIE - No. 040. Statistics Canada, Ottawa.

For example, policies promoting walking, riding a bicycle, or carpooling to reduce the province's transportation footprint are aimed primarily at residents of PEI and will have a limited impact on the transportation footprint of tourists. However, integrated land use/transportation planning would help to decrease the transportation footprint of both residents and visitors by locating commercial and recreational facilities close to accommodations. The suggestions listed in Table 16 for reducing household energy consumption could also be used by hotels and other providers of accommodation to help reduce the energy footprint of accommodations. Support for local agriculture and sustainable farming methods would help to reduce PEI's food footprint, regardless of who is consuming the food within the province.

20. A Good News Story: Prince Edward Island's Solid Waste Footprint

Finally, readers may wonder whether Prince Edward Islanders have the individual capacity and collective political will to reduce their ecological footprint substantially. The answer to that question is a simple one, and it is not theoretical. Islanders have *already* demonstrated in practice their ability to act quickly, decisively and effectively to reduce their footprint, in solid waste reduction. If they can act effectively in one key area to reduce their impact on the environment without compromising their quality of life, then they most certainly can do so in any of the other areas discussed in this report.

One of the most direct ways to assess the success of waste management systems is to examine waste generation, disposal, and diversion data. This is especially relevant in Canada, given that one of the organizing principles behind solid waste-resource systems in this country was a 1989 commitment by the Canadian Council of Ministers of the Environment to reduce the amount of material being disposed of in landfills or through incineration by 50% (of 1989 levels) by 2000. Comparing waste management data indicates how provincial systems measure up within Canada and within the international community.

Waste generation and disposal

Canadians generated an average of 490 kilograms of residential waste per capita in 1997, the tenth highest rate of waste generation in the world, and 11% higher than the Organisation for Economic Co-operation and Development (OECD) average of 440 kilograms per capita (Table 22).[165] Canada's waste generation decreased significantly during the mid 1990s. As recently as 1990, Canada generated 690 kilograms of residential waste per capita, and was the third largest generator of residential waste per capita, behind only the U.S. and Australia. Waste generation estimates in Table 22 are based on OECD data. Due to differences in definitions and calculation methods, OECD figures from the 1990s do not compare with Statistics Canada waste generation estimates, which are explored later in this section.

[165] Organisation for Economic Co-operation and Development (1999). *Towards More Sustainable Household Consumption Patterns: Indicators to Measure Progress*, Working Group on the State of the Environment.

Table 22. Largest Per Capita Residential Waste Generators, 1997

Country	Waste Generated (kilograms/capita)
U.S.	720
Australia	690
Norway	630
Switzerland	600
Ireland	560
Netherlands	560
Denmark	560
Austria	510
Hungary	500
Canada	**490**
OECD average	440

Source: OECD, October 1999. *Towards More Sustainable Household Consumption Patterns: Indicators to Measure Progress*, Working Group on the State of the Environment.

Of the 490 kg per capita generated, Canada disposed of 370 kg in landfills and 29 kg through incineration.[166] Canada's per capita landfill disposal rate is 25% higher than the OECD average of 296 kg per capita. Low levels of landfill waste disposal in countries such as Denmark, Japan, and Sweden can partly be attributed to high levels of incineration, though Switzerland boasts a 40% municipal waste diversion rate through recycling and composting (see Figure 28). Japan and Sweden, for example, incinerate 96% and 81% respectively of their waste while Canada incinerates less than 6%.[167]

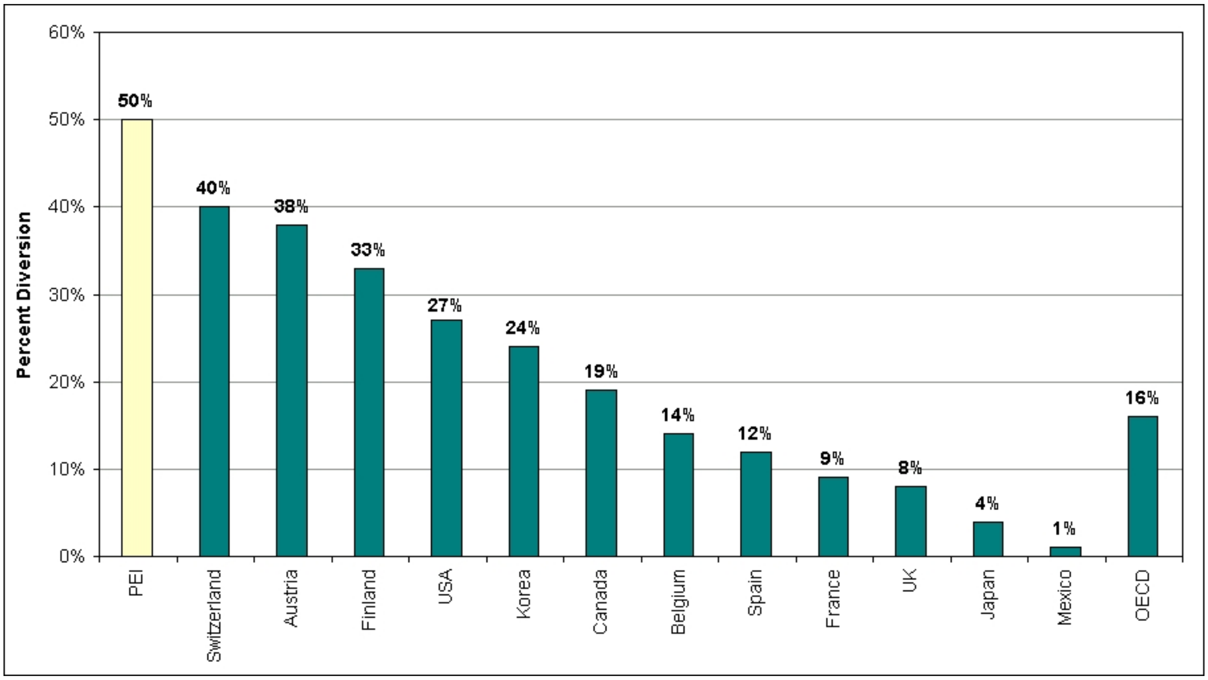
Canada has long been one of the largest waste producers in the world. From 1960 until 1990, municipal waste generation per Canadian increased by about 65% (Figure 29).[168] During the 1980s, however, due to environmental contamination from landfills and increasing public pressure against the placement of landfills and incinerators in local communities, dealing with waste became a pressing issue for all levels of government. Governments and the public began to recognize the need to give priority to effective waste management and waste reduction strategies.

In 1989, two key national initiatives marked a transition in how Canadians viewed solid waste. The first was a commitment by provincial environment ministers to reduce waste disposal by

[166] The Canadian average of 490 kilograms of waste disposed per capita reported by the OECD (1999) is 29% lower than the 690 kilograms per capita reported by Statistics Canada in 1996. Statistics Canada (2000). *Disposal of Waste by Province and Territory, 1998,* Environment Accounts and Statistics Division. According to Statistics Canada, 690 kilograms of waste disposed per capita was the national average in 1996 and 1998. The OECD figures are from 1997 (see footnote 165). The OECD data include only municipal solid waste whereas the Statistics Canada data include municipal and construction and demolition wastes disposed of in provincial landfills.
[167] OECD (1999). Waste incineration estimates are from the mid-1990s (see footnote 165 above).
[168] Estimates for 1980, 1990, and 1997: OECD (1999). *OECD Environmental Data Compendium 1999*. OECD Publications, Paris, France. The 1960 and 1970 figures are estimations derived from U.S. historical waste generation data: USEPA (1996). *Characterization of MSW in the United States, 1996 update*. Available at: www.epa.gov/epaoswer/non-hw/muncpl/factbook.

50% by 2000. The second was the introduction of a national packaging protocol, which committed industry to reduce packaging by 50% (by weight), by 2000.

Figure 28. Municipal Waste Diversion Through Recycling and Composting, Selected OECD Countries and Prince Edward Island, 1997



Note: OECD estimates for waste generation are from 1997. The percentages of waste recycled and composted are from the mid-1990s.

Sources: **PEI diversion rate**: D. Griffin, Assistant Deputy Minister, PEI Department of Fisheries, Aquaculture and Environment, personal communication, 2003. **Other diversion rates**: OECD, October 1999. *Towards More Sustainable Household Consumption Patterns: Indicators to Measure Progress*.

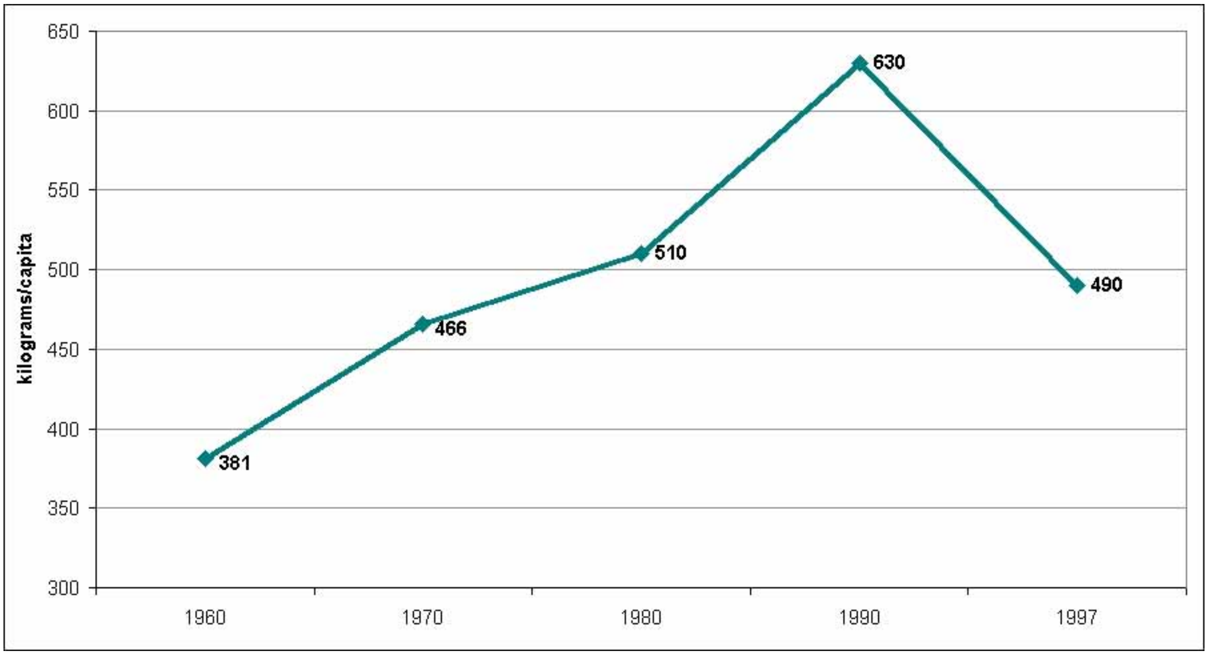
Consequently, the 1990s marked an end to Canada's 30-year trend of increasing waste generation and disposal, and arguably the beginning of a revolution in how we deal with and think about waste. That decade saw a sharp 22% decline in waste generation, largely due to the impacts of the National Packaging Protocol and a decline in the percentage of waste disposed in landfills in some provinces due to the introduction of municipal recycling and composting programs.[169]

Within Canada, success in waste reduction has varied dramatically from province to province. The data in Table 23 are from Statistics Canada and do not correlate with the information in Figure 29, which is from the OECD, due to differences in waste definitions and calculation methods. The OECD data, for example, include only municipal solid waste whereas the Statistics Canada data include municipal as well as construction and demolition wastes disposed of in provincial landfills. Due to provincial differences in waste disposal record keeping, even the comparability of the provincial statistics in Table 23 is questionable. A national standard for the

[169] OECD (1999) (see footnote 168).

collection of waste data is essential to track waste data more accurately than at present to ensure the reliability of comparisons.

Figure 29. Municipal Waste Generation, Canada, 1960-1997



Sources: OECD (1999). *OECD Environmental Data Compendium 1999*; and USEPA (1996). *Characterization of MSW in the United States, 1996 update*.

Table 23. Waste Disposal per Capita by Province, 1994-2000

Province	Kilograms Disposed Per Capita				% decrease 1994-2000
	1994	1996	1998	2000	
Newfoundland	840	670	670	760	10%
Prince Edward Island	x	x	x	x	x
Nova Scotia	760	590	540	460	39%
New Brunswick	760	670	620	630	17%
Quebec	710	750	750	940	-32%
Ontario	670	620	610	650	3%
Manitoba	840	840	850	820	2%
Saskatchewan	910	880	830	810	11%
Alberta	860	880	870	910	-6%
British Columbia	760	620	610	640	16%
Yukon and Northwest Territories	x	x	x	x	x
Canada	750	690	690	750	0%

Source: Statistics Canada, Environment Accounts and Statistics Division, 2000. *Waste Management Industry Survey: Government and Business Sectors, 2000.* Cells containing "x" indicate that the information has been suppressed by Statistics Canada to meet confidentiality requirements.

Statistics for PEI, Yukon, and the Northwest Territories in Table 23 have been suppressed to meet the confidentiality requirements of the *Statistics Act*. Statistics Canada collects waste disposal information using surveys completed by the waste management industry. In the case of PEI, there is only one company providing waste management services (the Island Waste Management Corporation). Therefore, the confidentiality guaranteed under the *Statistics Act* would not be possible to maintain if the statistics for PEI were published. Waste disposal per capita decreased by between 2% (Manitoba) and 39% (Nova Scotia) from 1994 to 2000 (Table 23). During this same period, the Canadian average remained constant, largely due to increases in waste disposal per capita of 6% in Alberta and 32% in Quebec.

Waste diversion

The OECD waste diversion estimates for 1997 are based on the percentage of waste recycled and composted as a proportion of total waste generation. The percentage of diversion in OECD countries ranges from a high of 40% in Switzerland to a low of 0% in the Czech Republic, Hungary, and Italy. Canada, with a diversion rate of 19%, ranks slightly above the OECD average of 16% (Figure 28).[170]

Prince Edward Island's 50% diversion rate in 1997 ranked higher than all the OECD nations. However, it is important to note that there are significant differences in the waste data definitions and calculation methods among the OECD countries, and there is no international protocol for waste diversion estimates. A comparison between PEI and the OECD countries, while subject to these data limitations, is nevertheless useful to demonstrate that PEI is at least among the leaders in waste diversion internationally.

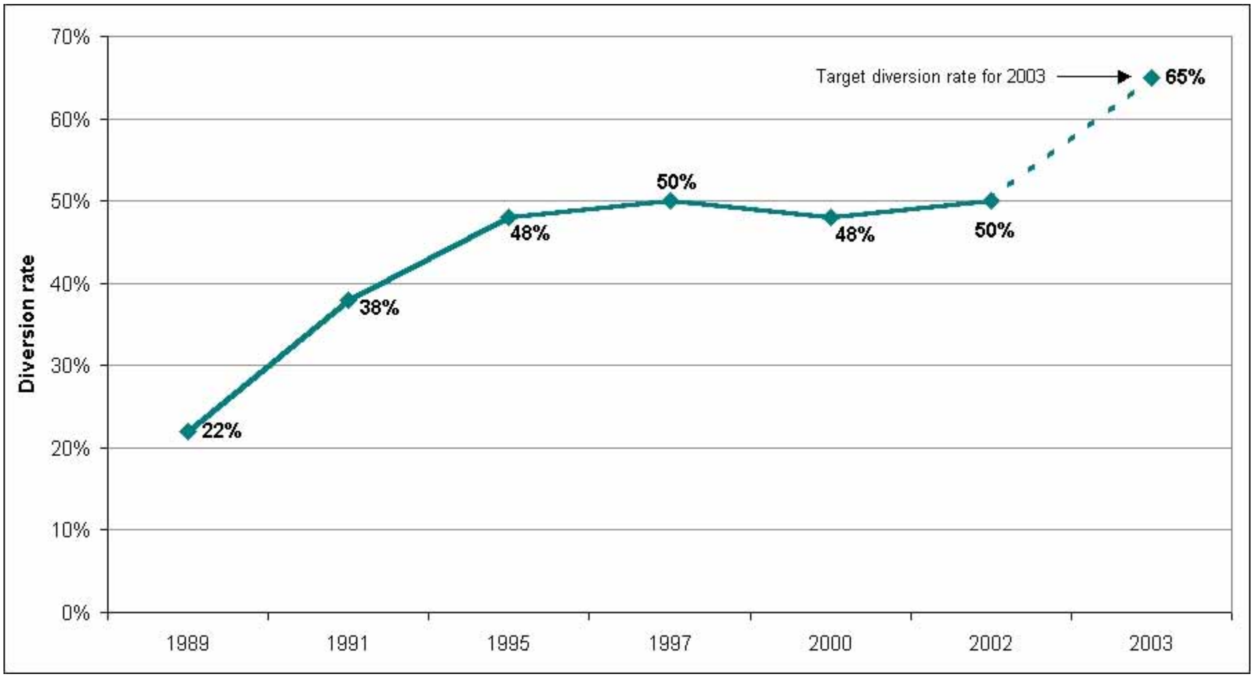
Solid waste management services in PEI are administered by the Island Waste Management Corporation (IWMC), a provincial Crown Corporation.[171] The IWMC operates and maintains provincial disposal sites, and is responsible for the Waste Watch program, a three-stream waste management system, based on source separation. The Waste Watch program sorts waste into recyclables, compostables, and residual waste materials. Items such as paper, plastics, metal and glass are recycled, organics such as food and yard waste are composted at the Central Compost Facility, and remaining residuals are disposed of to landfill or incinerator.

Figure 30 shows the increase in the waste diversion rate in PEI between 1989 and 2002 and the projected waste diversion rate for 2003. Between 1989 and 1997, the waste diversion rate increased from 22% to 50% before dropping slightly to 48% in 2000 and increasing to 50% again in 2002. Prior to 2002, only a quarter of the population of PEI was on the Waste Watch pilot project. The entire province is now covered by the IWMC's Waste Watch program, and it is anticipated that the diversion of material from landfill or incineration will be in the 65% range in 2003.

---

[170] OECD (1999). Waste generation data are from 1997. Recycling and composting data are from the mid-1990s (see footnote 168 above).
[171] For more information, see the Island Waste Management Corporation's web site at: http://www.iwmc.pe.ca/index.htm.

Figure 30. Prince Edward Island Waste Diversion Rates, 1989-2002, and Projected 2003 Waste Diversion Rate



Source: D. Griffin, Assistant Deputy Minister, PEI Department of Fisheries, Aquaculture and Environment, personal communication, 2003.

Prince Edward Island stewardship initiatives[172]

Prince Edward Island participates in several stewardship initiatives that also lead to waste diversion, including the Refillable Beverage Container Programme, the Beverage Container Recycling Programme, the Lead Acid Battery Take Back Programme, the Used Oil Recovery Programme, and the Tire Recovery Programme. A short summary of each of these initiatives is presented below, including information on their success rates.

Refillable Beverage Container Programme

The Refillable Beverage Container Programme is unique to Prince Edward Island, and covers the entire province. This mandatory program requires that beverage containers for beer and carbonated flavoured beverages be sold in refillable glass containers. The main goals are to reduce roadside litter to the greatest extent possible, to recover as many of the refillable containers as possible, and to maintain a 98% recovery rate on containers.

Consumers have the option to return bottles to the retailer or to bottle depots. Both soft drinks and beer have a 98% return rate. Bottle washing replaces the manufacturing of new cans or

[172] PEI's stewardship initiatives are summarized on the Environment Canada web site at: http://www.ec.gc.ca/epr/inventory/en/searchResults.cfm?intProvince=110&newQuery=1.

bottles, thus reducing waste generation, resource depletion, and energy use. Containers circulate in a two-way stream between beverage producers and consumers instead of a one-way stream from manufacture to disposal. Since 1980 over one billion one-way containers have been eliminated from use in PEI by the refillable system. The system also helps the Island's local economy since local bottle washers are supported, rather than out-of-province and international can and bottle manufacturers. Through the implementation of this program, therefore, disposal is largely eliminated and the local bottle washing industry is supported.

Beverage Container Recycling Programme

This mandatory province-wide wine and cooler beverage container recycling programme has been in place since 1992 with the purpose of reducing roadside waste and collecting as many recyclable containers as possible. The Prince Edward Island Liquor Control Commission accepts empty wine and cooler containers at all retail outlets and recycling depots. Deposits are $0.10 for bottles equal to or under 500ml, and $0.20 for bottles over 500ml. Consumers receive half of the deposit ($0.05 to $0.10) back at retail outlets, or $0.03 and $0.07 when returning them to recycling depots. In 2000-2001 the recovery rate for these liquor containers was 60%.

Lead Acid Battery Take Back Programme

Introduced in 1993, this program focuses on lead acid batteries, including all vehicle batteries (car, truck, snowmobile, motorcycle, off-road vehicle, and ride-on lawnmower batteries). Regulations require retailers to charge a $5 fee on new battery purchases, unless an old battery is returned within 30 days. Provincial regulations state that retailers must send old batteries to the appropriate facilities for recycling. The programme's target is to recover all batteries sold in PEI. In 1998, there was a 65% recovery rate of batteries and battery-related materials, followed by a 70-75% capture rate in 1999, and a remarkable 107% rate in 2000, as consumers returned more batteries than they bought.

Used Oil Recovery Programme

Introduced in 1988, this programme includes all lubricating oils, which include engine oil, transmission fluid and gear oil. The program is based on a return to the point-of-purchase (i.e., the seller), which includes any service stations, stores etc. that sell lubricating oil. Sellers are required to accept used oil in quantities of up to 10 litres per person per day or the equivalent size of the largest container of lubricating oil that is sold on the premises. Once collected, it is sent for recycling or other end-uses. In 2000, 463,586 litres of used oil were collected in PEI through the program.

Tire Recovery Programme

PEI Retailers charge a levy on all tires purchased within the province. The Island Waste Management Corporation contracts the retailers and disposal facilities, which collect the tires. The annual levy income of $200,000 is spent to collect and bale about 100,000 tires a year.

The tires are sent to a site on the central-western part of the Island where they are baled into blocks. Two projects in particular have used some of the baled material for sea wall applications.

Based on diversion and other waste management data, PEI is a leader both nationally and internationally in waste diversion. At the international level, Prince Edward Island's waste diversion rate is among the best in the world compared to all OECD countries. Along with Switzerland, the Netherlands, and Austria, PEI leads the world in waste diversion, surpassing even those European leaders.

Municipal waste generation and "Generally Accepted Principles"

It is extremely difficult to compare waste diversion numbers between jurisdictions because of a wide array of different approaches to measuring and reporting waste generation figures. For example, some municipalities include disposal of large appliances and furniture, as well as curb-side collection of waste from commercial establishments and multiple unit dwellings, while others do not. This lack of consistency in measurement methods has made it very difficult to compare or aggregate municipal, provincial, and even federal waste generation and diversion data. In early 2000, a non-profit organization called Corporations Supporting Recycling (CSR) established a Canada-wide group to examine municipal waste flow and diversion statistics in an effort to apply standardized principles and practices to measuring waste flow.

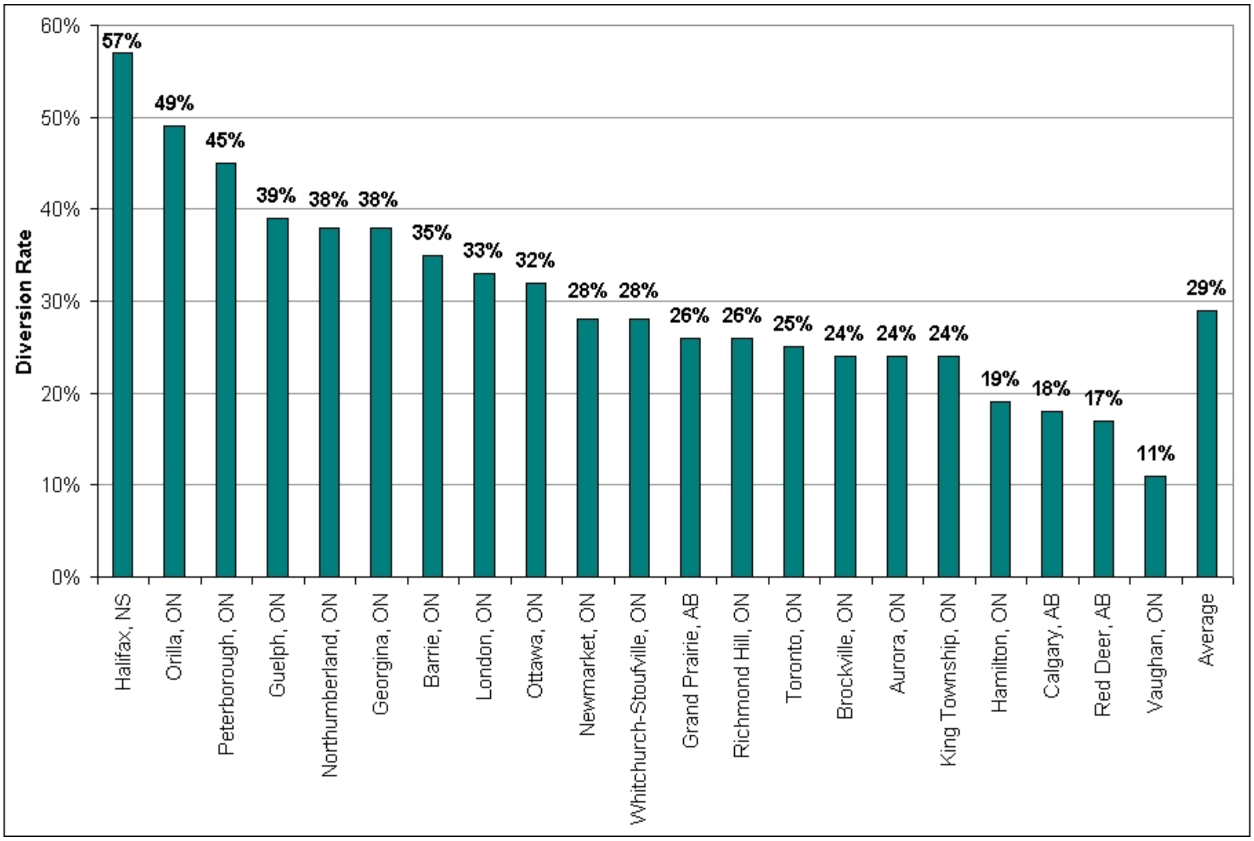
The result was the development of "Generally Accepted Principles" (GAP). GAP is a measurement protocol that ensures a consistent format for measuring and reporting waste flow and waste diversion at the residential level. Data on per capita disposal and diversion calculated using the GAP protocol are currently available for municipalities in Ontario, Alberta and Nova Scotia. Although not all municipalities adhere to the GAP protocol, the number of participating municipalities is growing, allowing for more consistent municipal waste generation comparisons. PEI municipalities do not currently participate in GAP reporting. For more information about the GAP model, visit the CSR web site at www.csr.org.[173]

The average residential waste generation for municipalities with GAP reports available was 374 kg per person in 2000, 259 kg or 69% of which is disposed in landfills.[174] Diversion rates for the GAP protocol are calculated (as are the OECD diversion rates) based on the proportion of total waste generated that is diverted from landfills by being reintroduced back into the flow of materials.[175] Halifax Regional Municipality, according to the GAP protocol, has a residential diversion rate of 57%, the highest diversion rate of all the municipalities with GAP reports available (Figure 31). The HRM diversion rate is twice as high as the GAP average and over 3.5

[173] Information about the GAP model can also be obtained by telephone at 416-594-3456, extension 238.
[174] Corporations Supporting Recycling (2001). GAP reports for municipalities reporting according to GAP guidelines are available at www.csr.org. The data set used in this report were accessed through the web site (www.csr.org) in November 2001.
[175] A GAP diversion rate is the percentage of waste generated that is diverted from landfills by being reintroduced back into the flow of materials. This is different from the diversion definition used by the Canadian Council of Ministers of the Environment (CCME) in setting the goal of 50% waste diversion by 2000. The 50% diversion goal refers to a 50% diversion from landfills compared to the amount being sent to landfills in 1989.

times the OECD average. If PEI municipalities were to report according to the GAP protocol, they would likely exceed the current HRM diversion rate.

Figure 31. "Generally Accepted Principles" Municipality Diversion Rates, 2000



Source: Corporations Supporting Recycling, November 2001 (www.csr.org).

Reducing Prince Edward Island's solid waste footprint further

Toward a zero waste target

Although PEI has made great and commendable strides in diverting wastes from landfill, there are still many other ways the Island can continue to reduce its solid waste footprint. In the past, most public policy on solid waste reduction has been narrowly focused on recycling and have been content with recycling targets ranging from 35-50%. But would Islanders accept 50% unemployment or 50% poverty, or a 50% reduction in famine or disease? Islanders would surely wish to see zero unemployment, zero poverty, zero famine and zero disease. By the same token, a society genuinely committed to sustainability can legitimately set "zero waste" as its ultimate target.

To make further substantial reductions in PEI's solid waste footprint, a paradigm shift in the approach waste issues is needed. Instead of concentrating on "managing" waste, *resources* should be managed and *waste* should be eliminated. The concept of "zero waste" unites environmental sustainability, community sustainability, and economic sustainability. Zero waste is not only about recycling and diverting waste from landfills and incinerators, but envisions the restructuring of production and distribution systems to prevent waste from being created from the outset.[176]

Practical strategies for movement towards a zero waste target include:

- incentives for extended producer responsibility (taking responsibility for the product and its packaging from cradle-to-grave);
- incentives for environmentally friendly product design (products that are produced for durability, easy repair, and/or easy upgrading, including design that accounts for the product's entire life cycle);
- incentives that encourage the use of renewable resources rather than virgin resources;
- resource recovery facilities to enable materials discarded by the community to be reused, recycled, and remanufactured (for example, PEI's Waste Watch Drop-Off Centers[177]);
- legislation and economic instruments that encourage conservation and resource recovery, and that penalize unsustainable practices.

PEI's remarkable success in reducing its solid waste footprint by 50% in just a few years indicates that dramatic and substantial shifts in behaviour and action are actually possible. Not only can PEI reduce its solid waste footprint even further, but the same basic principles and strategy of government-citizen cooperation can be applied to footprint reductions in energy use, innovative transportation options, integrated land use/transportation planning, support of sustainable agriculture, and exploration of renewable energy sources like wind power.

In the spirit of past successes, the last Chapter of this report proposes a specific footprint reduction target that PEI's solid waste achievements tell us is well within the Island's capacity and reach.

21. Treading Lightly: Ecological Footprint Can Be Reduced

The ecological footprint is primarily an educational tool that can help the citizens of Prince Edward Island to clearly visualize the impact of their consumption patterns, to become more responsible for their choices, and to move PEI toward a healthy, sustainable community. It allows all Islanders to share responsibility in this enterprise.

The 1999 PEI ecological footprint of 8.98 hectares per person is clearly not sustainable. A general lack of awareness of the environmental impact of resource consumption and waste production in the past has seriously degraded the natural world and undermined natural wealth.

[176] Target Zero Canada (2001). *Beyond Recycling – Zero Waste*. Available at: www.targetzerocanada.org/.
[177] For information on Waste Watch Drop-Off Centers in PEI, visit the Island Waste Management Corporation's web site: http://www.iwmc.pe.ca/sites.htm.

While the complex scientific processes that underlie human interaction with the environment are often difficult for ordinary citizens and policy makers to understand, let alone convert into policy, the ecological footprint is a simple yet powerful means to illustrate and represent the environmental impact of daily consumption patterns and life choices, and to suggest practical means to reduce that impact.

To secure a healthy, vibrant future for the children of Prince Edward Islanders, individuals, businesses, and government can use the ecological footprint concept to accept full responsibility for current policy and consumption choices and to take the necessary actions to reduce the footprint of PEI. The action can begin anywhere, because footprint savings add up quickly.

If all Prince Edward Islanders reduced their individual footprints from 8.98 ha/capita to 7.0 ha/capita, which can easily be done through some of the very basic transportation, household energy, and food consumption shifts outlined in this report, the total provincial footprint would shrink by **over one quarter of a million hectares**. That would be a sign of "genuine progress." **GPI*Atlantic* therefore proposes that a quarter million hectare reduction in the province's ecological footprint be set as an immediate goal, with a 2005 target date**.

Clearly in the long term, the province's ecological footprint needs to be reduced far more dramatically. However, as PEI's solid waste reduction accomplishment has shown, once footprint reduction priorities and clear targets are set, and decisive actions are taken, substantial successes can be achieved in a very short time period. As recently as 1981, the PEI footprint was just 5.79 ha per person, so substantial footprint reductions that do not impair quality of life are very conceivable.

Here are a few basic suggestions to help Islanders get started:

- Walk and ride a bicycle whenever possible.
- Car-pool or take public transportation to work instead of driving alone. In the case of PEI, which currently has no significant public transportation, the development of a public transportation system would help to reduce the ecological footprint of the province. In the meantime, Islanders can take advantage of their strong community and neighbourly ties to institute an effective car-pooling system, while continuing to lobby for public transit.
- Keep vehicles well maintained.
- Buy locally grown and organic foods.
- Consume the number of calories that are appropriate for one's age and level of activity.
- Eat more grains and vegetables, and less meat products.
- Reduce, reuse, recycle, and compost.
- Reduce household energy use by turning off lights and replacing burned out bulbs with halogen or compact fluorescent bulbs; turning down the temperature at night and when not home; hanging out the laundry to dry; insulating walls and roofs; and investing in energy efficient appliances.
- Select fuel-efficient vehicles, and avoid SUVs, minivans, light trucks and other fuel-inefficient vehicles.
- Live close to work or try to choose work in close proximity to where one lives.
- Grow a food garden.

If all Prince Edward Islanders took just a few of these simple steps – many of which can improve health, wellbeing and quality of life, and save money – they could quickly reduce their individual footprints by a hectare per person, and the provincial footprint by more than a quarter of a million hectares. Prince Edward Island communities can compete with each other in a friendly, constructive way, to determine which one can reduce its footprint most effectively and dramatically, while enhancing the quality of life of its residents. As a province, PEI can become a model for other Canadians and citizens world-wide by setting new standards of ecologically responsible living.

Once started on this path, Prince Edward Islanders can go deeper. Islanders can begin to evaluate the underlying nature of their consumer lifestyles in new ways and to ask themselves some tough questions:

- How much of what we consume is a reflection of need? Do we really need that second car or third TV?
- How much of our consumption is excessive? How important is a large home?
- How much of our consumption is driven by marketing and advertising?
- How much of our consumption is an attempt to fulfill missing psychological needs?
- Does consuming more really make us happier?
- Might our wellbeing and quality of life have more to do with strong and caring communities, a healthy environment, and long-term security than with more material consumption?
- How do our consumption habits affect our responsibility to our community, to PEI, to Canada, and to the world?
- How do we shift our public policy priorities to chart a more sustainable future for our children?

Real footprint savings will come by consuming less, shifting consumption choices, and changing public policy priorities. Consumption choices determine the size of an individual ecological footprint. The first choice is to exercise the right not to consume. Individuals also have the power to exercise choice over what products they consume. Purchasing local foods and goods, fuel-efficient car models, and energy-saving household appliances and equipment creates a smaller footprint than the usual alternatives.

Ultimately, if Islanders are to make the deep footprint reductions essential to curbing their current overshoot and protecting their childrens' future, they will have to act as a society rather than as individuals. Fortunately, there are many practical and constructive places to start that can improve social wellbeing and strengthen communities, while at the same time substantially reducing ecological footprint.

Both in urban and rural areas, how communities are designed has an immense influence on the resource intensity of the lifestyles of members of that community. There are excellent existing models that can help develop an infrastructure that:

- reduces dependency on the automobile,
- ensures safe and easy access to amenities,

- promotes attractive community and town centres and urban villages,
- reduces urban sprawl,
- promotes energy efficient homes and co-housing developments, and
- encourages the use of energy efficient technologies.

How communities are designed today will directly influence the ecological footprint of future generations, their quality of life, and the legacy they leave their own children.[178]

This report has also suggested policy actions that can support local agriculture, encourage sustainable farming methods, and promote nutritional education to reduce food footprint. Investments in public transit, construction of bicycle lanes, incentives for renewable energy development, district heating investments, and a range of other policy initiatives can sharply reduce PEI's energy footprint.

Internationally, many towns, communities, and governments have successfully taken these and other initiatives to reduce their ecological footprints, and improve the health and wellbeing of their citizens. Islanders can learn from their examples, and borrow the best of what is already available to suit PEI's particular needs and circumstances.

Prince Edward Islanders can *also* learn from what we they already accomplished in the province. Islanders have already dramatically reduced their solid waste footprint and the Island's world leadership in composting, recycling and solid waste diversion is a model of government-citizen cooperation that can show a sustainable way forward. In July 2003, the 44th Annual Premiers' Conference and the Tree Canada Foundation worked together to organize the first ever "carbon neutral" Premiers' conference in Charlottetown.[179] Tree Canada will plant 850 trees to offset the CO_2 emissions of the delegates, including their method of travel and the energy consumed during the time they spent on PEI. Thirteen of the trees were planted by the premiers and territorial leaders in Charlottetown, with the remaining trees planted across the country. Through this symbolic action, PEI has provided an outstanding example for the country, raised awareness about an important global issue, and helped reduce the ecological footprint of the conference. Clearly, footprint reductions are not only possible but have already been successfully accomplished in PEI.

In the early 1980s too, Prince Edward Islanders substantially reduced their energy footprint by switching to smaller, fuel-efficient cars, insulating their homes, and adopting other conservation measures. However, the provincial energy footprint started to creep upwards again in the 1990s. In 1999, PEI's total energy footprint (4.3 ha/person) was 29% larger than it was in 1981.
The average Prince Edward Islander's total ecological footprint in 1999 (8.98 ha/person) was 7% smaller than the average American's footprint (9.7 ha/person), but it was still 1.8 times larger than the average Western European's footprint (4.97 ha/person), indicating that PEI might more productively look to Europe and elsewhere for workable models of sustainable development than to the U.S. Denmark, for example, has become a world leader in wind energy; the Netherlands is actively promoting organic farming and bicycle use; BMW cars are now made with 35%

[178] Onisto et al, 1998. See footnote 10.
[179] *First "Carbon Neutral" Premiers' Conference to be Held in PEI*, press release available at: http://www.gov.pe.ca/news/getrelease.php3?number=3199.

recycled parts;[180] and Curitiba, Brazil, has become a world leader in integrated land use/transportation planning and mass transit use.

In sum, for a PEI determined to reduce its ecological footprint, there is no shortage of outstanding examples of sustainable living and development, including powerful ones within its own borders. The effort to reduce the Island's ecological footprint will require government, business and citizen participation. Policy makers and businesses can play a key leadership role in encouraging, supporting and investing in sustainable initiatives. Prince Edward Islanders will have to work together to bring about the changes necessary to make PEI a healthy, vibrant and sustainable province that Islanders are proud to leave as an inheritance to future generations, and that can serve as a model for others.

[180] "MP Looks for Better Method to Measure Canada's Success," *The Kingston Whig-Standard,* 21 February, 2001.

APPENDIX A
THE NOVA SCOTIA GENUINE PROGRESS INDEX: PURPOSES, PRINCIPLES AND METHODS

Limitations of the Gross Domestic Product as a Measure of Progress

The most commonly used basis for assessing economic and social wellbeing is the GDP. Yet, in recent years there has been increasingly widespread acknowledgement by leading economists of the shortcomings of the GDP as a comprehensive measure of progress. Indeed, as an aggregation of the market value of all goods and services, the GDP was not intended, even by its architects, as a composite index of economic welfare and prosperity.

Using GDP levels and economic growth rates to measure progress takes no account of the value of natural, human and social capital, including environmental assets, unpaid work, and free time. It does not allow policy makers to distinguish the costs and benefits of different economic activities, and it masks changes in income distribution. Such fundamental omissions and limitations render the GDP an inadequate measure of social and economic wellbeing.

It should be noted that these are not flaws of the GDP per se, but of its misuse as a benchmark of economic and social health, prosperity and welfare. Nobel Prize winner, Simon Kuznets, one of the principle architects of national income accounting and the Gross National Product, never endorsed its modern use as an overall measure of progress. As early as 1934, Kuznets warned the U.S. Congress that “the welfare of a nation can scarcely be inferred from a measurement of national income.”[181]

As the GNP and its successor, the GDP, began increasingly to be used as a measure of general social wellbeing and progress after the Second World War, Kuznets’ reservations about the limitations of the system he helped create grew stronger and he argued that the whole system of national accounting needed to be fundamentally rethought. In 1962 he wrote:

> “Distinctions must be kept in mind between quantity and quality of growth, between its costs and return and between the short and the long run. Goals for ‘more’ growth should specify more growth of what and for what.”[182]

When the GDP is misused as a measure of wellbeing and progress, it frequently sends misleading and inaccurate signals to policy makers that in turn results in the depletion of vital resources and investment in economic activities that carry hidden social and environmental costs. What we count and measure is a sign of what we value. By focusing on quantitative material

[181] Cobb, C., Halstead, T., and Rowe, J., 1995, *The Genuine Progress Indicator: Summary of Data and Methodology,* Redefining Progress, San Francisco, California.
[182] Kuznets, Simon, *The New Republic,* Oct. 20, 1962, (cited in Cobb et al. 1995).

growth as our primary measure of progress, we under-value the human, community, and social values, and environmental quality, which are the true basis of long-term wellbeing, prosperity and wealth. The flaws inherent in the misuse of the GDP as a measure of progress include the following:

The failure to value natural capital

The GDP is a current income approach that fails to value natural and human resources as capital assets subject to depletion and depreciation. As such it cannot send early warning signals to policy makers indicating the need for re-investment in natural and human capital. For example, the GDPs of Newfoundland and Nova Scotia registered massive fish exports as economic growth, but the depletion of fish stocks appeared nowhere in the accounts. Similarly, the more trees we cut down and the more quickly we cut them down, the faster the economy will grow. Measured from the consumption side, the more voraciously we consume energy, fish, timber, and other resource products, the "better off" we are assumed to be.

The failure to make qualitative distinctions

Secondly, the GDP itself is a quantitative measure only and fails to account for qualitative changes, both in the mix of economic activity and in the quality of our goods and services, including ecosystem services.[183] This failure can send perverse messages to policy makers, with pollution actually registering as a contribution to economic prosperity. The *Exxon Valdez*, for example, contributed far more to the Alaska GDP by spilling its oil than if it had delivered its oil safely to port, because all the clean-up costs, media activity, legal expenses, and salvage operations made a huge contribution to the state's economic growth statistics.

Thus, water pollution and bottled water sales are literally "better for the economy," according to our economic growth statistics, than free, clean water, simply because more money is spent on the former. Repairing the damage from extreme weather events and natural disasters due to climate change is actually counted as a contribution to our prosperity and wellbeing when the GDP is used to assess how "well off" we are. This happens because the GDP blindly records all money spent as a contribution to the economy, without assessing whether this spending actually signifies an improvement in wellbeing or a decline.

This incongruity extends even to ordinary household purchases. There is no recorded relationship, for example, between the cost of consumer durables as capital investments on the one hand and the quality of services they provide on the other, leading to the paradox that the quicker things wear out and have to be replaced, the better for the GDP.

[183] The Canadian System of National Accounts (CSNA) as a whole does provide information on shifts in the mix of economic activity by sector, industry, commodity, and province. These remarks, therefore, apply only to the use of GDP as a measure of progress, since industry and commodity shifts registered in the CSNA are rarely invoked as signals of changes in societal wellbeing and prosperity.

In sum, this failure to account for qualitative changes means that increases in crime, divorce, gambling, road accidents, natural disasters, disease, obesity, mental illness, and toxic pollution all make the GDP grow, simply because they produce additional economic activity. More prisons, security guards, burglar alarms, casinos, accident costs, storms, natural disasters, dieting pills, anti-depressants, lawyers, oil spill and pollution clean-ups, and the costs of setting up new households after family breakups, all add to the GDP and are thus conventionally counted as "progress."

This anomaly led Robert Kennedy to remark 30 years ago:

> "Too much and too long, we have surrendered community excellence and community values in the mere accumulation of material things....The (GNP) counts air pollution and cigarette advertising and ambulances to clear our highways of carnage. Yet the gross national product does not allow for the health of our children, the quality of their education, or the joy of their play. It measures neither our wit nor our courage; neither our wisdom nor our learning; neither our compassion nor our devotion to our country. It measures everything, in short, except that which makes life worthwhile."[184]

In short, because GDP statistics make no qualitative distinctions, they do not reveal whether expenditures signify an improvement in wellbeing or a decline. Standard economic growth measures are simply incapable of sending any meaningful signal about natural resource health, and of distinguishing gains from losses in wellbeing. Indeed, resource yield statistics, though conventionally used to signal industry health, may well signify the precise opposite from the perspective of long-term sustainability.

Other limitations

Thirdly, because it excludes most non-monetary production, the GDP records shifts in productive activity from the household and non-market sectors to the market economy as economic growth, even though total production may remain unchanged. Thus, paid child care, hired domestic help, and restaurant food preparation all add to the GDP, while the economic values of parenting, unpaid housework, home food preparation, and all forms of volunteer work remain invisible in the economic accounts.

Fourthly, market productivity gains may result in greater output *or* increased leisure, but the GDP counts only the former. Longer paid working hours add to GDP growth by increasing output and spending, but free time is not valued in our measures of progress, so its loss counts nowhere in our accounting system. Given this imbalance, it is not surprising that the substantial economic productivity gains of the last 50 years have manifested in increased output, incomes, and spending, while there has been no real increase in leisure time.

[184] Kennedy, R., 1993, "Recapturing America's Moral Vision," in *RFK: Collected Speeches,* Viking Press, New York.

Omitting the value of unpaid work and free time from our measures of progress has important implications for the changing role of women in the economy, who have entered the paid workforce in growing numbers without a corresponding decline in their share of unpaid work. Indeed, as the "value of leisure time" module in the GPI demonstrates, women have experienced an increase in their total work-load, higher rates of time stress, and an absolute loss of leisure time.

The failure to value leisure time is directly related to natural resource and environmental health and wellbeing. Blind economic growth and material gain have been the major anthropogenic forces fuelling ecological degradation, including the depletion and deterioration of vital natural resources and the dangerous warming of the planet. Re-examining work patterns in industrialized nations to value increased leisure rather than income growth alone as a key to wellbeing, can make a vital contribution to ecological health and stability.[185]

Finally, GDP tells us how much income the economy generates, but tells us nothing about how that income is shared. Because it does not account for income distribution, GDP growth may mask growing inequality. GDP may rise substantially, as it has in recent years, even while many people are getting poorer and experiencing an actual decline in real wages and disposable income. The benefits of what experts refer to as "strong" and "robust" economic growth, based on GDP measurements, may be distributed very unequally. The trend towards rising inequality in a period of strong economic growth has been even more pronounced in the U.S. than in Canada.[186]

These shortcomings and others led to a joint declaration by 400 leading economists, academics, and leaders, including Nobel Laureates:

> "Since the GDP measures only the quantity of market activity without accounting for the social and ecological costs involved, it is both inadequate and misleading as a measure of true prosperity... New indicators of progress are urgently needed to guide our society... The GPI is an important step in this direction."[187]

[185] For an outstanding exposition of this relationship, see Anders Hayden, *Sharing the Work, Sparing the Planet: Work Time, Consumption and Ecology,* Between the Lines, Toronto, 1999

[186] Cobb, C., Halstead, T., and Rowe, J., 1995, *The Genuine Progress Indicator: Summary of Data and Methodology,* Redefining Progress, San Francisco, California; Messinger, Hans, 1997, *Measuring Sustainable Economic Welfare: Looking Beyond GDP,* Statistics Canada, unpublished manuscript, Ottawa. Messinger demonstrates that the absolute decline in the original U.S. Genuine Progress Indicator since the early 1970s is largely due to growing disparities in income distribution in that country. Rising inequality is registered in column B of the original GPI as an adjustment to personal consumption based on the share of national income received by the poorest 20 percent of households.

[187] Signatories include Robert Dorfman, Professor Emeritus, Harvard University, Robert Heilbroner, Professor Emeritus, New School for Social Research, Herbert Simon, Nobel Laureate, 1978, Partha Dasgupta, Oxford University, Robert Eisner, former president, American Economics Association, Mohan Munasinghe, Chief, Environmental Policy and Research Division, World Bank, Stephen Marglin and Juliet Schor, Harvard University, Don Paarlberg, Professor Emeritus, Purdue University, Emile Van Lennep, former Secretary General, OECD, Maurice Strong, Chair, Ontario Hydro and Secretary General, Rio Earth Summit and Daniel Goeudevert, former Chairman and President, Volkswagen AG. Full text and signatory list available from *Redefining Progress*, One Kearny St., San Francisco, CA. 94108.

The Development of Expanded Accounts

Fortunately, considerable progress has been made in the last 20 years by the World Bank, OECD, United Nations, World Resources Institute, and other international organizations, by national statistical agencies, including Statistics Canada, and by leading research institutes and distinguished economists, in developing expanded economic accounts which include critical social and environmental variables. The internationally accepted guidelines in *The System of National Accounts 1993* now suggest that natural resources be incorporated into national balance sheet accounts and that governments develop a "satellite system for integrated environmental and economic accounting," and a satellite account to measure the value of unpaid household work.

Accordingly, Statistics Canada, in December, 1997, released its new *Canadian System of Environmental and Resource Accounts (CSERA),* which consist of natural resource accounts linked to the national balance sheets, material and energy flow accounts linked to the input-output tables, and environmental protection expenditure accounts. Statistics Canada has sponsored an international conference on the measurement of unpaid work, has produced its own extensive valuations of household work, and is developing a *Total Work Accounts System (TWAS)* which includes both paid and unpaid work (Statistics Canada 1997; Stone and Chicha 1996). Every six years an extensive time use survey is now part of Statistics Canada's General Social Survey. Other agencies are also moving in this direction. Human Resources Development Canada, for example, has issued an Index of Social Health for all the provinces and for the country as a whole.

Some composite indices, like the Measure of Economic Welfare (MEW), the Index of Sustainable Economic Welfare (ISEW), the Genuine Progress Indicator (GPI), and the Index of Economic Wellbeing (IEW), incorporate up to 26 social and environmental indicators, including unpaid work, income distribution, changes in free time, and valuations of natural capital and the durability of consumer goods.[188] These indices also distinguish direct contributions to economic welfare from defensive and intermediate expenditures and from economic activities that produce an actual decline in wellbeing. There have been continuing improvements in methodologies and data sources in recent years, and excellent models are now available for application.

In fact, the current interest in social indicators and comprehensive measures of progress owes a strong debt to the pioneers in this field of the late 1960s and early 1970s, who recognized the limitations of the GDP and sought to go beyond them. Nordhaus and Tobin's Measure of Economic Welfare and similar efforts to expand the definition of national wealth led to the development of new measurement instruments which today form the basis of recent efforts in this field.

[188] Cobb et al., op. cit., Messinger, op. cit., Osberg, Lars, and Sharpe Andrew, 1998, *An Index of Economic Wellbeing for Canada,* paper presented at the Conference on the State of Living Standards and the Quality of Life in Canada, Centre for the Study of Living Standards, Ottawa. Messinger compares the MEW and the original GPI and replicates the models for Canada. On the original GPI (Genuine Progress Indicator), see Cobb et al. op. cit. See also **GPI***Atlantic*, *Measuring Sustainable Development: Application of the Genuine Progress Index to Nova Scotia,* January, 1998 and *Project Profile,* March, 2000. This and other GPI materials are available on the **GPI***Atlantic* web site: www.gpiatlantic.org.

At that time, in the early 1970s, the pioneers' understanding of the potential importance of time use surveys, environmental quality indicators, and other measures, was not matched by the availability of data in these fields. The early recognition of the importance of valuing natural resources, for example, initiated the process of gathering data that did not exist at the time. The work of Andrew Harvey and others in constructing the first standard time use surveys, the development of state of the environment reporting in the same era, and the emergence of other important social indicator measurement tools, have now produced and made available the actual databases that make the Genuine Progress Index possible.

For the first time, 10 and 20-year time series for social and environmental indicators can actually be created. In short, the construction of an actual policy-relevant GPI at this time should not be seen as a "new" phenomenon, but as a natural evolution of earlier work in the field. The basic principle linking and integrating the components of these expanded accounts is the view of "sustainable development," which reflects a concern (a) to live within the limits of the world's and the community's resources and (b) to ensure the long-term prosperity and wellbeing of future generations.

Both inter-generational and intra-generational equity are cited as specific characteristics of sustainability in the Brundtland Commission's seminal definition of sustainable development:

> "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs....But physical sustainability cannot be secured unless development policies pay attention to such considerations as changes in access to resources and in the distribution of costs and benefits. Even the narrow notion of physical sustainability implies a concern for social equity between generations, a concern that must logically be extended to equity within each generation. "[189]

Statistics Canada notes that, from this definition,

> "A consensus has emerged that sustainable development refers at once to economic, social and environmental needs.... A clear social objective that falls out of the definition (of sustainable development) is that of equity, both among members of the present generation and between the present and future generations....It is clear that the spirit of sustainable development implies that all people have the right to a healthy, productive environment and the economic and social benefits that come with it."[190]

The new accounts also use cost-benefit analysis that includes environmental and social benefits and costs and an investment-oriented balance sheet approach that includes natural and social capital assets, to provide a more comprehensive view of progress than is possible with the current-income approach of the GDP.

---

[189] World Commission on Environment and Development (Brundtland Commission), 1987, *Our Common Future,* Oxford University Press, New York.
[190] Statistics Canada, 1997, *Econnections: Linking the Environment and the Economy: Concepts, Sources and Methods of the Canadian System of Environmental and Resource Accounts,* catalogue no. 16-505-GPE, Ottawa.

The current emphasis on "growth" is replaced, in the new accounting systems, by a concern with "development," as defined by former World Bank economist, Herman Daly:

> "Growth refers to the quantitative increase in the scale of the physical dimension of the economy, the rate of flow of matter and energy through the economy and the stock of human bodies and artifacts, while development refers to the qualitative improvement in the structure, design and composition of physical stocks and flows, that result from greater knowledge, both of technique and of purpose."[191]

Values, approach, methods and data sources in the Nova Scotia Genuine Progress Index

In essence, the fundamental approach of the Nova Scotia Genuine Progress Index is to assess the economic value of our social and environmental assets and to calculate their depreciation or depletion as costs. Maintenance of these capital assets is seen as providing the basis for economic prosperity. As such, the Nova Scotia GPI is a step towards fuller cost accounting than is possible by valuations of produced capital alone.

Value-based measures

Any index is ultimately normative, since it measures progress towards defined social goals. All asset values can therefore be seen as measurable or quantifiable proxies for underlying non-market social values such as security, health, equity, and environmental quality.[192] In the case of this particular component of the GPI, the normative value or goal that serves as the standard for measuring genuine progress is clean air, which is itself a component of a wider goal – namely, a reduction in human impact on the environment.

Despite the inclusiveness of the GPI approach, there is no question that it does represent a fundamental challenge to current assumptions and practices. When the GDP and economic growth statistics are used to assess wellbeing and prosperity, more production, more spending, and more consumption are signs of progress. In short, "more" is always "better." In the GPI, by contrast, "less" is frequently "better." *Less* crime, pollution, sickness, accidents, natural resource depletion, and fossil fuel combustion (the primary source of greenhouse gas emissions) are indicators of genuine progress from the GPI perspective, in marked contrast to the GDP, which counts increases in all these areas as contributions to prosperity.

---

[191] Daly, H., 1994, "Operationalizing Sustainable Development by Investing in Natural Capital," in Jansson, A., Hammer, M, Folke C., and Costanza, R. (editors), *Investing in Natural Capital: The Ecological Economics Approach to Sustainability,* International Society for Ecological Economics, Island Press, Washington, D.C.
[192] For the Nova Scotia GPI, these norms are defined in *Measuring Sustainable Development: What the Genuine Progress Index Can Do For Nova Scotia,* pages 12-15: presentation to the Nova Scotia Government Inter-Departmental Consultation, March 3, 1998, World Trade and Convention Centre, Halifax. For more information, see the **GPI***Atlantic* web site at For more information on the background, purposes, indicators, policy applications, and methodologies of the Nova Scotia GPI as a whole, please see the background documents on the **GPI***Atlantic* web site at www.gpiatlantic.org.

Although the materialist illusion that "more" is always "better" is still pervasive, the GPI approach is actually common-sense economics that reflects universally shared social values. The GPI quite simply counts crime, pollution, sickness, natural resource depletion, and greenhouse gas emissions as *costs* rather than gains to the economy, with reductions signifying "savings" to society and improvements in long-term wellbeing.

It must be emphasized here that there is no escape from the normative basis of any measure of progress. When the GDP is used to assess wellbeing, it is not objective (as is generally assumed), but embodies the value that "*more*" production and "*more*" spending are always "*better.*" The GPI accounting system also has an explicit value base. In this case, the normative values are that less crime, less pollution, a stable climate, and a healthy environment are "better" for human wellbeing than more crime, more pollution, climate instability, and a degraded environment.

GPI*Atlantic* feels confident, as a result of 18 months of extensive consultations in 1996-98, that its core GPI indicators represent consensus values among Canadians beyond any partisan or ideological viewpoint, and are not counter-intuitive to basic common sense. It is the unexamined assumption that the GDP and economic growth measures are "neutral" and "objective" measures of wellbeing, that allows their misuse for a purpose that the architects of national income accounting never intended. Once examined closely, that false assumption quickly falls apart, and the GPI values are seen as representing the common goals and shared objectives of Canadians.

One important caveat must be added here for the natural resource and environmental components of the GPI. Unlike some of the GPI social and economic components like crime and employment where impacts are more immediately felt, the impacts and costs of natural resource depletion and degradation can be subtle and long-term. This lack of immediacy frequently blunts policy initiatives designed to support more sustainable economic practices. The inclusion of environmental and resource accounts in the Genuine Progress Index therefore requires that we transcend a narrow short-term perspective and comprehend *our* wellbeing in terms of impacts on our children, on future generations, and on other species.

The challenge to conventional thinking is particularly acute because our own prosperity may temporarily increase by expanding our consumption of the world's resources, just as our standard of living appeared to rise in the 1980s through an expansion of government spending and debt. Again, it takes some raising of awareness to understand that the costs and impacts of excessive current consumption will be borne by our children and by future generations, whether through debt-induced service reductions, university tuition increases, climate change damage costs, or depleted natural resources.

Because the connection between natural resource health and wellbeing therefore clearly requires a longer-term perspective than some other components of the GPI, and because the immediacy of our narrower conventional desires frequently inhibits that perspective and undermines effective policy initiatives, a key purpose of this report is simply to raise awareness among ordinary Nova Scotians.

If this province is to take a lead in acting responsibly to protect the world's resources and environment and the interests of future generations, a concerted educational campaign will be necessary for Nova Scotians to support actions which can become a model for the country and the world. This report is intended primarily as a contribution to that educational effort.

Data sources and methodology

The Nova Scotia GPI uses existing data sources in its valuations and applies the most practical and policy-relevant methodologies already developed by the World Resources Institute, the OECD, the World Bank, national statistical agencies, and other established research bodies. In particular, the Nova Scotia GPI relies on published data from Statistics Canada, Environment Canada, the NS Department of Natural Resources (DNR), Department of Fisheries and Oceans (DFO), the Canadian Institute for Health Information (CIHI), and other government sources where ever possible, to ensure accessibility and ease of replication by other jurisdictions.

Inevitably, the assessment of the environmental impacts of human economic and social activity is an imprecise science, and predicted long-term changes due to current consumption patterns are uncertain. When future impacts are uncertain but *potentially* damaging and even irreversible, the Genuine Progress Index follows the “precautionary principle.” This widely accepted dictum, enshrined in the *Nova Scotia Environment Act* and in Canada’s international commitments, holds that scientific uncertainty must not be a cause for inaction when there is the potential for serious environmental damage.

The fundamental approach used in all GPI natural resource accounts is to value resources as natural capital assets that perform a wide range of interconnected ecological, social, and economic functions, and provide both direct and indirect services to human society and the economy. These assets are also subject to depreciation, just as manufactured capital is, with two important caveats. First, unlike manufactured capital, the services provided by renewable natural capital can be sustained over time, and there is therefore no *inherent* reason for forests, soils, fisheries, air quality, and water resources to depreciate if they are used responsibly. Secondly, again unlike manufactured capital, lost ecosystem services are frequently irreplaceable, as for example when species become extinct. Nevertheless, it is completely appropriate to consider resource depletion and degradation as a depreciation of value from an economic point of view.

A primary goal of the Nova Scotia GPI is to provide a data bank that can contribute to the Nova Scotia government’s existing outcome measures. The reports and data will therefore be presented to Nova Scotia policy makers stressing the areas of policy relevance. Conclusions will emphasize the most important data requirements needed to update and maintain the index over time. The GPI full-cost accounting methods, that include social and environmental values, can also be used to evaluate the impacts of alternative policy scenarios and particular investment strategies on overall progress towards sustainable development in the province.

What the GPI is not

Just as the GDP has been misused as a measure of progress, there are also several potential misinterpretations of the GPI and misuses of the data it presents. These are discussed in more detail within each of the separate modules. But it may be helpful to list some of the major issues here.

First, the GPI is not intended to replace the GDP. The GDP will undoubtedly continue to function for the purpose for which it was intended, as a gross aggregate of final market production. It is not, therefore, that the GDP itself is flawed. It is the *misuse* of the GDP as a comprehensive measure of overall progress that is being challenged, and it is this need that the GPI attempts to address.

Identifying omissions from our measures of progress does not imply that the GDP itself should be changed to include these assets. The purpose of the GPI reports, therefore, is not to suggest that unpaid work and non-market forest values, for example, should be included in the GDP, or that the costs of crime, water and air pollution, and climate change damage be subtracted from the GDP. Nor do the GPI natural resource accounts and environmental quality valuations recommend the creation of a "green GDP", or "net domestic product" which subtracts defensive expenditures on environmental protection. This can be done, but it is not the purpose of the GPI.

Rather than suggesting changes to the GDP, the GPI in effect adopts a qualitatively different approach. While the GDP is a current income statement, the GPI presents a balance sheet of social, economic, and environmental assets and liabilities and reports the long-term flows or trends that cause our assets to appreciate or decline in value. It is only our current obsession with short-term GDP growth trends that is misplaced. The GPI seeks to "put the GDP in its place" rather than to abolish or change it. If the GDP is simply used for the purposes its architects intended, then there is no problem with the GDP per se.

The authors of the original U.S. GPI suggested that misuse of the GDP is analogous to evaluating a policeman's performance by adding up the total quantity of street activity he observes, with no distinction between dog walkers, car thefts, children playing, and assaults. Just as we expect more of our policeman – the capacity to distinguish benefit from harm, for example, so we need a performance measurement capable of distinguishing the benefits and costs of economic activity. To extend the metaphor, the GDP is still necessary, just as the quantity of street activity is still important in order to decide where to deploy the policeman most effectively. But once deployed, effective policing and effective policy can only be judged by qualitative criteria.

Second, the GPI assesses the economic value of social and environmental assets by imputing market values to the services provided by our stock of human, social, and environmental capital. But this imputation of market values is not an end in itself. It is a temporary measure, necessary only as long as financial structures, such as prices, taxes, and monetary incentives, continue to provide the primary cues for the actual behaviour of businesses, consumers, and governments.

Monetization is only a tool to communicate with the world of conventional economics, not a view that reduces profound human, social, and environmental values to monetary terms. It is a necessary step, given the dominance of the materialist ethic, in order to overcome the tendency to undervalue the services of unpaid labour, natural resources, and other "free" assets; to make their contribution to prosperity clearly visible; and to bring these social and environmental assets more fully into the policy arena. Monetization also serves to demonstrate the linkages and connections between non-market and market factors, such as the reality that depletion of a natural resource will eventually produce an actual loss of value in the market economy. But monetary values should never be taken as a literal description of reality.

In order to separate ends from means, the first two GPI reports on the value of unpaid work presented time use valuations first as the basis of the secondary and dependent, monetary valuations. In the third GPI report, on costs of crime, crime rates were presented first as the basis of the secondary, dependent monetary valuation of the costs of crime. Similarly, in the GPI natural resource and environmental accounts, physical accounts will always precede and form the basis for the subsequent monetary accounts. Secondary (derived) monetary values are always dependent on primary physical valuations and have no inherent reality in their own right. They should always be understood as simple strategies to bring neglected physical realities onto the policy agenda.

As the grip of market statistics on the policy arena is gradually loosened, the desired direction for the GPI is to return to the direct use of time, environmental quality, and social indicators in decision making. This will also allow for greater accuracy and precision than relying on derivative economic values. For this reason, an ecological footprint analysis is also included in the Nova Scotia GPI, even though it is the one component of the index in which no attempt at monetization is made. The use of land values is actually a far more direct method of assessing environmental impacts than the use of monetary values.

While the assignment of monetary values to non-market assets may appear absurd and even objectionable, society does accept court awards for grief and suffering and insurance company premiums on life and limbs as necessary measures to compensate actual human losses. We pay higher rents for dwellings with aesthetically pleasing views and we sell our time, labour, and intelligence often to the highest bidder. Similarly, in a world where “everything has its price,” monetizing social and environmental variables assigns them greater value in the policy arena and provides a more accurate measure of progress than excluding them from our central wealth accounts. For that reason, and to draw attention to vital assets that would otherwise remain hidden, these air quality accounts and other GPI components do use monetary values wherever possible.

Ultimately, however, it must be acknowledged that money is a poor tool for assessing the non-timber values of a forest, the costs of pollution or climate change, the value of caring work, the quality of education, or the fear, pain and suffering of a crime victim. A materialist criterion cannot adequately assign value to the non-material values that give life meaning.

Eventually, therefore, the Genuine Progress Index itself should give way to multi-dimensional policy analysis across a number of databases. New Zealand economist Marilyn Waring suggests a central triad of indicators – time use studies, qualitative environmental assessments, and market statistics – as a comprehensive basis for assessing wellbeing and progress.[193]

[193] Waring, Marilyn, 1998, “Women, Work and Wellbeing: A Global Perspective,” address delivered at Kings College, Halifax, Nova Scotia, 30 April, 1998.

In the meantime and only so long as market statistics dominate our economic thinking and our policy and planning processes, the GPI can provide a useful tool for communication between the market and non-market sectors. By pointing to important linkages between the sectors, the GPI itself can provide a means to move beyond monetary assessments towards a more inclusive and integrated policy and planning framework.

Third, the Genuine Progress Index is not designed to be a final product, but it is a significant step in the direction of more comprehensive measures of progress than are currently in use. The GPI itself should be seen as a work in progress subject to continuous revision, improvement in methodologies, and inclusion of additional variables. It will continue to evolve in form and content with further research, the development of new methods of measurement, and the availability of improved data sources. Given these caveats, all interpretations and viewpoints expressed in this and other reports are designed to raise important issues for debate and discussion rather than as definitive or final conclusions or prescriptions.

For example, the GPI researchers have wrestled long and hard with definitions of "defensive expenditures" and the degree to which these might be interpreted in measures of progress, negatively as surrogate values for damage incurred or alternatively as positive investments in environmental restoration. In other words, are *more* defensive expenditures are sign of progress or not? Or do the indicators of genuine progress themselves need to be based squarely on the physical indicators themselves, and separated entirely from the secondary economic valuations?

High expenditures on restorative forestry are, for example, *both* a cost of prior excess and neglect, *and* a positive sign that concerted efforts are being made to take necessary action. For this reason the actual quantity of defensive expenditures is not easily interpreted as a measure of progress and it is preferable to base such assessments and annual benchmarks on the core physical indicators which are the basis for subsequent economic cost-benefit analyses.

Similarly, much more work needs to be done on separating resource stock accounts from flow data like harvesting rates, and on distinguishing *relative* progress towards greater sustainability, which refers to changes in human activity, from a more absolute standard of sustainability based on nature's own balance and capacity to support human activity. For example, attainment of the internationally agreed Kyoto targets, a sure sign of *relative* progress, will not prevent the further atmospheric accumulation of greenhouse gases or the acceleration of global climate change. The more absolute standards require difficult assessments of sustainability thresholds and ecosystem "carrying capacity." Rees and Wackernagel have made that leap towards assessments of global carrying capacity in constructing the ecological footprint paradigm. But they admit that their analysis does not include several key elements, including the sustainability of current harvesting *methods*.

Rather than offering any pretence of definitive answer to these challenging questions, **GPI***Atlantic* hopes that its natural resource and environmental quality accounts stimulate further productive debate among researchers that will allow for every greater clarity and accuracy in future updates of the GPI work. In sum, **GPI***Atlantic* is not wedded to any particular method of measurement or to any final assessment of results, but seeks to improve both its accounting methodologies and the accuracy of its results over time in accord with the constructive feedback its work receives.

Fourth and finally, it must be stated that the economic valuations are not precise. Any attempt to move beyond simple quantitative market statistics to the valuation of goods and services that are not exchanged for money in the market economy will produce considerable uncertainty. In the GPI report on the economic value of unpaid household work, for example, six different valuation methods were compared, each producing different aggregates. In the GPI *Cost of Crime* report, a range of cost estimates was presented from the most conservative measurements to more comprehensive estimates that included costs of unreported crimes; retail "shrinkage;" losses of unpaid production; and suffering of crime victims. The GPI *Greenhouse Gas Accounts* and the cost-benefit case study in the GPI *Water Quality Accounts* similarly presented a range of values based both on different discount rates and on high and low-end estimates of projected changes in climate, tourism, property values, and a wide range of other variables.

This problem of precision is particularly acute in the natural resource accounts, with attempts to place an economic value on ecological services and the non-market functions of natural assets. For example, there is no doubt that water bodies, wetlands, and forest watersheds provide vitally important functions to human society, including waste and nutrient cycling; erosion, flood and storm control; recreation; water filtration and purification; and food production; and that these functions have vital economic value. But these functions have so long been accepted as "free," that any diminution of functional capacity has gone unrecorded in standard accounting procedures that track only market transactions in which money is exchanged.

How then, are such functions to be valued? Clearly a reduced natural nutrient or waste cycling capacity in a water body as a result of nutrient or waste overload, will have to be replaced by waste treatment upgrades that compensate for the loss of "free" ecological services, if water quality is to be maintained. In its *Water Quality Accounts*, for example, **GPI***Atlantic* used the capital costs of engineering upgrades as a surrogate value for the cost of lost nutrient cycling capacity. But should the operating costs of the replacement facility also be included? These difficulties are vastly accentuated in the GPI *Forest Accounts*, for example, in estimating the potential climate change damage costs from a loss of forest carbon sequestration capacity, because of the great difficulty in estimating the local impacts of global trends and global impacts of local forest practices.

Throughout the GPI environmental and resource accounts, there are many such difficult valuation challenges, and the GPI valuations are based on the author's best understanding of the available scientific and economic assessments. These few examples demonstrate that any economic assessment of natural resource values, or costs of natural capital depreciation, cannot pretend to be precise.

What the GPI Can Contribute

Despite all these major qualifications, it is important not to throw the baby out with the bath water! The GPI is in its earliest stages of development, but it is still considerably *more* accurate to assign explicit economic value to unpaid production, natural capital, and other social and environmental assets than to assign them an arbitrary value of zero, as is currently the case in our conventional economic accounting system. And it is far *more* precise to recognize natural resource depletion, and crime, sickness and pollution costs as economic liabilities rather than to count them as contributions to a more "robust" economy and to social progress, as is presently done.

Though the potential environmental impacts of current consumption practices are extraordinarily difficult to estimate, and though the web of cause-effect relationships is infinitely complex, it would be utterly foolhardy to deny the reality of these relationships or to pretend that costs will not be incurred. While it is very important to improve on the precision and methodologies of natural resource accounting and of social and environmental valuations, the current lack of precision should not be taken as an excuse for any delay in incorporating these mechanisms into our accounting systems. Efforts to value social and environmental assets, using the best available methodologies and data sources, still provide far greater accuracy and precision than continued reliance on an accounting system and measure of progress that gives *no* value to these assets and counts their depletion as gain.

In the long run, the GPI is intended as one step towards greater "full-cost accounting" both in our core national and provincial accounts and as the basis for taxation and financial policy that will ultimately enable market prices themselves to reflect the full values and costs of embodied resources. The transition from externalized to internalized costs, from non-market to market valuations, and from fixed to variable pricing mechanisms are the three core principles of full-cost accounting.

For example, the inclusion of climate change and air pollution costs in gasoline, energy, and road pricing can be far more effective in encouraging resource conservation than taxation systems based entirely on income rather than resource usage. Similarly, very high market pricing of old-growth lumber would reflect the wide range of valuable services provided by ancient forests and encourage their preservation. Incorporation of natural resource valuations into our core economic accounts is, therefore, the first essential step in improving the efficiency of market mechanisms, so that they reflect the full range of social, economic, and environmental benefits and costs of both production and consumption processes.

The Nova Scotia Genuine Progress Index is not an isolated effort, but part of a global movement to overcome the recognized flaws in our current measures of progress and to ensure a more sustainable future for our children and for the planet. Indeed, as we have seen, the new System of National Accounts, Canada's own international commitments, and the considerable advances of recent years in developing expanded measures of progress, require that further efforts be made to integrate social, economic, and environmental variables into our accounting mechanisms. The costs of continuing to ignore our social and environmental assets are too great. We have learned the hard way that measuring our progress in strictly materialist terms and without reference to our natural environment, which is the source of all life and of human survival, ultimately undermines wellbeing and prosperity.

In sum and with all its limitations, the GPI is a substantial step towards measuring sustainable development more precisely than prevailing accounts are able to do. It is itself a work in progress designed to help lay the foundations for the new economy of the 21st century, and economy that will genuinely reflect the social, spiritual, environmental, and human values of our society.

APPENDIX B
THE NOVA SCOTIA GENUINE PROGRESS INDEX: LIST OF COMPONENTS

Time Use:
* Economic Value of Civic and Voluntary Work
* Economic Value of Unpaid Housework and Childcare
* Costs of Underemployment
* Value of Leisure Time

Natural Capital:
* Soils and Agriculture
* Forests
* Marine Environment/Fisheries
* Nonrenewable Subsoil Assets

Environment:
* Greenhouse Gas Emissions
* Sustainable Transportation
* Ecological Footprint Analysis
* Air Quality
* Water Quality
* Solid Waste

Socioeconomic:
* Income Distribution
* Debt, External Borrowing and Capital Movements
* Valuations of Durability
* Composite Livelihood Security Index

Social Capital:
* Health Care
* Educational Attainment
* Costs of Crime
* Human Freedom Index

APPENDIX C
FOOD FOOTPRINT & HEALTH

As noted in Chapter 18, Canadians are overeating. This appendix explores the connections between food footprint, health, and the genuine progress index. Overeating and eating too much of the wrong kinds of food contribute to a higher food footprint, and are contributing causes to obesity and to a wide range of illnesses. Numerous studies have linked overweight and obesity to a wide range of health problems, especially cardiovascular disease, diabetes, hypertension, and some forms of cancer.[194]

The American Cancer Society conducted the most comprehensive study ever done on obesity and mortality. Examining one million people, the study found that overweight people have a higher rate of premature death even if they don't smoke and are otherwise healthy. The results were adjusted for age, education, physical activity, alcohol use, marital status, use of aspirin and estrogen supplements, and consumption of fats and vegetables. Harvard University endocrinologist, Dr. JoAnn Manson, concludes:

> "The evidence is now compelling and irrefutable. Obesity is probably the second-leading preventable cause of death in the United States after cigarette smoking, so it is a very serious problem."[195]

In 1997 the World Health Organization for the first time referred to obesity as a "global epidemic."[196] According to one estimate, obesity has increased by 400% in the western world in the last 50 years.[197] Given the close association between obesity and adult-onset diabetes, it is not surprising that the global population with this illness has jumped nearly five-fold from 30 million in 1985 to 143 million in 1998. 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.[198]

A Statistics Canada analysis of the 1996-97 National Population Health Survey data found that Canadians with a body mass index (BMI)[199] of greater than 30 were four times as likely to have

---

[194] Health Canada (1999). *Statistical Report on the Health of Canadians*. Health Canada, Ottawa, p. 264.
[195] Cited in the *Halifax Chronicle-Herald,* October 9, 1999, page C1.
[196] World Health Organization (1997). *Obesity: Preventing and Managing the Global Epidemic,* Report of a WHO Consultation on Obesity, Geneva.
[197] Montignac, Michel, in The *Halifax Chronicle-Herald,* March 28, 2000, page A10.
[198] Gardner, Gary, and Brian Halweil (2000). "Nourishing the Underfed and Overfed," Chapter 4 in Worldwatch Institute, *State of the World 2000,* W.W. Norton and Co., New York, p. 72.
[199] "Body Mass Index" (BMI) has become an internationally accepted indicator of relative weight. According to Statistics Canada, "[b]ody mass index (BMI) - Canadian standard, which relates weight to height, is a common method of determining if an individual's weight is in a healthy range based on their height. BMI is calculated as follows: weight in kilograms divided by height in metres squared. The index is: under 20 (underweight), 20-24.9 (acceptable weight), 25-27.0 (some excess weight) and greater than 27 (overweight). The index is calculated for those aged 20 to 64 excluding pregnant women and persons less than 3 feet (0.914 metres) tall or greater than 6 feet 11 inches (2.108 metres)." According to this measure, a BMI of 20 to 24.9 means that this weight to height ratio confers no known health risk or likelihood of premature death. A BMI in this range translates into about 140 to 170

diabetes, 3.3 times as likely to have high blood pressure, 2.6 times as likely to report urinary incontinence, 56% more likely to have heart disease, and 50% *less* likely to rate their health positively than Canadians with an acceptable weight. Even at a lower BMI, between 25 and 30, Canadians had a significantly higher risk of asthma, arthritis, back problems, high blood pressure, stroke, diabetes, thyroid problems, activity limitations, and repetitive strain injuries.[200]

Across the country, and in Atlantic Canada, women are more likely to have an "acceptable weight" (BMI = 20-24.9) than men, with 46% of women and 40% of men in that range. All four Atlantic provinces have substantially higher rates of overweight (BMI ≥ 27) than the Canadian average, with Newfoundland and Labrador registering the highest rates of overweight for both men and women. Counting men and women together, 43% of Newfoundlanders are overweight, as are 38% of Prince Edward Islanders, 39% of Nova Scotians and New Brunswickers, and 32% of Canadians (Figure 25, Chapter 13 and Table 24 below).

Without any exception, there is a higher proportion of overweight men and women in every one of the 21 health districts in Atlantic Canada than the Canadian average (36.1% of men; 27.5% of women.) Rural PEI has markedly higher rates of overweight (47.5% of men, 36.2% of women) than urban PEI (38.7% of men, 29.8% of women) (Figure 32).

Poor nutrition is an important contributing factor to obesity, which in turn is a major risk factor in hypertension, type 2 diabetes, coronary artery disease, gallbladder disease, stroke, hyperlipidemia, pulmonary embolism, colorectal cancer, endometrial cancer, and postmenopausal breast cancer.[201] In addition, unhealthy eating is a risk factor in its own right for many chronic illnesses. Health Canada estimates that the Canadian economy loses $6.3 billion a year to preventable diet-related disease.[202]

pounds for a 5-foot-10-inch man; and about 105 to 135 pounds for a 5-foot-2-inch woman. Beginning with a BMI of 25 (which is about 150 pounds for a 5-foot-5 woman and 174 pounds for a 5-foot-10 man), researchers have found a gradually increasing risk of premature death and disease. Health Canada's *Statistical Report on the Health of Canadians* defines a BMI of between 25.0 and 26.9 as conferring a "possible health risk," and a BMI of 27.0 or greater as conferring a "probable health risk." (Sources: Statistics Canada, http://www.statcan.ca/english/freepub/82-221-XIE/00502/defin1.htm#3; American Cancer Society report published in *New England Journal of Medicine,* October, 1999, and cited in the *Halifax Chronicle-Herald,* October 9, 1999, page C1, based on longitudinal research on participants in the U.S. national Cancer Prevention Study from 1982 to 1996; and Health Canada, 1999 (see footnote 121 above).

[200] Gilmore, Jason (1999). "Body Mass Index and Health," *Health Reports,* Statistics Canada, catalogue no. 82-003, 11 (1), Summer, 1999, pp. 31-43.

[201] Birmingham, C. L., et al. (1999). "The Cost of Obesity in Canada." *Canadian Medical Association Journal,* **23**.

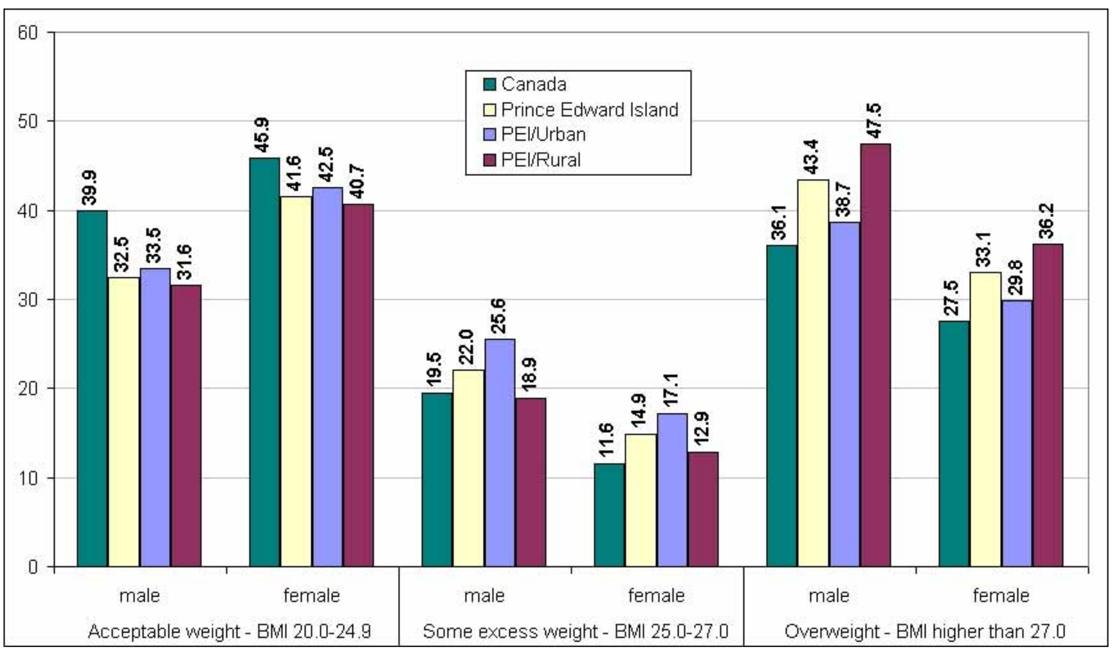
[202] Health Canada (2000). "*Nutrition Labelling: The Background*." Available at http://www.hc-sc.gc.ca/english/archives/releases/2000/2000_103e.htm and follow the link to "Nutrition Labelling: Support for Healthy Eating"; for U.S. estimates of costs of diet-related diseases, see "Benefits of Nutrition Services – A Cost and Marketing Approach," *Ross Laboratories Report of the Seventh Ross Roundtable on Medical Issues*, August 18-19, 1986: 2-9, 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 39.

Table 24. Percentage of Overweight Canadians, Canada and Provinces, 2000/01

	Percentage Overweight (Body Mass Index higher than 27.0)		
	both	male	female
Newfoundland and Labrador	42.8	47.9	37.7
Prince Edward Island	38.3	43.4	33.1
Nova Scotia	38.9	44.1	33.8
New Brunswick	39.2	41.5	36.8
Quebec	29.0	32.9	25.0
Ontario	32.6	36.9	28.2
Manitoba	35.7	40.1	31.2
Saskatchewan	39.1	45.3	32.7
Alberta	33.0	37.8	27.8
British Columbia	27.0	30.8	23.1
Canada	**31.9**	**36.1**	**27.5**

Source: Statistics Canada, Canadian Community Health Survey, 2000/01, Health File. Available at: http://www.statcan.ca/english/freepub/82-221-XIE/01002/toc.htm.

Figure 32. Body mass index, Canada, Prince Edward Island, and Prince Edward Island Health Districts, 2000/01



Note: Individuals aged 20 to 64, excluding pregnant women.

Source: Statistics Canada, Canadian Community Health Survey, 2000/01, Health File. Available at: http://www.statcan.ca/english/freepub/82-221-XIE/01002/toc.htm.

'Rich' diets, high in calories, cholesterol, saturated and total fats, and salt, and low in fibre, have been identified by analysts as "the *primary* and *essential* cause of epidemic CHD [coronary heart disease]:"

> "Rich diet is the pivotal mass exposure responsible for the coronary epidemic. Where rich diet does not prevail as a population wide trait, there is no CHD epidemic. This is the case even when high blood pressure and cigarette smoking are prevalent (witness Japan)."[203]

Rich diets include an excessive proportion of foods with a high ratio of calories to essential nutrients, including high-fat animal products, dairy products, processed foods including processed meats, junk food, and foods with high proportion of refined sugars, including many baked goods. These foods are also frequently low in essential constituents such as potassium, fibre, and anti-oxidant vitamins.

Recommended dietary shifts include:

- reducing saturated fat and total fat consumption, as well as dietary cholesterol intake from animal products such as high-fat meat, dairy, and egg yolks;
- eating more complex carbohydrates and high fibre foods like whole grains, cereals, fruits and vegetables; and
- reducing consumption of sodium, caffeine, alcohol, sugar, and highly processed foods.

One indicator of dietary practices is included here – fruit and vegetable consumption – due to data availability in Statistics Canada's Canadian Community Health Survey. Preventive health literature and nutrition guides generally recommend that between five and ten servings of fruit and vegetables be consumed daily.[204] While fruit and vegetable consumption is clearly only one aspect of good nutrition, it serves here as a temporary proxy for healthy eating, with the recognition that further development of nutrition indicators is essential.

Most Canadians do not comply with the recommendation to consume between five and ten servings of fruits and vegetables daily. Across the country, women generally consume more fruits and vegetables than men. But more than two-thirds of Canadian men, and 57% of Canadian women do not meet the recommended requirement.

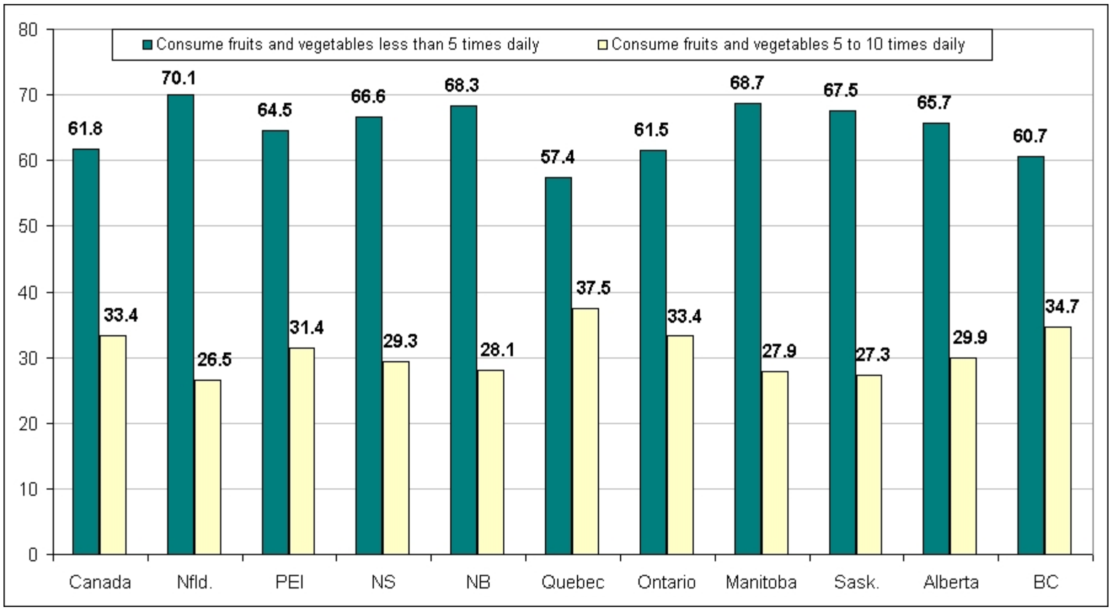
Atlantic Canadians generally eat fewer fruits and vegetables than other Canadians, with less than one-third eating enough fruits and vegetables for good health. Nearly three-quarters of Atlantic region men eat insufficient fruits and vegetables for good health. Prince Edward Islanders eat somewhat more fruits and vegetables than other Atlantic Canadians, and Newfoundlanders eat the least, but all four Atlantic provinces rank below the national average for adequate fruit and vegetable consumption (Figure 33).

---

[203] Stamler, Jeremiah and Rose, preface to Ockene, Ira, and Judith Ockene, *Prevention of Coronary Heart Disease,* Little, Brown and Company, Boston, 1992, pages xi and xii.

[204] Health Canada, http://www.hc-sc.gc.ca/hpfb-dgpsa/onpp-bppn/food_guide_rainbow_e.html

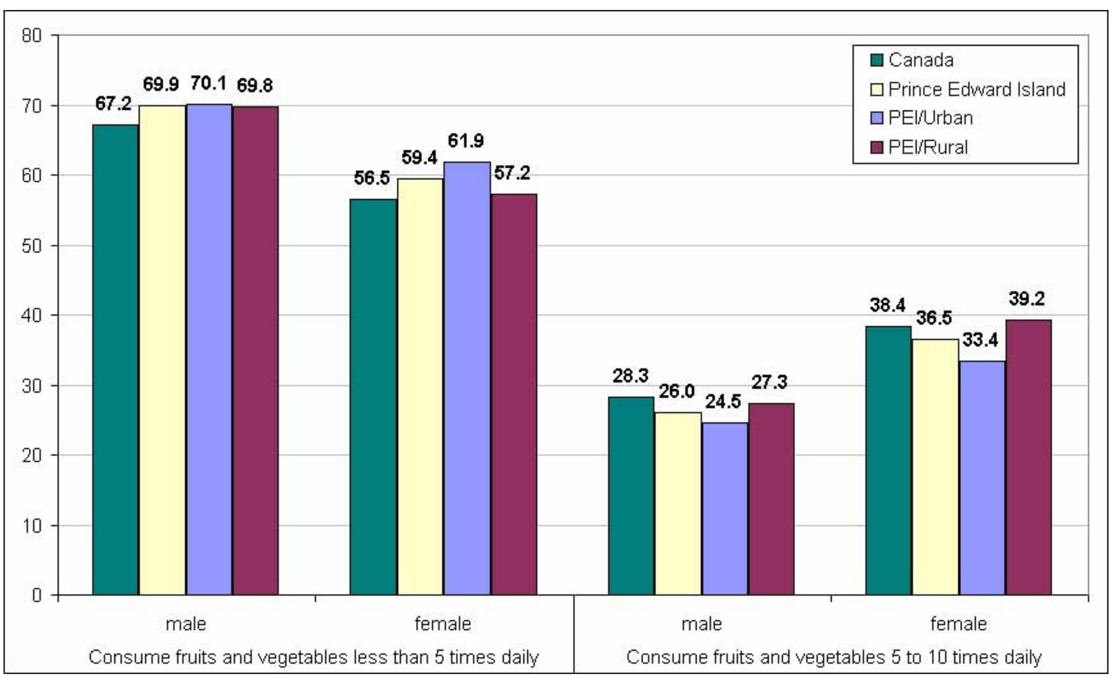
Figure 33. Consumption of Fruits and Vegetables, Canada and Provinces, 2000/01 (%)



Note: Consumption of fruits and vegetables is calculated for household population aged 12 and over.

Source: Statistics Canada, Canadian Community Health Survey, 2000/01, Health File. Available at: http://www.statcan.ca/english/freepub/82-221-XIE/01002/toc.htm.

Figure 34. Consumption of Fruits and Vegetables, Canada, Prince Edward Island, and Prince Edward Island Health Districts, 2000/01 (%)



Note: Consumption of fruits and vegetables is calculated for household population aged 12 and over.

Source: Statistics Canada, Canadian Community Health Survey, 2000/01, Health File. Available at: http://www.statcan.ca/english/freepub/82-221-XIE/01002/toc.htm.

In every one of the 21 Atlantic region health districts, women eat more fruits and vegetables than men. But there are some significant variations among women in the different health districts. For example, women in farming districts like rural PEI tend to eat somewhat more fruits and vegetables than their counterparts in other parts of Atlantic Canada. Fewer women in urban PEI consume vegetables 5 to 10 times daily (33%) compared to rural PEI (39%) (Figure 34).

If we stop overeating, and eat less food that are is harmful to our health, we can not only reduce our food footprint substantially, but contribute to our health and wellbeing as individuals and as a society. We can also save millions of dollars annually in taxpayer-funded health care costs. Unlike measures of progress based on the GDP in which "more" is always "better," this is one example where "less" is clearly "better."