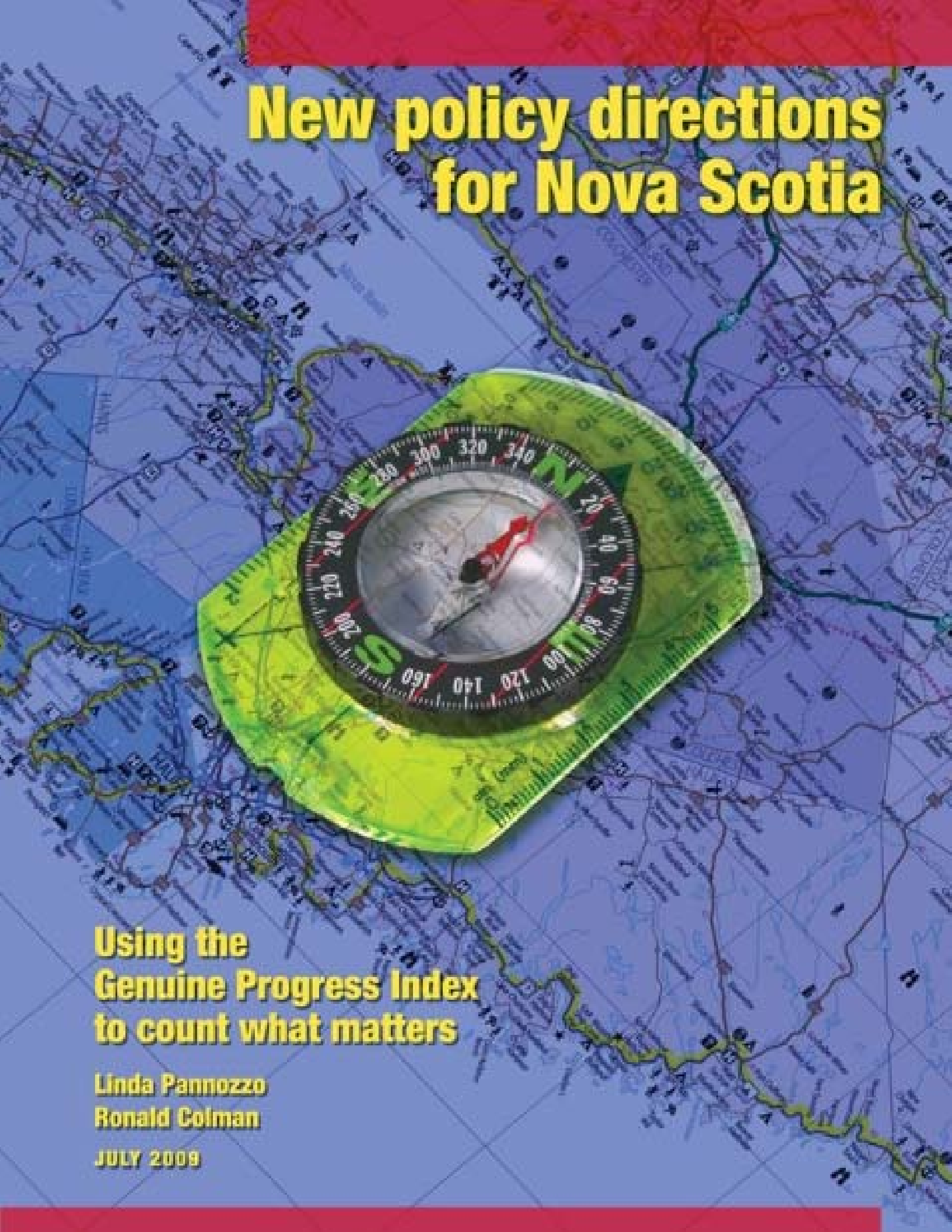
New policy directions for Nova Scotia



Using the Genuine Progress Index to count what matters

Linda Pannozzo
Ronald Colman

JULY 2009

GPIAtlantic

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The reform that is needed is simply the transition from short-term to long-term thinking. From recklessness and excess to moderation and the precautionary principle.

– Ronald Wright[1]

Foreword

I am delighted to have been involved with the work of GPI Atlantic since its inception more than 12 years ago. I am also honoured to be the longest serving member on its Board of Directors. Back in the fall of 1995 Ronald Colman and I, plus many others, were intrigued by an article in the October issue of the Atlantic Monthly, "*If the Economy is Up, Why is America Down*?" This article can be regarded as a sparkplug that re-kindled a new generation of developing wellbeing indicators to overcome the limitations of Gross Domestic Product (GDP) as a proxy measure of economic welfare. Having spent a good many years of my career at Statistics Canada in the field of National Accounting, I was asked to provide a departmental assessment of the GPI, and look into the feasibility of replicating such a measure for Canada. It is the results of this work that brought Ron and I together.

During my years as a Director at Statistics Canada, my major responsibility was to produce a monthly estimate of GDP. This in itself is an important tool for policy makers to assess and analyze the performance of the market economy, but should not be interpreted as much beyond that. GDP per capita is often used as a measure of change in economic welfare over time and commonly used for international and inter-provincial comparisons. Although it can be argued that this indicator has a place in the measurement of wellbeing, it has serious limitations. GDP per capita can be increasing while the gap between rich and poor is also rising. GDP does not factor in the contribution of unpaid and volunteer work. GDP tells us nothing about the physical and mental health of our population and many other important dimensions of social wellbeing. Neither does GDP tell us about the state and quality of our environment.

More than 40 years ago Senator Robert F. Kennedy stated that GDP *"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."* Simon Kuznets, a pioneer in the field of National Accounting and Nobel laureate (1971), noted that "*The welfare of a nation can scarcely be inferred from a measurement of national income"* as defined by the GDP. In all fairness, Statistics Canada has been active in developing new social and environmental statistics as well as accounting structures that support the new generation of measuring wellbeing and progress.

When Ron and I discussed the goals and strategies of GPI Atlantic, I gave him two pieces of advice: (1) don't get obsessed with an aggregate "bottom line" index. My assessment of the US GPI revealed that its aggregate index was fraught with serious accounting problems, data shortcomings, excessive subjective valuations and weighting, and the omissions of key progress components such as health and education; (2) select areas of research such that components of measuring societal wellbeing and progress relate to the policy making process. Turning the clock ahead 12 years, GPI Atlantic has achieved an important milestone in producing more than 100 high-quality research reports for 20 policy relevant domains that are discussed in the user manual. There has to date been no bold attempt to generate a "bottom line".

I give full credit to Ron and his research team for their excellent work. These research reports have received prominent media attention and have been actively used by policy makers and researchers. Furthermore, the reports often provide comparable data for other provinces, particularly within Atlantic Canada and national information for comparative purposes. In effect, these reports have set a standard and provide a model that can be readily adapted by other provinces and countries. GPI Atlantic has also developed an electronic database with easy access to key indicators and data sets associated with the reports. I am pleased to have played a minor role in many of these reports and development of the database, which include education on data awareness, helping to facilitate data access, reviewing drafts of research reports and connecting GPI Atlantic researchers with subject matter and data expertise at Statistics Canada.

The Nova Scotia GPI User Manual, **"New policy directions for Nova Scotia. Using the Genuine Progress Index to count what matters,"** was designed to provide a guide to the policy relevance and utility of the GPI Atlantic research reports. I strongly advise policy makers, policy researchers, students and interested citizens to read this manual in order to get a full appreciation of the work and effort that has gone into the numerous reports, and also to get the most out of these reports for developing new policy recommendations and initiatives. The user manual is in effect an education tool to better understand the goals and objectives of the reports, the research approaches and techniques used, and how to interpret the messages that the reports are conveying. I found the manual well written and informative. It explains the rationale behind the selection of research themes and the approaches used for measuring progress. Concepts, methods and terminology are clearly explained, and the manual shows how the GPI components factor into the domains of the various Nova Scotia Government departments.

GPI Atlantic has reached an important stage and along the way has been influential in fuelling national and international interest in the development of wellbeing measures. As much as I applaud GPI Atlantic for its achievements, I also encourage its researchers to continue building new standards. The tools we build today are meant to shed light on the challenges of tomorrow. Over past generations, children, on average, were always better off than their parents in terms of material living standards, life expectancy, income security, access to social services etc. The present generation, however, faces serious concerns about the wellbeing of future generations in light of factors such as increasing dependency ratios, higher demands for health care, global economic competitiveness, and environmental risks such as global warming. The issue of intergenerational equity needs further development of stock estimates in areas of natural, human and social capital in a full cost accounting concept in order to gain a perception of a future flow of capital services. In short investment stretches well beyond the financial and non-financial assets recorded in the National Accounts Balance Sheets.

In closing I want to congratulate the GPI Atlantic team for its achievements. Read the User Manual to get the most out of the research reports that were produced over the past 12 years. And finally to GPI Atlantic I want to say keep up the good work and continue to set new standards.

Hans Messinger
Former Director, Industry Measures and Analysis, Statistics Canada

Preface

For more than a decade, GPI Atlantic's focus and mandate have been to ask what *genuine progress* in Nova Scotia looks like, and to attempt to assess whether we are achieving such progress. In order to do this, GPI Atlantic has developed a set of genuine progress indicators and accounts for 20 key social, economic, and environmental dimensions of wellbeing. From the GPI perspective, value should be explicitly placed on human, social, and natural capital which are integral components of our national and provincial wealth, in addition to the manufactured capital conventionally counted. The GPI also recognizes that these non-material assets are as subject to depreciation as manufactured capital, and that they also require re-investment to restore and enhance their value.

This past fall, GPI Atlantic released its *2008 Nova Scotia GPI Accounts,* the culmination of more than 12 years of research and developmental work to create a Genuine Progress Index for the Province. The set of indicators and accounts, gradually developed in more than 100 detailed studies using the best available data and measurement methodologies, is intended to provide the province with a practical tool to measure progress towards genuinely sustainable prosperity.

It is highly significant that in 2006 the Nova Scotia Government officially adopted a five capital approach to its development, undertaking to value its natural capital, human capital, and social capital in addition to its built and financial capital. In doing so, the Nova Scotia Government has actually made an enormously far-reaching and important commitment that should eventually produce a new form of budget estimates, a new set of accounts, and a new economic paradigm. Certainly, the commitment to value all five capitals indicates a new openness to integrating social, economic, and environmental objectives in the Province's development, and it forms an excellent basis for forward movement.

One of the most interesting and important aspects of this commitment is that these new measurement tools are a unifying force with the power to transcend partisan politics. Indeed, the 2007 Environmental Goals and Sustainable Prosperity Act, which set out targets "to make Nova Scotia one of the cleanest and most sustainable environments in the world by 2020," was passed by the Nova Scotia legislature without a single dissenting vote. Clearly, the new sustainable prosperity commitment, with its accompanying goals, targets, and measures, expresses underlying consensus values in the province, and reflects a common vision for Nova Scotia society.

The work of GPI Atlantic has also represented a common vision for the province. After 12 years of monitoring and updating trends in more than 100 key headline indicators of social, environmental, and economic wellbeing—and many more subsidiary indicators—it has come to one resounding conclusion: The GDP's omission of these key measures of health, environmental sustainability, quality of life, equity, and economic security, make it a misleading and delusional statistic when it is mistakenly used by policy makers as a measure of progress.

By contrast, the purpose of this *new* GPI measurement system is to provide a more comprehensive set of measures that can accurately identify our strengths so that we can build on them and protect them rather than take them for granted, and that can identify our weaknesses so that we can work to overcome them as soon as we detect early warning signals.

It is now widely accepted universally that the time is ripe for a new system of accounting that assigns value to human, social, and natural capital and registers their depreciation or degradation as costs. This new system of measuring progress, which the world so urgently needs, will naturally result in policies that shift behaviours toward sustainability and that create a society that nurtures the wellbeing of individuals, families, communities and the natural world. Indeed, there have already been shining examples globally of enlightened policy making that reflect the fundamentals of GPI thinking.

However, no jurisdiction in the world now has available to it as detailed, developed, and comprehensive a set of integrated measures of progress as this province. Nova Scotia is therefore uniquely placed to make the shift to enlightened policy making in a structured and systemic (rather than episodic) way that fully integrates the social, economic, and environmental dimensions of development. Just as it did with its leading edge solid waste management system, Nova Scotia is therefore well positioned to act as an example and model in moving towards a genuinely flourishing and sustainable society.

To ease the transition from more than 12 years of research and measurement to the application of the GPI in the policy arena, this 'user manual' attempts to make transparent a few of the key assumptions, principles, and structural foundations of the Nova Scotia Genuine Progress Index, to cite examples of where the GPI perspective has already informed certain policies and initiatives in recent years, and to demonstrate the potential utility and practical relevance of the GPI to policy formation in the current economic conditions and into the future.

This manual is by no means "comprehensive" in the sense of covering all of the detailed methodologies, data sources, and other considerations involved in each indicator, accounting, and costing exercise. GPI Atlantic will gladly provide detailed step-by-step guidance on the methodology used for each set of accounts upon request, as needs for that arise or emerge naturally from the initial efforts to apply the GPI in practice. These methodologies and data sources are also very transparent and explained in detail in each of the more than 100 detailed reports that GPI Atlantic has produced over the years in constructing each of the GPI components. All those reports are freely available for download from the GPI website at www.gpiatlantic.org. As well, the GPI database has been made available in Excel format to the Nova Scotia Statistics Agency in the Department of Finance to facilitate easy and regular updating and reporting of the GPI by the Government itself.

In addition, this manual also outlines the flaws inherent in reliance on conventional measure of progress based on the Gross Domestic Product and economic growth statistics, and contrasts those limited measures to the new system of measurement. We also explore what makes the Genuine Progress Index different from other wellbeing indicator systems—

namely its layering of an accounting framework and system of economic valuation on top of its indicator foundation. This is by no means a dismissal of other wellbeing indicator systems, all of which have played a crucial role in moving us beyond the narrow, economic growth-based indicators of progress that have too long served as a misleading proxy for societal wellbeing and progress and thus skewed policy formation in entirely unsustainable ways. Those wellbeing indicator systems have laid a firm and important foundation for the new measurement methods, and the GPI has openly borrowed from and built on that foundation.

At the same time, these wellbeing indicator systems have major limitations in their capacity to influence policy—not because they are conceptually flawed or methodologically unsound, but because they undertake only one component of the measurement challenge. To provide accurate and effective guidance to policy makers, it is essential to have both an indicator framework that assesses progress and trends over time, and an accounting framework that assesses value. As the following analysis intends to demonstrate, both forms of measurement are essential in policy formation, and it is this dual approach that distinguishes the Genuine Progress Index from other indicator systems.

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Indicators and accounts are powerful. What we count and measure reflects our values as a society and determines what makes it onto the policy agendas of governments. They can tell us whether we are better off than we used to be, whether we are leaving the world a better place for our children, and what we need to change.

When we talk of measuring *genuine progress,* we must first ask: genuine progress towards what? What kind of society do we aspire to? Most of us will answer that we want to create and nurture healthy and sustainable societies—social, economic, cultural, and physical environments that enhance wellbeing—for our children and our children's children and for the sake of all species and the natural world itself.

When we measure genuine progress, therefore, we assess whether Nova Scotians are better off or worse off than they used to be—not just materially or based on how fast the economy is growing—but in terms of their overall wellbeing. That requires that we go beyond the current produce-and-spend accounting system to one that properly and accurately reflects the social, cultural, and environmental benefits and costs of economic activity. This more comprehensive and meaningful information can then be used to inform policy and shape an economic infrastructure capable of supporting future generations and of ensuring long-term sustainable prosperity in harmony with the natural world.

1.1 Why go beyond Gross Domestic Product?

We currently measure our progress and gauge our wellbeing according to a narrow set of materialist indicators—our economic growth rates. Even small changes in the gross domestic product (GDP) and related market statistics currently have great weight in the policy arena, while vital social and environmental factors remain invisible.

But the GDP can only tell us about the overall size of the market economy. It is not an indicator of societal progress and was never intended to be used as a measure of wellbeing. The GDP aggregates the economic value of the total quantity of all goods and services produced in the market economy, and also reflects the total amount of money earned and spent in the market economy. It makes no distinction between a dollar spent on an Lennie Gallant CD or a dollar spent repairing a window smashed by vandals. Activities that degrade our quality of life, like crime, pollution, war, stress, and environmental degradation, all make the GDP go up. The more fish we sell, the more trees we cut down, the more cigarettes we buy, the more prisons we build, the more we consume, the longer hours we work—the more the economy grows.

Because the GDP assigns no value to our natural world, we actually count its depreciation as gain, since GDP only counts what we extract from our natural resource base and send to market, and fails to account for the health and value of what we leave behind—in our oceans, forests, soils, and atmosphere. GDP also ignores genuine contributions to wellbeing, like volunteer work, simply because no money is exchanged. And it tells us how much income is being produced, but nothing about how that income is shared and distributed, so that most Canadians might be losing real income, as happened in the 1990s, while GDP continues to grow.

The GDPs omission of key measures of environmental sustainability, health, quality of life, equity, and financial security make it a misleading and possibly even dangerous statistic when it is misused as a measure of progress. Indeed, because it is a gross rather than net accounting system, GDP failed to send key warning signals of the current economic crisis, like the fact that much of the growth in GDP in the U.S. since 2001 was the result of people borrowing money against their homes to make consumer purchases.[2] A sane accounting system that considered debt growth in relation to income growth could have predicted and even helped prevent the current financial and economic crisis.

The GDP is not designed to distinguish between those economic activities that are beneficial for society and those that signify a decline in wellbeing. It is a crude market measure that narrowly accounts for the quantitative size of the market economy but not for the social, human, cultural, and natural wealth that contribute hugely to our true wealth as a society. Because GDP is not an indicator of either prosperity or wellbeing, it should not be used to inform the making of policy. This was explicitly recognized and understood by the architects of GDP itself, like Simon Kuznets, Nobel Prize winning economist, who wrote half a century ago that to assess the welfare of a nation it is necessary to ask not how much the economy is growing, but *what* is growing.

1.2 A new paradigm: the Genuine Progress Index (GPI)

The idea of measuring what really matters—the broader constituents of wellbeing and genuine progress—has been evolving over the last 40 years as policy makers, like yourselves, have grown more aware of and more disenchanted with the limitations and indeed dangers of using the GDP as an indicator of progress. This growing awareness led to the gradual development of new measures of population health, volunteer work, time use, social supports, fish stocks, greenhouse gas emissions, air quality, and a wide range of other social and environmental dimensions of wellbeing and progress. These diverse new data sources have now yielded time series that, for the first time historically, now make it possible to assess trends and progress more accurately and comprehensively, and to begin to value natural, human, and social capital.

As a result, the Genuine Progress Index can make crucial distinctions between the wider costs and benefits of economic activity that are invisible in GDP-based accounting mechanisms. Thus, for example, the GPI values the economic contributions of household and volunteer work, and of ecosystem life support services, but counts crime, pollution, sickness, and environmental degradation as costs not gains to the economy. That's because things that are bad for society and the natural world end up producing actual economic costs in the form of what economists call "defensive expenditures." Essentially, the GPI simply recognizes that the economy is not a closed box that exists for its own sake, but is designed to serve the interests of people, communities, and the planet, which are inextricably linked.

In this way, the GPI provides a more accurate and realistic picture of how we are really doing as a society. From an accounting standpoint, the GPI also begins to move towards a balance sheet of human, social, economic, and environmental assets and liabilities that reflect, in part, the consequences of the long-term flows or trends that cause these assets to depreciate or increase in value. In order to create this more comprehensive accounting mechanism, the GPI assesses the economic value of these assets by imputing market values wherever possible to the services provided by human, social, and environmental capital. This process of monetization, which will be discussed later in greater detail, is a necessary step in assessing value, simply because financial structures, such as prices, taxes, government budgets, and monetary incentives continue to provide the primary cues for the actual behaviour of individuals, businesses, and governments.

To illustrate this point, the most recent data indicate that there has been a significant decline in volunteer hours nationwide, with fewer volunteers now putting in longer hours in order to maintain services. However, this important trend, which directly reflects community strength and quality of life, has never been the subject of debate in any legislature in Canada, and the trend itself remains unknown to the vast majority of legislators. This is largely because no money is exchanged for volunteer work, and therefore the value of volunteerism is nowhere to be seen in our economic growth statistics and related measures of progress. And yet, if we had to replace the services offered by volunteers in this province alone, it would cost roughly $1.8 billion a year.[3]

This estimate is conservative as it does not include indirect benefits like the value of a strong 'civil society.' Nor, therefore, does the recent decline in the value of voluntary work and

services reflect the hidden social and economic costs associated with a decline in 'civil society,' which according to the literature, also leads to social unrest, alienation, higher rates of crime, drug abuse, and other dysfunctional activities. The invisibility of the benefits of volunteerism in our current accounting system and economic growth-based measures of progress ensures that a major decline in social capital in recent years remains off the policy agenda of governments.

Another illustrative example deals with natural capital, which hardly registers on conventional account sheets despite being the source of a very large portion of human economic wealth. The goods and services provided by an optimally functioning forest ecosystem, for instance, have been shown to be far more valuable than the immediate financial returns of clearcutting and selling the timber from that forest. Yet, when the ability of a forest to provide these goods and services is compromised, our economic accounting mechanisms should count the losses as costs, not gains, to the economy. In our current GDP-based accounting system, forests are only given a monetary value when they are cut down and the timber is sent to market. Forests are not valued for the other essential non-market services they provide when left standing. Thus, when a forest is clearcut, GDP accounts only for what is extracted from our natural resource base, but fails to account for what is left behind. This is like a factory owner selling off machinery and counting the proceeds as profit, regardless of the depletion of the capital base of production.

Fortunately, significant improvements in data availability and assessment methodologies in recent years now—for the first time historically—enable movement towards a better, more accurate, and more comprehensive accounting system that truly reflects a nation's or province's true wealth. Thus, government departments can now use the GPI accounting mechanisms and monetization methods to ensure that hidden social, human, environmental, and cultural values are duly and properly considered in assessing assets, liabilities, and the true benefits and costs of diverse economic activities. They can thereby ensure that vital aspects of our inherent wealth are not assigned an arbitrary value of zero, as they are in our conventional accounting mechanisms, and that any depletion or degradation of that wealth can be quickly recognised and reversed rather than remain invisible as at present. Because it speaks the language of measurement, accounting, and valuation, the GPI can also be used as a strategic tool to communicate with the world of conventional economics, even while acknowledging fully that profound human, social, and environmental values can never properly be reduced to monetary terms.

***Important note*:** One of the most common misinterpretations of the GPI critique of GDP-based measures is that it proposes either replacing GDP or revising GDP to account for social and environmental benefits and costs. Nothing could be further from the truth. Indeed, it is important to emphasize here that there is nothing wrong with GDP, and no need for its revision or adjustment *so long as* it is used for the purpose its architects intended 70 years ago—namely to measure the size of the market economy. GDP performs that function very well and in a remarkably detailed and comprehensive way.

The problem arises only when GDP is misused for a purpose never intended—namely to measure prosperity, progress, and wellbeing. Therefore the purpose of the GPI is both to replace the misused GDP as a measure of wellbeing and progress, and to restore the GDP to

its proper place as a measure of the size of the market economy. In that case, GDP will become much less important and will certainly not need to be calculated monthly as at present—an unnecessary and expensive exercise that frequently mistakes short-term episodic fluctuations for long-term trends and thereby undermines rather than enhances market stability. GDP statistics issued once every 6 months would be entirely adequate, and the saved resources could well be used to develop much needed (and hitherto neglected) measures of human, social, and natural capital.

We also do not recommend tinkering with GDP to create a "green GDP" that subtracts environmental costs from GDP. Statistics Canada notes that its environmental protection expenditure accounts—one of the three accounting components of the Canadian System of Environmental and Resource Accounts—could potentially be used for this purpose. However, such an exercise would still be based on the fundamental assumption, which is questionable from a sustainability and ecological footprint perspective, that more production and consumption are a beneficial sign of progress.

1.3 Summary of policy uses of the Genuine Progress Index

It is highly significant that in 2006 the Nova Scotia Government—with the support of all political parties—officially adopted a five capital approach to its development, undertaking to value its natural capital, human capital, and social capital in addition to its built and financial capital. It is likely that the Nova Scotia Government has not yet fully grasped the full implications of its commendable undertaking and of what it has really committed to do by adopting the expanded capital model.

In fact, by adopting the five capital model, the Government has actually made an enormously far-reaching and quite radical commitment that should eventually produce a new form of budget estimates and a new set of economic accounts. And that, in turn, will change everything—including policy priorities, the current system of financial incentives and penalties (including taxes), the prices that consumers pay for products, and, therefore, consumer behaviour.

To give just one illustrative example, a new accounting system that explicitly values natural capital will produce a system of financial incentives and penalties that will, in turn, price local, organic, and sustainably grown produce that sustains soil value and minimizes greenhouse gas emissions lower than imported, chemically grown, and unsustainably produced agricultural products that deplete soil quality and increase transport-related emissions.

This is in sharp contrast to the present accounting system that ignores natural capital values and environmental benefits and costs, labelling them "externalities," and thus generates perverse economic incentives to import, sell, and buy unsustainably grown produce from China, Chile, and elsewhere. When other social and economic "externalities" like food safety, farm labour conditions, local jobs, and upstream and downstream spinoffs are added to the equation, the GPI accounting system clearly leads to policies that will price local, sustainably grown produce so that it is no longer beyond the reach of most consumers.

We have yet to see this kind of practical application of the Nova Scotia Government's five capital approach. Nevertheless, the laudable commitment to value all five capitals certainly indicates a new openness to integrating social, economic, and environmental objectives into the Province's development, and it forms an excellent basis for moving forward.

The following policy uses of the Genuine Progress Index are arranged in a somewhat "chronological" order. Thus, the first three policy applications below are short-term in the sense that they can be implemented without delay and require only baseline data. The second three are medium-term applications that require the development and use of trend lines. The final three are longer-term systemic and structural shifts that can be expected to occur as a result of adoption and implementation of the GPI.

1. Set goals /targets

Because the GPI measures reflect consensus social values, and embody a vision of where we want to be 5, 10, 20, and 50 years from now, they can help set specific goals and targets and mobilize the population behind that common vision. Any measure of progress is normative by nature—always value-based and assessing progress towards an agreed vision and set of goals. The consequent target setting is not theoretical or conceptual but very practical. For example, if we know what the crime rate, smoking rate, poverty rate, or waste disposal rate is, we can set concrete targets of reducing those rates by 20% by a certain year, and halving them by a subsequent year, and we can measure our progress in getting there. In this way, we can practically assess the degree to which we are on track, in these cases, in achieving our agreed goals of a safer, healthier, more sustainable, and more economically secure Nova Scotia.

2. Good evidence is necessary for informed decision-making

In more than 12 years of research and development, the Nova Scotia Genuine Progress Index (GPI) has generated more than 100 in-depth reports on various dimensions of the GPI, containing thousands of spreadsheets, tables, and charts. This wealth of data now provides the Province of Nova Scotia with more detailed, integrated information on its social, economic, and environmental wellbeing and progress than is available to any other jurisdiction in North America. In the fall of 2008, a comprehensive summary report was released updating key indicators and economic valuations in all 20 GPI components with the most recent available data. It is accompanied by a systematized GPI database—that has been turned over to the Nova Scotia Statistics Agency in the Department of Finance—that will allow easy updating of all the most important data sets and replication of the GPI for other jurisdictions.

The entire purpose of GPI Atlantic's research, number-crunching, and wide-ranging literature reviews over the years is to provide the evidence base for good policy that seeks to integrate and harmonize social, economic, and environmental objectives with a view to enhancing wellbeing in the largest sense both for the present and future generations.

Without reliable, comprehensive evidence and measures to track progress, policy making will inevitably be blind and visionless at best, and misguided and even dangerous at worst. It will have no understanding of where the greatest needs are, and which population groups need to be targeted with which programs. By contrast, the GPI evidence greatly enhances the capacity for informed policy making.

3. Demonstrate linkages among the GPI domains

The new GPI measures—spanning 20 social, economic, and environmental components in five different domains—enable policy makers and the general public to be aware of the practical trade-offs involved in each decision. If we make progress in one area, is it at the expense of another, or can we identify actions that will advance all GPI domains—like health, living standards, and environmental quality, for example—simultaneously and harmoniously?

Understanding the direct relationships between the GPI domains and components is vital for policy formulation, as effective policy must necessarily target those sectors most responsible for actual impacts. For instance, the relationship between income, consumption, and environmental impact is important to recognise, because examining human demands on the natural world cuts through the illusion that we can improve the living standards of the poor without also questioning the consumption patterns of the rich, and it underscores the ecological reality that we cannot maintain current excesses if we also intend to alleviate hunger and poverty.

4. Early warning signals and predictive power of new measures can trigger preventive remedial action

Over the last 12 years, the GPI has demonstrated a remarkable predictive power that appears to derive both from the analytical strength of examining social, economic, and environmental realities in an integrated way, and from a net accounting system that recognises the costs as well as benefits of economic activity. This GPI predictive capacity provides policy makers with early warning signals of potential difficulties and challenges, and thus enables them to take timely remedial action well before any crisis develops. A few illustrative examples will demonstrate this particular policy function.

In 1998, GPI Atlantic released its first report on the economic value of civic and voluntary work, and pointed to certain trends that threatened the viability of the voluntary sector. Ten years later the numbers revealed a massive decline in voluntary work, belatedly proving the earlier warning correct.

In 2000, the GPI analysis of the agriculture sector pointed to a serious long-term decline in the economic viability of farming in Nova Scotia, based on five key indicators—net farm income, expense to income ratio, debt to income ratio, return on investment, and solvency ratio. The study warned that if existing trends continued unabated, farmers would be forced off the land because they could no longer afford to farm. In 2008, GPI Atlantic updated that report and found that the downward trends in farm viability had in fact continued and that—for the first time on record—net farm income had actually dropped below zero in

four of the last six years. Put simply, it is now costing farmers more to farm than they are earning.

When GPI Atlantic issued the warning eight years ago, net farm income was not yet below zero, but it was headed in that direction. Unfortunately, however, the GPI was still in its early developmental stages at that time, and the GPI warning was not sufficiently heeded to spur timely remedial action to enhance farm economic viability. For many farmers, it's now too late! But what is most important here is the fact that conventional GDP-based measures sent no such warning signals, and in fact sent perverse and entirely misleading signals to policy makers. While all five GPI *net* farm viability indicators were trending seriously downward over a 36-year period from the early 1970s to the present, *gross* farm cash receipts (which are the primary input to agriculture GDP) have trended upward and show no problem at all.

Similarly, fishery GDP remained at record high levels, with the fisheries regarded as a 'boom' industry, right up to the moment that the Atlantic groundfish stocks collapsed in 1992. As noted earlier, GDP is a *gross* rather than *net* accounting approach that only counts what we extract from our natural resource base and takes no account of the health of the resource—in this case the fish stocks in the oceans—left behind. Reliance on GDP statistics actually encouraged over-fishing and natural resource depletion simply because it tracked only the numerator (fish landings) and not the denominator (fish stocks). This, quite frankly, is primitive and poor accounting practice that serves neither Nova Scotians nor their rich natural inheritance.

Again, a basic net accounting system, as provided by the GPI, is not rocket science, and is entirely in line with simple household budgeting practice, in which we count not only our gross income, but rather keep track of our expenses and debt *in relation to* our income and assets. Any *net* approach will have the predictive power described here and the capacity to send early warning signals that allow timely remedial action. That, in a nutshell, is one of the key purposes and practical functions of a set of GPI Accounts.

One final example of the predictive power of the new accounts—and perhaps most poignant of all given the current economic circumstances—is GPI Atlantic's release of a report on debt and financial security just a month before the current economic collapse. That study warned of unsustainable trends in the economy—like the fact that the rate of debt growth during the so called economic boom period of the previous decade had massively outpaced the rate of income growth for 80% of Canadian households, thus threatening the ability of many households to manage and service their debt. Only among the wealthiest 20% of Canadians did we find the rate of income growth exceeding the rate of debt growth—far too narrow a base for a healthy economy. The GPI study noted that more than 77,000 Atlantic Canadian households, in our small corner of Canada, had become so deeply indebted that they could not get out of debt even if they sold everything they owned, including their homes. When the crash came a few weeks later, GPI Atlantic researchers were not surprised.

5. *Hold government accountable using objective standards*

The GPI indicators will enable Nova Scotians to hold their government accountable according to agreed standards. At election time, for example, Nova Scotians can assess the degree to which their elected representatives made progress towards the goals and targets established through the GPI indicators, and they can cast their votes accordingly. They can also assess their own personal commitment and that of their communities in making progress towards those goals. In fact, the new measures can ensure that—whichever political party gains power—all elected representatives are held to a set of common principles and consensus goals, and they will all be judged by the same standard.

6. *Unifying force*

New measurement tools that establish commonly agreed goals and targets towards a shared vision can be a remarkable unifying force with the power to transcend partisan politics. For example, the 2007 Environmental Goals and Sustainable Prosperity Act setting out targets designed "to make Nova Scotia one of the cleanest and most sustainable environments in the world by the year 2020," was passed by the Nova Scotia legislature without a single dissenting vote.

Good measures of progress themselves contribute greatly to this unifying role, since they necessarily reflect deeply held underlying values and express agreed goals. In identifying genuine progress indicators for Nova Scotia, GPI Atlantic took particular care to ensure that each indicator reflected consensus values.

Of course, this unifying function does not eliminate the need for debate. While consensus goals, shared vision, and non-partisan measurement can help unify a society and provide a strong basis for evidence-based decision making and informed debate, politics is about *how* to achieve these goals and targets. Indeed, the appropriate role of democratic politics is to debate the best way to achieve the goals expressed in the GPI indicators, even while there is a consensus on what those goals are and on the agreed ways of measuring progress towards those goals. To take two practical examples, there can be complete consensus on the need to reduce poverty and greenhouse gas emissions and even agreement on specific targets, and at the same time vigorous debate on how best to achieve those goals. In other words, there should be consensus on goals—the realm of measurement—and debate on strategy—the realm of politics.

7. *Reverse destructive trends and crises created by old paradigm by valuing natural, human, and social capital*

The new measures constitute a new way of doing business, according to new criteria, and leading to new policies that advance economic, social, and environmental priorities simultaneously. Genuine courage and political will are needed to let go of the old paradigm and to adopt a new one. For example, we cannot justifiably use the language of sustainability without simultaneously challenging a materialist philosophy based on ever expanding consumption. This does not undermine the goal of "sustainable prosperity," so long as the term 'prosperity' is not mindlessly equated with expanded consumption. For example, an

enhanced sense of prosperity may arise from expanded economic and financial security and from appreciation of our inherent natural, human, and social wealth, rather than from more material acquisition.

However, frank acknowledgment of a real paradigm shift means that using the GPI is not simply adding a bunch of new indicators to existing ones that are fundamentally flawed and that currently send highly misleading signals to policy makers. If we do so, we run the danger in our indicator and measurement world of exacerbating rather than ameliorating confusion, however well-intentioned we may be.

For example, the GPI does not use GDP or GDP per capita as one of its indicators of progress, primarily because some GDP components signify a decline rather than gain in wellbeing, and because a quantitative measure of growth does not signify an improvement in *quality* of life. However, the GPI does measure directly some of the *outcomes* that may or may not be achieved by expanded GDP—such as employment, job security, economic security, financial security, and poverty reduction. The phenomenon of capital intensive "jobless" growth seen particularly in the U.S., reduced real incomes and a growing gap between rich and poor in Canada in the 1990s, employment creation through redistribution of work hours as achieved in the Netherlands, and the natural resource depletion and waste production associated with excess consumption, all indicate that GDP may not always achieved desired outcomes and that other means may achieve those outcomes.

In sum, the old and new paradigms are not reconcilable, and the GPI actually signifies a profound shift to a new sustainable development model.

This is stated explicitly here so that there are no illusions, and in order to quash the tendency to view the GPI indicators as social and environmental "add-ons" to the existing economic growth-based measures currently in use. Thus, the GPI begins from a critique of the flaws in the existing growth-based paradigm and accounting system.

8. Implementing full cost accounting in policy-making: A four-step process

The most far-reaching application of the Genuine Progress Index stems from its use as an accounting mechanism that can eventually change the structure of market prices so that they reflect and reward sustainable and socially responsible production. Because there is no more effective mechanism than price signals to shift consumer behaviour at the mass level, the GPI accounting system must be seen as the first step in a four step process that will eventually impact market prices. These four steps are briefly outlined below:

1 Build a new accounting system that goes beyond just indicators.
The GPI begins to build the new accounting system by valuing natural, social, and human capital properly. Much more work is needed in this field, including improvements in data sources and methodologies. But tremendous strides have been made globally in the last three decades in both data collection and measurement methods, so that it is now truly possible to identify, and in many cases to quantify, the true value of natural, economic, social, and cultural assets, and the full benefits and costs of economic activity. This is very good news. What was once just a concept and an aspiration is now feasible and measurable, and there is

no barrier for a jurisdiction like Nova Scotia to construct, adopt, and implement the new indicator and accounting tools as guides to policy. That measurement work is so well under way—and the new system so amply developed as to be ready for immediate application and use—that there is already no obstacle to step 2.

2 Political will

Political will is required to adopt and implement the new indicator and accounting systems in practice in order to demonstrate their feasibility, and to use them actively as the Province's core measures of progress and valuation, and as the evidence base for new policy.

Nova Scotia could be ideally suited to take that leap. The Province, through its Opportunities for Sustainable Prosperity development strategy, Weaving the Threads social strategy, Environmental Goals and Sustainable Prosperity Act, and Power of Green conferences, and the commitments made in those documents and fora, has indicated its willingness to be on the forefront of the new integrated development path. It has even made an explicit commitment to move to an expanded capital system of valuation—which in itself places it well ahead of other jurisdictions in this field. And the fact that a GPI for Nova Scotia now exists, in all its rich detail and with a comprehensive database spanning 20 components, and is ready to use, makes the leap to application much more feasible in this Province than anywhere else.

3 Create a system of financial incentives and penalties (e.g. tax shifting).

Once the new accounting system has been adopted by government, it provides the basis for a system of financial incentives and penalties designed to encourage sustainable and socially beneficial behaviours that contribute to wellbeing and to discourage unsustainable behaviours that undermine wellbeing. This system of financial incentives and penalties includes very practical actions like shifting taxes from low-income households to carbon and pollutant emissions, and subsidizing renewable energy development, public transit, local organic farming, and uneven-aged forest management, while increasing taxes and fees on gas-guzzling SUVs, synthetic fertilizers, and clearcutting, for example. The underlying *accounts* provide an objective basis for determining the dollar amounts of such incentives and penalties, since the accounts assess the true and actual benefits and costs of economic activity to society.[4]

4 Pricing to reflect the true costs and benefits.

These incentives and penalties in turn will naturally affect consumer prices, thereby changing behaviour. It is absurd, for example, that organically grown local food is currently more expensive than chemically grown food imported from 2,000 miles away—a perversity only made possible by ignoring the true costs of soil degradation, transportation, greenhouse gas and pollutant emissions, and other actual costs of production, and ignoring the true value of enhanced nutrition, freshness, health, and resource conservation.

Once goods are properly and accurately priced according to their true costs of production, not only will consumer behaviour change, but the market economy itself will become far more efficient—with profligate and wasteful energy use penalized for example, and rewards for energy conservation built into the price structure. This enhanced market efficiency will in turn reduce the need for heavy-handed government regulation and intervention. Building

pollution costs into market prices, for example, provides a natural incentive for producers to minimize pollution in production processes, and thus reduces the need for taxpayer-funded cleanup costs after the fact, as occurred in the massive government-funded Sydney Tar Ponds remediation.

There is no more effective trigger for change than price signals. Implementation of this fourth step in the implementation and use of full cost accounting—flowing as it does naturally from adoption of the accounting system itself—will therefore provide the most effective and powerful incentive for beneficial and far-reaching social change that truly enhances wellbeing and sustainability.

2 Indicators and accounts

- What are indicators?
- What are accounts?
- Why we need both

It is ideas that determine the direction in which civilizations go. If you don't get your ideas right, it doesn't matter what policies you try to put in place. The policies will backfire, because the ideas that dominate will not be the right ideas. You have to begin with the ideas—then you can simply go ahead and put them into effect.[5]

— John Ralston Saul

In the last half century, the economic idea that has dominated the public, policy, expert, and journalistic discourse is that GDP growth is equated with societal health and wellbeing. The degree to which economic growth has become identified with wellbeing through habitual reliance on GDP-based measures has never been clearer than in the health and sickness language used to describe the current economic collapse. Look in any day's newspapers and you will find references to the "sick" and "ailing" economy and the need to "inject" billions of dollars in order to spur a "recovery." The 'sickness' is synonymous with a shrinking economy and decline in consumer spending, and the 'recovery' with renewed spending and economic growth. Similarly, the economic boom period of the previous decade and a half was characterized by a "robust" and "healthy" economy—terms unthinkingly equated with simple quantitative growth, regardless of whether that growth was fuelled by debt, resource depletion, sickness, war, or other liabilities.

The idea that economic growth is good no matter what is growing—debt, disease, environmental degradation, social unrest—has dominated economic thinking and informed policy since the Second World War. At the same time, growing global dissatisfaction with this delusional paradigm has led, in the last two decades, to significant headway in the development both of indicators that measure real progress towards a wide range of important social, economic, and environmental objectives and of accounts that include valuations of natural, human, and social capital. This burgeoning understanding of the interdependence of social, economic, and environmental factors in development and of the

interrelated nature of reality represents a very different idea that challenges the materialist assumption implicit in the growth-based view of wellbeing.

The new idea is actually reflected and applied in two sets of measures, both of which are equally necessary and which complement each other—indicators that assess progress, and accounts that assess value.

2.1 What are indicators?

There is an old saying that the finger pointing to the moon is not the moon. And so, indicators can only point in the general direction of a social reality and can never pretend to describe it fully and accurately. Indicators are statistics that assess progress over time and that can therefore be used to measure trends in collective wellbeing. They are based on physical measures (e.g. employment, crime, poverty, and illness rates, levels of educational attainment, greenhouse gas and air pollutant emissions, etc.). The units of measurement are unique to each indicator, with rates often expressed in per capita terms (e.g. number of jobs, crime incidents, smokers, or graduates per 100,000 population or as a percentage of total population, or tonnes per capita for pollutant emissions).

Good indicators provide essential information about the health and functioning of a system and can tell us whether progress is being made. They can also perform vitally important policy functions, sending early warning signals to policy makers, and assessing which programs are working and which are not in attaining agreed upon targets.

However, not all statistics are created equal. For a statistic to be an indicator it must meet certain standards and satisfy certain substantive and technical criteria. For instance, an indicator should provide a clear and accepted benchmark for measuring progress; and provide information about a feature of the system that has been shown to be linked with a desired outcome, or about a current or future problem in the system. Indicators should also be readily understood, they should be feasible in terms of time, cost, and expertise required to collect and analyse the data, and they should be generally accepted as valid and reliable at measuring what they are intended to measure.

However, there must also be recognition that many existing indicators are inadequate to measure progress in a particular field, and that new indicators therefore need to be developed that in turn will require new data collection. Education indicators are a case in point. In the last twenty years there has been a surge in education indicators related to economic policy objectives—in particular to assess whether formal education is contributing adequately to economic productivity and competitiveness in the global economy. But this information does not tell us whether people are becoming more educated, knowledgeable, or wise. In fact, it may well signify nearly the opposite. The increased focus on the role of education in serving the economy has often marginalized and come at the expense of broader considerations, such as the role of education in advancing social justice and environmental sustainability, of spreading civic values, and of transmitting cultural values. And the focus on education in the service of economic productivity and competitiveness may even be anti-educational to the degree that it unquestioningly accepts the economic

status quo, fails to expose serious flaws in the economic system, and fails to explore whether that system effectively serve the needs of society.

In addition, most conventional education indicator systems are based on what has been labelled an 'industrial' model of education that is sometimes called the 'productivity model.' This model encourages the view that the educational system produces "products" (graduates) by taking various raw materials, including students, and processing them in schools. Many education indicators that currently exist were also chosen simply because the data were readily available. As well, education indicators have generally been narrowly equated with formal schooling, despite evidence that most learning occurs in other settings. In other words, if a set of indicators focuses attention on the wrong issues, or purports to measure something it simply does not, such indicators may create more confusion than clarity, and more problems than they solve.

Because of the inadequacy of existing conventional education indicators, GPI Atlantic therefore recommended the development of new measures and a new Canadian Knowledge Survey assessing literacy in 11 key knowledge areas.[6] The example is presented here simply to acknowledge that some of the criteria for good indicators noted above may not be applicable in cases where the assumptions underlying accepted conventional measures are conceptually flawed.

In general, indicators are expected to fulfill a myriad of functions from reporting on the status or health of a system, to monitoring changes, explaining the causes of prevailing conditions, presenting the strengths and weaknesses of a system, and predicting future changes. To this end, there has—particularly in the last 20 years—been unprecedented development in the data sources required for such measurement, vast improvements in measurement methodologies, and construction and administration of new survey instruments designed to collect the appropriate data in areas never previously monitored or tracked. Following the development of initial baseline data in new areas, reliable and comparable time series are now becoming available that, for the first time, allow measures of progress over time in a wide range of social and environmental dimensions.

To take just one illustrative example from the population health field: Three decades ago there were no reliable time series allowing an assessment of obesity trends, even though obesity is linked to a wide range of serious illnesses, including diabetes, heart disease, hypertension, stroke, and some cancers. Since that time, international and national health agencies have established widely accepted measurement definitions, standards, and thresholds for overweight and obesity based on 'body mass index' (BMI). Self-reported measures of weight and height in population health surveys gradually allowed development of time series data in this area. Nevertheless, self-reported statistics were widely accepted to be unreliable, with respondents frequently tending to over-report height and under-report weight. In 2004, Statistics Canada for the first time administered a new survey directly measuring respondents' height and weight, and allowing for considerable improvements in data accuracy, though time series are not yet available for these new objective BMI measures.

This example illustrates the developmental process that has occurred in a wide range of new areas—first identifying key new indicators; then developing definitions, standards and

thresholds to allow for comparability; then collecting data in new survey instruments and questions; reporting trends over time; and then refining and improving data collection and measurement methodologies.

The emerging indicators and the new evidence that has become available through their development have been an essential first step in bringing vital new issues onto the policy agenda, and in directing policy attention to a wide range of pressing social, health, and environmental concerns. As well, the new indicators have played a key role in 'objectifying' and bringing into the mainstream issues like poverty, income distribution, and greenhouse gas and pollutant emissions, that were once confined to the domain of advocacy or dismissed as marginal concerns of particular interest groups.

In the previous chapter we summarized the policy uses of the GPI and explored the relationship between measurement and policy. It was seen that the new indicators are very practical policy-relevant tools that can shape the policy agenda by providing good evidence for informed decision-making, help set goals and targets, clarify trade-offs, evaluate programs, help hold governments accountable, and spur an integrated, holistic development path.

In order for these new wellbeing indicators to be effectively and enduringly integrated into the policy arena to provide a sound evidence base for achieving social, economic, and environmental objectives in policy and planning scenarios, a second key measurement step is essential—the development of a set of GPI Accounts.

2.2 What are accounts?

Accounts assess value, with units of measurement expressed in common monetary terms (dollars) to the degree possible, and with evidence describing and pointing to economic value when monetization is not possible. Accounts form the basis of government financial incentives and penalties—including taxes, subsidies, and investments in particular sectors of the economy. And those financial incentives and penalties in turn affect price—which is the most immediate, powerful, and effective determinant of behavioural change.

Accounts depend on the data and evidence provided by indicators. Therefore, if there is a change in the rates of smoking, crime, volunteer work, pollutant emissions, etc. it allows for the calculation of the related economic costs and the savings (in dollars) that will accrue from an improvement in the indicator.

As noted, what distinguishes the Genuine Progress Index from other wellbeing indicator systems is that the GPI includes both kinds of measures—indicators and accounts—and builds a system of economic valuation onto its measures of progress. Below are several examples of the difference between indicators and accounts:

- Crime rates (an indicator) tell us—in criminal incidents per 100,000 population—whether crime is going up or down, with lower rates signifying progress. Accounts tell us the cost of crime to society—how much we spend in dollars on courts, prisons, burglar

- Trends in volunteer work can be a good indicator of 'civil society'—and of generosity and community strength and vitality—and tell us, in hours, whether volunteerism is increasing or declining. Accounts tell us the economic value of volunteer work by assessing what it would cost to replace for pay the services presently provided for free by volunteers. If volunteerism declines, as it has in Canada, accounts tell us the lost economic value of those missing volunteer hours.
- Smoking rates (an indicator) tell us—in number of smokers as a percentage of total population—whether we are making progress in avoiding high rates of premature death and illness attributable to smoking. Accounts tell us the cost of smoking to society in both direct health care costs and lost economic productivity.
- Unemployment rates (an indicator) tell us—in number of unemployed as a percentage of the total labour force—whether we are making progress in reducing unemployment. Accounts tell us the cost of unemployment to society in terms of lost productivity, fiscal costs, physical and mental health costs, crime, and costs of family breakdown. If unemployment declines, accounts can then tell us the economic savings that result from fewer people being unemployed.
- A climate change indicator tells us—in CO_2 equivalent kilotonnes—whether greenhouse gas emissions are increasing or not, and therefore whether we are making progress in combating climate change. Accounts tell us the economic costs of climate change damages and the costs of controlling and reducing greenhouse gas emissions by a certain amount. By comparing those damage costs with those control costs, accounts enable us to assess the cost-effectiveness of particular measures to reduce emissions.

All of these examples make very clear the relationship between indicators and accounts, and why the latter depend on the data and evidence provided by the former. It is the change in the rates of a particular indicator that allows for the calculation of the related economic costs or the savings that will accrue from an improvement in the indicator.

2.3 Why we need both

While indicators provide the physical measures on which a new accounting system will be based, they still do not challenge the accounting system that currently dominates our present economic paradigm.

Recall that the Gross Domestic Product (GDP) is currently the primary measure used to "evaluate the health of the economy"—and by extension of society—despite the fact that it is a totally materialist measure that counts only goods and services exchanged for money. But GDP is not an indicator; it is an accounting system, despite the fact that it has been wrongly turned into an indicator of wellbeing and economic prosperity. Therefore, if the grip GDP currently has on decision-makers is to be weakened, it will not happen through the use of indicators alone. The current materialist accounting system needs to be reshaped to reflect

the constituents of the GPI, with its broader social, economic, and environmental components and concerns.

Nothing changes behaviour like price signals. And we won't begin to send price signals that are in accord with sustainability and wellbeing values and principles until we change the present produce-and-spend economic accounting system to reflect the true social and environmental costs and benefits of economic activity. The new GPI accounting system can shape an economic infrastructure capable of supporting future generations and of ensuring long-term sustainable prosperity in harmony with the natural world and with our deepest human and social values.

Indeed, in the past 12 or more years, we have noticed that it is the accounting component of the GPI that has had the greatest policy influence—far more than the indicators. This seems to be largely due to the reality that the policy arena is dominated by concerns over budgets, costs, and savings, and that expression of results in dollar terms reaches a much wider audience than expression in units specific to a particular indicator.

For example, the GPI finding that preventable chronic disease costs the province half a billion dollars annually in excess health care costs that could potentially be avoided if Nova Scotians didn't smoke, had healthy weights, and exercised regularly, led directly to the creation of the new Department of Health Promotion and Protection, with its own budget and minister at the Cabinet table. While illness and risk factor rates were of interest to health officials, it was the dollar figure that caught the attention of the finance minister and Cabinet—concerned with the ever increasing budget share of spiralling health care costs.

Similarly, the Nova Scotia Government now regularly uses the GPI figure that smoking costs the province $170 million annually in direct health care costs. The NS Department of Environment and several municipalities across Canada have made extensive use of the GPI Solid Waste Resource Accounts, which found—from a full-cost accounting perspective—that Nova Scotia's leading edge solid waste management system saves at least $31 million a year – or $33 for every Nova Scotian – compared to the old landfill system.

And when the Premier presented the annual Volunteer of the Year award, he was welcomed onto the stage with the presentation of an enormous cheque made out for $1.8 billion, representing the value of voluntary services to the Nova Scotia economy in the previous year. That GPI valuation significantly raised the profile of volunteerism in the province by raising awareness of its economic benefits and savings to government.

In sum, it is the accounting component of the GPI work that has hitherto had more impact, and that has demonstrated greater transformative potential, than the indicators on which it is based. This may well be a function of the materialist ethos of the times, and it may well be more desirable to assess value in direct physical rather than derived monetary terms. But so long as budgets dominate policy considerations and GDP holds sway as the dominant measure of wellbeing and prosperity, the GPI accounts appear to be the most effective available tool to bring consideration of social and environmental benefits and costs into the policy arena and onto the agenda of policy makers.

3 Fundamentals of the new accounting system

- Stocks and flows
- Principles and methods of full-cost accounting
- Limitations of monetization

Most of our valuable assets are not on the books. We need to reinvent economics.[7]

— Robert Costanza

The key to restructuring the global economy is to get the market to tell the ecological truth.[8]

— Lester Brown

3.1 Stocks and flows

Two types of accounts or systems of economic valuation are always needed—stock accounts and flow accounts. Stock accounts consist of national balance sheets that assess a nation's assets, liabilities, and wealth (which is defined as assets minus liabilities). These stocks—also sometimes called capital accounts—consist of produced tangible assets, non-produced tangible assets, and financial assets and liabilities. Produced tangible assets represent the value of new investment and the undepreciated value of existing assets. The Balance Accounts allow a monitoring of the nation's wealth through time.

Flow accounts, by contrast, measure economic activity and capital and financial transactions on a quarterly and annual frequency. A house, for example, is a stock or capital asset, whose undepreciated value is captured in the Balance Accounts, while rent (actually paid or else imputed for homeowners) is a flow captured in the consumer spending accounts. The income flow represents the rent less intermediate expenses, allowances for depreciation, and a real interest rate (i.e. the opportunity cost of making the investment).

In Canada the System of National Economic Accounts provides information on various aspects of the economy, such as economic growth, exports, productivity, gross domestic

product, government debt, industrial production, consumer credit, purchases of foreign bonds, and economic cycles. There are four main components of these national accounts: input-output accounts; income and expenditure accounts; financial and wealth accounts; and the balance of payments.

The input-output accounts are the most comprehensive of these, since they show a detailed structure of the economy for production, intermediate and primary inputs (labour and capital), and final demand (consumer spending, investment, Government spending on goods and services, and international trade of goods and services). The input-output accounts are a benchmark in that they reconcile the calculation of GDP using three different approaches: income, final demand expenditures, and value-added by industry.

The income and expenditure accounts and the financial and wealth accounts produce statistics for four sectors of the economy: persons and non-profit institutions, business, government, and non-residents. The balance of payments accounts provide data on the non-resident sector, using current account data on trade of goods and services and a capital account balance showing international financial transactions.

According to Statistics Canada, two key concepts dominate the System of National Economic Accounts: "for the input-output accounts and the income and expenditure accounts, it is production, whereas in the financial and balance sheet accounts it is finance and wealth accumulation….It is important to note that these two concepts are not synonymous for a measure of a country's welfare or 'happiness.'"[9]

At present, only a fraction of our true wealth is recorded in the Balance Accounts, which are therefore remarkably narrow and distorted from the perspective of the country's actual wealth and of the full benefits and costs of economic activity. Recognizing the limitations of the current system, Statistics Canada has taken several concrete steps in the last 15 years in an effort to overcome and remedy some of the inadequacies of the existing accounts. These include development of 'satellite accounts' for the non-profit, tourism, and transportation sectors, and of Environmental and Resource Accounts designed "to enable the study of the relationship between the environment and human and economic activity."[10]

The Canadian System of Environmental and Resource Accounts, developed by Statistics Canada in the 1990s, consists of the three key components—natural resource stock accounts, material and energy flow accounts, and environmental protection expenditure accounts—the first representing stocks, and the second two reflecting flows.

The natural resource stock accounts aim to measure and add to the national accounts "stocks of natural capital" including oil, natural gas, minerals, timber, and land, and to account for annual changes in these stocks due to natural processes and human activity.[11] However, not all natural capital stocks are included—for example there are no fish stock estimates—and not all forest, energy, and mineral resources are measured.

For example, the only forests that are given any value are those that are accessible, commercially valuable, and slated for timber harvesting.[12] This falls far short of the value of Canada's natural forest capital and accounts for only a fraction of the goods and services

provided by forest ecosystems, both directly and indirectly, to the economy. The value of forest services like climate regulation and carbon sequestration, watershed and soil protection, flood control, biodiversity, provision of habitat for other species and recreational opportunities, and more, remains invisible in our national accounts. As a result, these forest values are not adequately considered in decision-making, and are generally subordinated to the one key forest value that is measured and tracked—namely timber. To remedy this shortcoming, the GPI forest accounts for Nova Scotia include measures like age and species diversity and carbon storage value that reflect these wider forest values and that account for forest quality as well as simple fibre quantity.

Canada's finance and wealth accounts consist of two components. The financial flow accounts track capital and financial transactions. The national balance sheets (our stock accounts) count primarily the value of produced capital like equipment, machinery, and buildings, financial assets and liabilities, and certain elements of natural capital, but they ignore the value of human, social, and cultural capital. With the exception of timber, land, and subsoil assets like oil and minerals, they also exclude most components of natural capital and qualitative valuations like forest quality.

Thus, the conventional balance sheets also fail to account for the depreciation or degradation of key components of our capital, and thus are unable to send early warning signals that would point to a need for re-investment. For example, a sick and uneducated populace reflects a depreciation of human capital that might require investment in health promotion and education, while higher crime rates reflect a depreciation of social capital. A forest that is clear-cut reflects a depreciation of natural capital, and thus points to the need for 'living off the interest' generated by forest capital through harvest methods like selection cutting that maintain rather than deplete and degrade the full range of forest functions and services.

Similarly, our present flow accounts—Statistics Canada's input-output and income and expenditure accounts that give us GDP[13]—count only the value of market production (goods and services produced for pay and sold in the market). They take no account of the value of unpaid work or of the un-priced services to society provided by nature, culture, social networks, or knowledge—though these underpin the market economy itself. Ironically, when those un-priced services become depleted or degraded and have to be replaced for comparable paid services, we then count the value of these services in our economic growth statistics, and thus tout their replacement value as a contribution to prosperity. And when economic activities like child care shift from the unpaid household sector to the market economy, we again count that shift as "growth."

These examples clearly indicate a need to include values of unpaid work as actual production in our estimates of GDP. As Arthur Pigou demonstrated as long ago as 1932, the absurdity of this system is well illustrated by the fact that GDP goes up when someone hires a housekeeper and goes down when the employer marries the housekeeper.[14]

Our current accounting system has a term for everything that it excludes—it calls them "externalities," which are either positive impacts (benefits) or negative impacts (costs) that result from the production or consumption of goods and services. Examples of external

costs are global warming, which is an externality of nearly all economic activity in our fossil-fuel based economy; water pollution, which is an externality of a pulp and paper industry or of factory farming; crime, which is an externality of high rates of unemployment; loss of habitat for forest-dependent species and loss of watershed protection and flood control, which are externalities of clear-cutting; coral reef ecosystem damage, which is an externality of benthic trawling by fishing boats; lung cancer, which is an externality of smoking; etc.

According to GDP-based measures, depleting our natural resource stocks contributes to current economic gain, even though these apparent gains are at the expense of future prosperity. As noted earlier, this is exactly what happens when we over-fish and cut down our forests but count only the fish and timber sent to market without accounting for what we leave behind in the oceans and forests. As also noted, this is simply bad accounting and bad economics, as any factory owner knows if he were to sell off all his machinery and count it as profit. It is also bad financial management, as we now recognize after a debt-fuelled decade of spending. As well, failure to invest in human and social capital will be detrimental to future production capacity.

In summary, the GPI requires both indicators of progress and also a set of full cost accounts that include valuations of all key forms of capital (natural, social, human, cultural, and manufactured stock or wealth accounts) and the services they provide (corresponding flow accounts). Only such comprehensive accounts can properly assess the cost-effectiveness of alternative policy options, and balance the costs and benefits of particular actions against the costs of not taking action.

Is the new system too complex?

Before outlining the principles and methods of full cost accounting, it is necessary to address briefly here one key concern and question that frequently arises at this point. The GDP is a simple, straightforward single number, critics note, whereas the GPI, with its valuations of multiple capitals—many not amenable to monetization—seems extraordinarily complex by comparison, and thus correspondingly difficult to grasp and use.

On the one hand, we should never apologize for the complexity of the GPI—reality is complex after all—nor become apologists for a misguided simple-mindedness that excludes large portions of reality. Would we rather fly in a plane with a single gauge (say altitude), or one with a complex battery of interrelated gauges showing multiple aeroplane functions and piloted by one trained to scan and read all these gauges? Piloting the ship of state is no less complex than flying a plane, and we are unlikely to reach our destination as a society safely with a single gauge (GDP) that excludes a wide range of activities vital to our security and wellbeing. Let us rather take the basic training needed to read and understand the gauges we need to achieve our shared vision and goals as a society.

On the other hand, the GPI is actually much easier to grasp and apply than GDP precisely because it does correspond to our living reality, experience, and common sense. We know that good health, safe communities, decent living standards, clean air and water, a healthy environment, knowledge, and strong social supports are essential to our wellbeing. And we

can readily understand an honest appraisal of our strengths and weaknesses, even when there are apparently conflicting trends.

Yes—smoking rates are down, which bodes well for reduced tobacco-related lung cancer, respiratory and heart disease death and illness. But obesity rates are up, which will lead to higher rates of obesity-induced diabetes, hypertension, heart and gallbladder disease, and colon cancer. The policy implications are clear and unambiguous—continue to strengthen our comprehensive tobacco control strategy which is working, through higher tobacco taxes, smoke-free places, advertising restrictions, media messages, and school-based prevention programs, and let us take active new measures to promote healthy weights through investment in nutritional and physical activity programs in schools and workplaces, and through addressing the documented societal causes of the obesity epidemic.

Similarly, in environmental matters, we can celebrate and build on our successes in improving inner-city air quality, pollution controls, drinking water quality, and solid waste management. And we can take active measures to reverse destructive trends, like excess greenhouse gas emissions, over-reliance on coal-fired electricity generation, forest clearcutting, and bottom trawling that destroys the ocean floor. Policy makers and the general public are fully capable of absorbing and understanding such multiple messages and taking needed action to improve wellbeing and quality of life for this and future generations.

By contrast, it is the GDP that sends such highly confusing messages that a seminal journal headline asked: "If the GDP is Up, Why is America Down?"[15] In fact, the insecurity that airline passengers would certainly feel being transported in a plane with a single gauge by a pilot who knew only how to read altitude is matched by the distrust and alienation that so many ordinary citizens experience when leaders, politicians, and government officials fail to acknowledge and address the key constituents of their wellbeing, and when they steer the ship of state blindly without a vision or proper compass capable of ensuring security and wellbeing for themselves and their children. In reality, the illusory simplicity of GDP-based measures masks a dangerous simple-mindedness and provides no clear basis for informed policy making.

The real issue here is not simplicity vs. complexity. Rather it is that the greatest danger lies in ignoring and concealing vital dimensions of reality, which in turn allows human security and wellbeing to be eroded almost invisibly. We have come to accept unemployment and crime rates, university tuition, and student and government debt levels that would have been anathema and entirely unacceptable a generation ago. The vast majority of Nova Scotians have never seen or walked in an old-growth Acadian forest, since they have been logged almost to extinction, confined today to tiny remnants (0.3%) of the province's remaining forests. And so perhaps they think that the planted monocultures that they see from their car windows are 'natural' forests. Nor will the next generation likely know cod or wild salmon, and will therefore not miss them.

By contrast, the primary function of the GPI is to shine the spotlight on these hidden but vital dimensions of personal, community, social, economic, and environmental health and wellbeing. Once these realities are exposed and addressed honestly and straightforwardly, policy options and solutions naturally present themselves. If we could, as Nova Scotians,

effectively and successfully face our unsustainable waste management system and move rapidly from less than 5% diversion from landfills in the mid-1990s to 50% diversion in 2000, then we can take similarly effective action to create sustainable transportation and energy systems, sharply reduce greenhouse gas emissions. And if, as Canadians, we could effectively reduce poverty rates among seniors by half, as we did in the 1980s, then we can do the same for single mothers, Aboriginals, and other disadvantaged groups.

One other dimension of the simplicity vs. complexity issue must be addressed here. It is sometimes argued that the GPI would be more attractive and easier to communicate if results were aggregated to a single index number, so that it is easy to see whether the GPI as a whole is moving up or down. The original U.S. GPI, developed in 1995, did that, and that is also the intention of the forthcoming Canadian Index of Wellbeing. However, the Nova Scotia Genuine Progress Index has eschewed such efforts. Thus, it is important to note here that the Nova Scotia GPI is described in this manual and elsewhere as 'integrating' results in the sense of demonstrating key linkages and relationships between the social, economic, and environmental dimensions of wellbeing and progress. However, it does not attempt to 'aggregate' results to a single summary number for several reasons.

First, GPI Atlantic has found the methodological challenges of aggregation to be insuperable, at least for the present. Those challenges include, but are not limited to, differing units of measurement for different indicators, differing data availability and time series, the subjective nature of the weighting processes required for aggregation, the arbitrariness inherent in assigning all indicators equal value, and conceptual flaws in aggregating indicators as different as crime rates, forest age class, obesity rates, and greenhouse gas emissions. In sum, the broad assumptions underlying aggregation efforts frequently act to compromise the integrity of the results themselves. Even more importantly, such aggregation is not helpful to policy makers who are less concerned to know whether an overall index is going up or down than to know *what* is going up or down and thus to identify particular strengths and weaknesses amenable to specific policy intervention. While this lack of aggregation provides no mask for the complexity of the Nova Scotia GPI, we believe it actually enhances the clarity of results for policy purposes and ensures the integrity and transparency of results.

In sum—yes the GPI is complex in the sense of focussing attention on the interrelated social, economic, and environmental dimensions of reality rather than simple-mindedly and misleadingly regarding the market economy as a closed box isolated from social goals and from the natural world that generates resources and life-support services and that acts as a repository for our wastes. But this complexity elucidates and clarifies rather than confuses and obfuscates. Columnist Silver Donald Cameron recently described the difference using a provocative metaphor:

> Electrical engineers use a measure called the "signal-to-noise ratio," which compares the level of a desired signal speech, for instance to the level of background noise. If it's hard to make sense of the speech because of the static, the signal-to-noise ratio is poor. The GPI filters out the static, and makes sense of the conversation. The GDP simply measures economic noise.[16]

3.2 Principles and methods of full-cost accounting

There are three basic principles of full-cost accounting, which together can actually function to make the market economy much more efficient if adopted and implemented in practice:

1 Internalization of external costs
From a flow perspective, full-cost accounting internalizes 'externalities' such as the social and environmental impacts of economic activity, and thus assesses the true costs of production, which in turn should be reflected in market prices. If, for example, the full costs of pollution and greenhouse gas emissions were included in the cost of production, and in market prices, imported food might become considerably more expensive than locally grown produce.

2 The economic valuation of non-market assets
From a stock perspective, full-cost accounting recognizes and accounts for the economic value of non-market assets that are not traded in the market economy, but which nevertheless have real economic value. In assessing the value of a forest, for example, a full set of natural capital accounts will include not only the market value of the timber (as in conventional balance sheets), but also the value of the forest in regulating the climate and sequestering carbon from the atmosphere, in protecting watersheds, in preventing soil erosion, in providing habitat for many species, and in providing aesthetic and recreational enjoyment. From the perspective of a full-cost/benefit analysis, a 'healthy forest' is one that performs all these functions optimally. Indeed, the scientific evidence clearly shows that when the non-market values of a forest are compromised, the quality of the wood cut also declines. In that sense, full-cost accounting is far more in accord with science, the scientific method, and economic efficiency, than an accounting system that ignores the non-market values of natural, social, human, and cultural capital.

3 The replacement of fixed with variable costs to the extent possible
This essentially means that costs would vary according to usage. To give a concrete example, fixed annual payments for car registration and insurance provide no incentives for conservation and no penalties for unsustainable behaviours. If payments varied by type of vehicle, fuel efficiency, and number of kilometres driven annually, they would reflect a far more accurate picture of the actual social, economic, and environmental impacts of driving.

All three of these accounting principles enhance market efficiency by pricing assets and economic activity more comprehensively and in ways that reflect actual benefits and costs to society.

To illustrate the challenges inherent in the internalization of externalities and in the economic valuation of non-market assets, we will briefly review three full-cost accounting methodologies: replacement cost valuation, damage and control cost assessment, and contingent valuation.

Replacement cost valuation

Replacement cost valuations are derived by determining how much it would cost to replace non-market assets in the market economy. For instance, to assess the value of volunteer work, the GPI looks at the type and number of hours of work performed by volunteers and then assesses how much it would cost to replace volunteer services for pay in the market economy. Similarly, the value of ecosystem services like flood control or water filtration can be approximated by assessing how much it would cost to replace these services with man-made products, infrastructure, or engineering technologies?

A classic example demonstrating the cost-effectiveness of reliance on natural watershed restoration and protection services to protect a municipality's water supply and the integrity of its water quality, is New York City's purchase of the complete 4,144 square kilometre forested watershed in the Catskill Mountains that supplies the city's water. By the early 1990s, the city recognized that the development of villages, dairy farms, and other human enterprises in the watershed was affecting the quality of its water supply. It then compared the costs of a new filtration plant to the cost of watershed restoration. City planners found that purchasing and restoring the integrity of the watershed would cost less than US$2 billion, while the filtration plant would cost almost US$11 billion in capital and operating costs just in the first ten years. In other words, the work of the watershed's forest and soils could save the city as much as US$9 billion over ten years.[17]

Thus, the money that would have been spent on the filtration plant can be taken as a proxy (or potential replacement cost) for the natural watershed protection value of the Catskill watershed's forests and soils. Yet that vital service—provided largely by a standing forest—is given a value of zero in our conventional economic accounts, which value only the timber produced by the felled forest. The GPI, by contrast, explicitly recognizes the direct economic value of clean, natural environments in providing the services we depend upon for life support.

The burgeoning field of ecological economics has made remarkable advances in recent years in applying replacement cost methodologies and valuations to a wide range of natural capital assets and ecosystem services. In assessing the services provided by wetlands, for example, ecological economists have:

- Valued the storm protection services of coastal wetlands by assessing the cost of replacing these services by building retaining walls or levees;
- Valued wetland and forest erosion protection services by assessing how much it would cost to remove eroded sediment from areas downstream;
- Valued the spawning and nursery habitat services provided by wetlands by assessing replacement costs for fish breeding and stocking programs.

Damage and control cost assessment

Damage and control cost assessments are derived by assessing the potential damage resulting from an economic activity and then determining the cost to repair or to avoid such damage. Those restoration and avoidance costs are sometimes labelled "defensive expenditures," as

they 'defend' against harm rather than enhance net wellbeing. For example, it is possible to use climate change models to assess in monetary terms the potential damage costs of each tonne of greenhouse gas emissions. Those potential damage costs can then be compared to the costs of controlling emissions—as former World Bank chief economist Lord Nicholas Stern recently did in the UK—to assess the cost-effectiveness of different greenhouse gas reduction strategies and scenarios intended and designed to avoid those damages.

Other examples of damage cost valuations include:

- Cost of illness studies, as undertaken by GPI Atlantic in Nova Scotia to assess the direct health care costs and indirect productivity losses attributable to chronic disease and to risk factors like tobacco, obesity, and physical inactivity;
- Assessing the market losses due to closures in the shellfish industry attributable to high bacterial counts and water quality decline in estuaries;
- The damage costs associated with ambient air pollution, which can be measured in terms of additional burdens on the health care system, lost time at work, and pain and suffering of affected individuals, and of acid rain induced environmental damages attributable to SOx and NOx acidification of lakes and forests;
- The damage costs associated with an increase in unemployment, which can be measured in terms of increases in illness, disability, premature death, family breakdown, social unrest, and crime attributable to unemployment.

Attribution in the health care field is generally assessed through relative risk ratios (RR) derived from the epidemiological literature, which are then combined with risk factor prevalence rates (P) based on survey data, in order to determine the population attributable fraction (PAF) of each disease that can be attributed to the risk factor (e.g. obesity, air pollution, unemployment). Those PAFs are then applied to the Public Health Agency of Canada's *Economic Burden of Illness in Canada* (EBIC) database to assess direct and indirect illness (damage) costs. Please see Chapter 5 of this manual as well as GPI Atlantic's cost of obesity and physical inactivity studies for more detail on these particular damage cost methodologies. In the case of health, control costs are the investments required to promote and improve health and to prevent illness, and the cost-effectiveness of particular interventions can again be assessed (as in the climate change example above) by comparing control costs with avoided damage costs.

Contingent valuation

Contingent valuation is the most controversial of the non-market valuation methods, primarily because it generally relies on subjective assessments that may have considerably less precision than the more objective criteria underlying replacement cost, damage cost, and control cost assessments. Contingent valuation is essentially a technique—often used for valuing ecosystem services or environmental resources—based on how much people would be willing to pay for a specific ecosystem service or environmental good. However, contingent valuation methods may use objective as well as subjective evidence. For example, "willingness to pay" for wilderness conservation and protected areas can be assessed both by surveys (subjective) and also by examining actual behaviours (for example, how much people actually spend travelling to and visiting national and wilderness parks).

However, willingness to pay (WTP) as a tool to identify the value of complex systems such as wetlands or forest ecosystems has major shortcomings. According to Costanza et al. (1989):

> The economic value of ecosystems is connected to their physical, chemical, and biological role in the overall system, *whether the public fully recognizes that role or not*. Standard economics has too often operated on the assumption that the only appropriate measures of value are the current public's subjective preferences. This yields appropriate values only if the current public is fully informed.[18]

Thus, the first problem with "willingness to pay" estimates is that the public is not fully informed about the true contribution of ecosystems to their wellbeing. Secondly, the general public has a very difficult time attaching an economic value to ecosystem services, because people do not use them directly and visibly to further their immediate interests and because they generally take those services for granted (e.g. the air we breathe) and are highly unlikely to recognize the full range of services provided.

Thus, WTP may be a useful tool to estimate what people are willing to pay for a restoration project where damage has become visible—cleaning up an oil spill or polluted river, or restoring a degraded habitat for example—but not to reflect the true economic value of ecosystem services. On the other hand, it has been argued that contingent valuation will more closely reflect true values over time as ecosystem goods and services gradually move to the forefront of the public mind in response to a decline in environmental quality and as individual interests are increasingly seen to be dependent on ecosystem health. For example, the loss of 40,000 jobs as a result of the collapse of Atlantic groundfish stocks catapulted awareness of and support for fish stock and ocean conservation to the forefront of the public mind in Nova Scotia.

Contingent valuation has also been criticized because it values specific assets rather than an ecosystem as a whole, and may therefore miss critical linkages and interdependent relationships. However, many ecological economists argue that contingent valuation measurements are still far more accurate in at least acknowledging and recognizing the non-market value of nature's services than assigning these services an arbitrary value of zero, as conventional accounting mechanisms imply.[19]

Examples of contingent valuation include:

- Surveys undertaken in Halifax to assess how much Haligonians would be willing to pay, in higher water rates, for a clean harbour and for the sewage treatment plants required to prevent raw sewage being dumped into the harbour;
- Surveys assessing how much people would be willing to pay to maintain the existence of (or be compensated for the loss of) biodiversity in particular habitats;
- Surveys asking how much individuals would be willing to pay, beyond what they may already contribute in market expenditures (e.g. the entrance fee to a park), to ensure that a wilderness area is protected;

- Surveys asking individuals how much they would be willing to pay for preserving a critical habitat of an endangered non-commercial fish species.

3.3 Limitations of monetization

Putting a price tag on the value of many non-market values and assets is highly problematic, in large part because there are many that simply cannot be quantified. Indeed, money is a highly inadequate valuation instrument and common metric for this purpose because it was designed to facilitate market transactions and was never intended to price assets and services outside the market economy. How, for example, can a dollar value be placed on a forest species, or on the habitat provided to that species, or on the beauty of an intact wilderness area, or for that matter on community vitality or world peace? Or, how can a dollar value be placed on the health of a child, or on community vitality? Money was not designed to assess such assets and simply cannot adequately capture the intrinsic value of the natural world or the value of a truly healthy and peaceful society.

On the other hand, this major intrinsic limitation of monetization does not mean that these assets have no economic value or that individuals would not be willing to pay actual money to preserve and enhance them. To take just one example, individuals do regularly pay for beauty and aesthetic rewards, as when they pay higher rent for an apartment overlooking a beautiful park or natural waterway than for one overlooking a polluting factory or dump.

'Economic value' in a full-cost accounting system must necessarily be defined far more broadly than in monetary terms alone. In the GPI, monetization of non-market values and so-called 'externalities' is undertaken, where possible, but for strategic rather than intrinsic reasons—primarily because such monetization creates a language and bridge to communicate with the world of conventional economics and accounting. Monetization is therefore seen as a necessary step to overcome the conventional tendency to attribute *no* value to non-market assets and values.

This paradox is not unlike insurance compensation for loss of a limb, or court awards for grief and suffering. Some monetary compensation is seen as essential to acknowledge actual loss and the fact that life and limb have real value, even though they are not traded in the marketplace. But there is no pretence that the award truly reflects the experience or extent of loss, or that it can fully and properly compensate for that loss. Similarly, indirect illness cost assessments in terms of economic productivity losses due to premature death and disability by no means reflect the full extent of loss in human terms, but have become necessary market-based proxies for more far-reaching values. In sum, the fact that something is not traded for money in the market economy does not indicate a lack of real and actual value. Therefore, monetization can be an important interim tool to acknowledge those real non-market values in a world dominated by market values, transactions, and considerations.

However, where monetary approximations are simply not possible, as they often are not—indeed some non-market values cannot even be properly quantified let alone monetized—economic value must be described in non-monetary terms by pointing to the social and economic functions performed by natural, human, social, and cultural capital. For example,

there is no doubt that a coastal wetland is performing an economically valuable function by protecting against storm surges and coastal erosion, though it is not presently possible to monetize the value of that function with rigour or accuracy. Similarly, there is no question that having an educated populace is beneficial to society for a variety of reasons, but there is no methodologically rigorous way of putting a price tag on the economic value of a well educated populace with the knowledge to fulfil its potential.

Despite the enormous challenges inherent in valuing natural, human, social, and cultural capital, and in pricing non-market assets and services, the methods and data sources available to do so have vastly improved and expanded in recent years—making a full set of GPI Provincial Accounts more feasible than ever. Thirty years ago, for example, we had no reliable measures of greenhouse gas emissions, few comprehensive forest inventories, almost no scientific monitoring of soil, water, and air quality, virtually no diversion of solid waste from dumps, almost no systematic monitoring of health risks such as obesity and physical inactivity, no comparable international literacy assessments, and no time use surveys assessing time spent on unpaid work and free time. We now know how to measure these and other non-market values, and we have burgeoning databases and time series in these and other areas.

In terms of feasibility, economic valuations of human activity are generally much more straightforward than economic valuations of natural capital and ecosystem services. For example, the use of market replacement values to assess the value of unpaid voluntary or household work makes intuitive sense, since similar work can be performed for pay. Also, monetizing the cost of crime is relatively direct since many costs are market-based—including direct victim losses, spending on police, courts, lawyers, prisons, security guards, burglar alarms, hospitalization due to assault, retail losses due to shoplifting and employee theft, higher premiums due to insurance fraud, and productivity losses to the economy due to homicide or assault. Illness costs attributable to risk factors such as smoking, physical inactivity, and obesity are also market-based—either directly through taxpayer funded or private health care costs or indirectly through economic productivity losses due to premature death and disability.

But how do we assign an economic value to natural capital such as forests, agriculture soils, marine environment, water, and clean air? And how do we assess the costs of their depreciation and the returns on investment in natural capital when we conventionally take 'free' ecosystem services for granted? While valuations of natural capital and environmental services certainly pose particular challenges, and while money is a particularly inadequate valuation tool in this area, the attempt to undertake such economic valuation is essential to prevent the under-valuation of natural wealth and to bring the necessity for adequate conservation and protection properly into the policy arena.

4 The GPI: a new compass for policy-makers

- GPI domains and components
- Using the GPI in the policy arena
- Policy implications of measuring genuine progress
- Examples of enlightened public and private sector policy-making

There may never be a better time than the present while the conventional system is in crisis and the so-called experts are wringing their hands to seize a golden opportunity to present a new and saner economic paradigm that accounts properly for what truly matters to us.

Now is a good time in Nova Scotia to start preparing the ground for a new way of accounting. Through practice and application, policy-makers can demonstrate that these new core measures of progress and valuation are a viable and visionary alternative to the present growth-centred paradigm.

While acknowledging the limitations of a departmental, sector-specific approach to what is basically a holistic and integrated measurement system, this chapter acknowledges that we must begin from where we are. Because government is presently structured departmentally, the following pages therefore:

- present examples of practical ways in which various provincial departments can begin using the GPI for decision-making purposes,
- identify which GPI domains are particularly relevant for each department, and
- suggest how departments might proceed when attempting to use the GPI indicators and full-cost accounts.

In addition, some examples of existing policies that reflect the vision and approach of the GPI will be discussed in some detail.

4.1 GPI domains and components

The Genuine Progress Index is a set of more than 100 headline indicators and many more subsidiary indicators in 20 social, economic, and environmental areas that have been divided into the following 5 domains: time use, living standards, human and social capital, natural capital, and human impact on the environment.

In October, 2008, GPI released its first integrated Genuine Progress Index for Nova Scotia in a comprehensive report that presented and updated a representative selection of key indicators and accounts for each component. A summary of the trends and accounts for each headline indicator is provided in the accompanying *Table of Summary Results* provided in Appendix A of this manual.[20]

As a whole, the GPI results have clearly demonstrated that the GDP's omission of key measures of environmental sustainability, health, equity, financial security, educational attainment, community strength, free time and other key dimensions of wellbeing and quality of life make it unsuitable, misleading, and possibly even dangerous when mistakenly used as a measure of progress. The current economic crisis shows just how misleading GDP-based measures can be. To take just one example, much of the growth in GDP in the U.S. since 2001 was simply the result of people excessively borrowing money against their homes to make consumer purchases, so that excessive reliance on the GDP concealed dangerous trends that might have predicted the wave of foreclosures and credit crises that precipitated the collapse.

In advancing the GPI for this purpose—and in proposing now that the Nova Scotia Genuine Progress Index is "ready to use"—no pretence is made that it is complete or requires no further development. On the contrary, the GPI reports regularly point to data gaps and insufficiencies and to methodological uncertainties, and they make specific recommendations for improvements in these areas. As well, the 20 existing GPI components listed below are presented as 'representative' of wellbeing and progress but are by no means complete. To take just one example, arts and culture are key components of wellbeing. While we have undertaken some work in this field as part of the GPI education component—in areas like bilingualism, Indigenous knowledge, and arts literacy—further developmental work is required to establish this as a full GPI component in its own right.

For all these reasons, the GPI should always be seen as a work in progress, with ongoing improvements in data sources, methodologies, and substantive issues enhancing the measures over time as resources become available. The present gaps and limitations, however, should not be taken as a reason for inaction in adopting and using the GPI, nor obscure the fact that it is already a far more detailed, accurate, and comprehensive portrayal of reality than is provided by conventional measures.

Overall, trends in the 20 key areas examined over the last twelve years indicate progress in some key economic, social, and environmental indicators, but also point to a significant decline in the ability of ecosystems to perform a wide range of interconnected ecological, social, and economic functions that provide vital services to human society. They also point to growing inequities, and to significant concerns in areas like health, education, economic

security, energy, and farm viability. A key conclusion from the evidence examined is that more growth of the same kind we have witnessed will create significant downward trends in the Genuine Progress Index over time, and thus leave a far more questionable future for our children than we would wish. At the same time, the GPI evidence points to clear actions that can be taken to improve wellbeing significantly both for this and future generations.

Below is a list of the five GPI domains and their constituent components. For details on any of the indicators, trends, or accounts, please refer to the Table of Summary Results in Appendix A of this manual. Further detail, needless to say, is available in the individual component studies and reports, many of which are also listed by component in Appendix B of this manual.

Table 1. Domains and components of the GPI

The Nova Scotia Genuine Progress Index *Domains and Components*	
1. Time use Civic and voluntary work Unpaid household work and childcare Leisure time Paid work hours /employment	**4. Natural capital** Soils and agriculture Forests Fisheries and marine environment Air quality Water quality
2. Living standards Income distribution Financial security and debt Economic security	**5. Human impact on the environment** Energy Solid Waste Ecological footprint Greenhouse gas emissions Transportation
3. Human and social capital Population health Safety and security Educated populace	

Note: The Paid Work Hours component falls into both the Time Use Domain and Living Standards Domain. The Energy component falls into both the Natural Capital Domain and Human Impact on the Environment Domain.

4.2 Using the GPI in the policy arena

What is measured in the GPI is entirely in line with the provincial government's own 2006 Opportunities for Sustainable Prosperity development strategy, which is based on valuing natural, social, and human capital alongside conventional measures of built and financial capital. The GPI measures are also directly relevant to the Province's 2007 Environmental Goals and Sustainable Prosperity Act (EGSPA), which also undertakes to value Nova

Scotia's natural wealth and to create one of the most sustainable environments in the world by the year 2020. Together, these tools can provide the foundation for an enviable future for Nova Scotia reflecting the highest shared aspirations of its citizens. And significantly, they have garnered all-party support, indicating that they reflect shared goals and consensus values among Nova Scotians.

As previously noted, the new GPI measures are now ready to be used and applied in practice. Key to this practical application is the understanding that measurement and policy are intimately and naturally connected in so far as good and comprehensive evidence is required for informed decision making, and that the GPI therefore has direct policy utility and relevance. The following table is designed to assist policy makers in the various departments to locate those GPI components that are most relevant for study and use in their particular areas.

As will be discussed in further detail in the section that follows, the various social, economic, and environmental components of the GPI are a reflection of the interdependent nature reality and are therefore intrinsically linked. Progress or decline in one area will have an impact on other areas, and it is therefore essential to recognize this connectivity from a departmental point of view. For example, many tax policies, labour market policies, and early childhood development policies have been developed with economic or social objectives in mind, but all have profound health consequences. Similarly, many economic development policies have been developed with social and economic outcomes in mind but have profound environmental ramifications, which in turn may have further social and health consequences.

In many cases, policy makers may therefore need to look beyond their own departments for the impacts of policies they develop, and the linked components of the GPI are designed to facilitate such understanding. In other words, creating policy that effectively targets the population and issue at hand requires a deep understanding of the complex ways in which causes, conditions, and consequences are related. Similarly, it is necessary to recognize the potential unintended consequences of a policy—beyond the confines of a particular department—to conclude whether it is the right policy to put forth. Ideally, all policy would be constructed from this holistic perspective to assess its likely economic, social, and environmental impacts. Our current reality, however, is that government is structured sectorally, and that budgets are allocated by department. In the present circumstances, therefore, and pending a more far-reaching longer-term re-restructuring of government, a first step will be to use the GPI to track likely outcomes and impacts beyond the sectors in which specific policies are made.

For instance, the Department of Justice might be interested first and foremost in studying the *safety and security* component of the GPI, which documents crime rates over time and the economic costs of crime in Nova Scotia. However, the GPI also references the social consequences—including increases in crime—that result from growth in unemployment and inequality, and from an erosion of 'civil society.' From that perspective, the *paid work hours, income distribution,* and *civic and voluntary work* components of the GPI respectively are also relevant to the Department of Justice in so far as policy formation is concerned to prevent crime and reduce its costs to the province.

Similarly, the Department of Health Promotion and Protection would first study the *population health* component of the GPI. But policies designed to improve population health should also be informed by the:

- *living standards* domain and its components—where the relationship between income distribution and health, and poverty and health, are well documented;
- *time use* domain and its components, which point to the health consequences of unemployment, long work hours, work stress, and time stress;
- *education* component that notes the close relationship between literacy and health, and assesses health literacy and food and nutrition literacy;
- *air quality* component that documents the health costs of pollution; and so on.

In sum, crime and health are outcomes that flow from a wide range of social, economic, and environmental causes and conditions. To craft informed policy that effectively targets the causes and conditions of crime and health therefore requires a broader and more holistic understanding of the GPI as a whole. And in general, a wide range of possible influences and consequences should be factored into the formulation of any public policy. These connections and relationships—between living standards and health, time use and health, economic development and environmental health, environmental health and human health, to name but a few— are already well documented in the literature, and much of this background evidence has been conveniently summarized in the literature reviews that constitute part of the GPI studies. Thus, we hope that the GPI will be used by policy makers not only for its immediate results but also for the evidence it has assembled on the linkages between its component parts.

Ideally, and in the longer term, use of the GPI in this way will lead to an enhanced recognition at the departmental level that many departmental objectives and outcomes are held in common, and that a transfer of ideas and ongoing cooperation between departments are therefore needed so that these relationships and connections are well understood and so that they inform decision making in all major government initiatives. In the even longer term, and as this understanding deepens, the very structure of government and allocation of budgets may change to a more holistic, inter-sectoral model.

Indeed, in its *Chronic Disease Prevention Strategy* the NS Department of Health Promotion and Protection explicitly acknowledged these connections, and pointed to the need for departments to work in tandem to implement complementary strategies:

> Many of the significant factors that impact chronic disease prevention are beyond the scope of one government department, or the health sector in general. In terms of public policy, government health departments are unable to address many issues related to the determinants of health (e.g. issues related to income or unemployment) because health departments do not have the authority to enact policies that directly affect these issues. Examples of non-health sector interventions that have health implications are policies about transportation, education and income taxes.[21]

The Strategy goes on to point out that health is linked to "social circumstances and poverty" and that "addressing chronic disease risk factors will require a concerted effort to decrease health inequalities."[22]

Similarly, at the time of GPI Atlantic's first *Cost of Tobacco* report in 2000, the province's director of addiction services at the time bemoaned how difficult it was to put in place an effective comprehensive tobacco control strategy without getting the finance, tourism, education, police and other departments around the table, since they were all needed for critical elements of the proposed strategy—including raising tobacco taxes, creating smoke-free places legislation, implementing school-based smoking prevention programs, and enforcement of new regulations. If these departments regarded tobacco control as the jurisdiction of the health department and none of their own business, a comprehensive tobacco control strategy would be correspondingly difficult to craft and implement.

Fortunately, those barriers were finally overcome, and an effective strategy was launched in 2001 that quickly reduced Nova Scotia smoking rates from the highest in the country (30%) at least to average status (22%) in just five years. That kind of inter-departmental collaboration is a model for the approach inherent in the GPI analysis and its potential application to policy.

While the following table outlines samples of the particular relevance of the various GPI domains and components to different departments, it should by no means be regarded as comprehensive. Indeed, it can well be argued that every GPI component is relevant to every department's mandate. To give just one example, the first three blank cells in the first column (Agriculture Department) are all directly addressed in a major GPI report released in October 2008, on social capital in agriculture. Using time use and other survey data, the GPI study documented the fact that farmers have particularly high rates of civic and voluntary work, rely on substantial quantities of unpaid family labour, and have considerably less leisure time than workers in other sectors. So these first three blank cells in Column 1 below could well be checked, as could many other (if not all) blank cells in the table below.

Therefore, the following table is only illustrative of some of the more overt inter-sectoral links. Nevertheless, it is presented here because of the importance of at least demonstrating the cross-cutting relevance of the GPI components, and perhaps as a small step towards breaking down some of the more rigid departmental silos with their conventionally defined structures, hierarchies, budgets, and specialized mandates.

In the GPI, education is regarded as a crucial link between all components both because an educated populace is literate in a wide range of knowledge areas and because knowledge is also key to improving wellbeing in each area. It is therefore checked in each departmental box. Ecological footprint is also checked in many of the departmental boxes because all human activities and all consumption use natural resources and produce waste and therefore have an ecological footprint. A similar logic could be applied to many other GPI components.

Table 2. GPI components by NS government department

GPI domain / component	Nova Scotia government department					
	Agriculture	Community Services	Economic & Rural Development	Education	Energy	Environment
TIME USE						
Civic and voluntary work		√	√	√		
Unpaid housework and childcare		√				
Leisure time		√				
Paid work hours	√	√	√	√		
LIVING STANDARDS						
Income distribution		√				
Financial security and debt	√	√	√	√		
Economic security	√	√				
HUMAN AND SOCIAL CAPITAL						
Population health		√		√		√
Safety and security		√				
Educated populace	√	√	√	√	√	√
NATURAL CAPITAL						
Soils and agriculture	√		√			√
Forests			√			√
Fisheries and marine environment			√			√
Energy					√	√
Air quality					√	√
Water quality	√					√
HUMAN IMPACT ON THE ENVIRONMENT						
Solid waste				√		√
Ecological footprint	√	√	√	√	√	√
Greenhouse gas emissions	√		√		√	√
Transportation	√		√		√	√

GPI domain / component	Nova Scotia government department					
	Finance	Fisheries & Aquaculture	Health	Health Promotion Protection	Justice	Labour & Workforce Development
TIME USE						
Civic and voluntary work	√		√	√	√	√
Unpaid housework and childcare	√		√	√		√
Leisure time	√		√	√		√
Paid work hours	√	√	√	√	√	√
LIVING STANDARDS						
Income distribution	√		√	√	√	√
Financial security and debt	√	√	√	√	√	
Economic security	√		√	√	√	√
HUMAN AND SOCIAL CAPITAL						
Population health	√		√	√		√
Safety and security	√		√	√	√	√
Educated populace	√	√	√	√	√	√
NATURAL CAPITAL						
Soils and agriculture	√	√	√	√		√
Forests	√	√	√	√		
Fisheries and marine environment	√	√	√	√		
Energy	√		√	√		
Air quality	√		√	√		
Water quality	√	√	√	√		
HUMAN IMPACT ON THE ENVIRONMENT						
Solid waste	√		√	√		
Ecological footprint	√	√	√	√		
Greenhouse gas emissions	√	√	√	√		
Transportation	√		√	√		

GPI domain / component	Nova Scotia government department				
	Natural Resources	Seniors	Service NS & Municipal Relations	Tourism, Culture & Heritage	Transportation & Infrastructure Renewal
TIME USE					
Civic and voluntary work		√		√	
Unpaid housework and childcare					
Leisure time				√	
Paid work hours					√
LIVING STANDARDS					
Income distribution		√			

Financial security and debt		√			
Economic security		√			
HUMAN AND SOCIAL CAPITAL					
Population health		√			√
Safety and security		√			√
Educated populace	√	√	√	√	√
NATURAL CAPITAL					
Soils and agriculture	√		√		
Forests	√			√	
Fisheries and marine environment	√			√	
Energy	√			√	√
Air quality					
Water quality	√				
HUMAN IMPACT ON THE ENVIRONMENT					
Solid waste					
Ecological footprint	√	√	√	√	√
Greenhouse gas emissions	√				√
Transportation					√

4.3 Policy implications of measuring genuine progress

One of the key services GPI Atlantic has endeavoured to provide over the years, beyond assembling the data to construct its indicators and accounts, has been to draw on the best available evidence and literature to present practical policy-relevant recommendations that integrate social, economic, and environmental objectives. Thus, any government department interested in further studying and using the GPI should refer to the concluding sections of the full reports to find comprehensive sets of policy recommendations, which naturally flow from the evidence and findings of each report. The accounting component of the GPI work also enables a focus on the cost-effectiveness of these recommendations. For example, there are specific recommendations on improving the health of Nova Scotians and enhancing their economic and financial security, on forest, fisheries, and waste management, farmland preservation, energy conservation, sustainable transportation, and more.

While this summary GPI user manual cannot adequately describe and explain each of these evidence-based policy considerations, the section below attempts to crystallize a few key highlights from each of the 20 GPI components at least to illustrate its importance and relevance to the overall measures of progress, to show how it has been valued in this new accounting system and how it interconnects with other GPI components, and to point to the kinds of policy implications that flow from these realities and relationships.

Due to space considerations, the key indicators that make up each component have not been listed or discussed in any detail in this section. For trends in some of the headline indicators that comprise each of the components below, please refer to Appendix A of this manual.

Nor is this the place to explain the methodologies used for different sets of valuations. In this section we highlight a selection of important and final summary results for illustrative purposes. For more detail on each component, including the data sources and methods used to estimate these and other results, please refer to the examples provided in Chapter 5 of this manual, as well as to the full GPI reports that are all downloadable for free from the publications section of the GPI Atlantic website.

TIME USE

Civic and voluntary work

A widespread, independent, and active network of community and voluntary organizations is widely regarded as the hallmark of "civil society," and its active strength as a critical indicator of healthy democracy. This "social economy" is the arena in which we participate most fully as citizens, freely choosing our interests and associations, and expressing our deepest aspirations to help others. The strength of a society's commitment to voluntary work is, for many social scientists, a touchstone of social health, stability, and harmony, and thus a key indicator of social and community wellbeing. Analysts have observed that a weak civil society, by contrast, is more subject to social unrest, alienation, and disintegration. It is frequently associated with higher rates of crime, drug abuse, and other dysfunctional activities, which eventually produce much greater social and economic costs than wise investment in the community and voluntary associations that strengthen the fabric of civil society.

According to Health Canada, social support networks, which extend from close family and friends to voluntary associations in the broader community, are a major determinant of health, and are "reflected in the institutions, organizations and informal giving practices that people create to share resources and build attachments with others."[23] For this reason, Health Canada uses volunteerism as a key indicator of a "supportive social environment" that can improve health. In addition, the Treasury Board, which publishes yearly reports evaluating national trends in quality of life, includes volunteering as one of its five key indicators of "the strength and safety of Canadian communities."[24]

As previously noted, because no money is exchanged, the value of volunteerism is nowhere to be seen in our economic growth statistics and related measures of progress. In fact, the most recent data indicate that there has been a significant decline in volunteer hours nationwide, with fewer volunteers now putting in longer hours in order to maintain services. And yet, if we had to replace the services offered by volunteers in this province alone, it would cost roughly $1.8 billion.[25] The replacement cost of voluntary work does not include the hidden social and economic costs associated with a decline in "civil society."

Unpaid housework and childcare

Every day, and for no pay, Canadians perform hours of valuable services in their own homes that contribute directly to wellbeing and economic prosperity. In fact, it has been argued that the work performed in households is more essential to basic survival and quality of life than much of the work done in offices, factories, and stores, and is a fundamental precondition for a healthy market sector. If children are not reared with attention and care and if

household members are not provided with nutritious sustenance, for example, workplace productivity will decline and social costs will rise. Yet, because these services—from raising children to running a household—are assigned no monetary value, their massive contribution to society does not show up in our standard measures of economic progress.

The implications are especially harmful to women, who perform the bulk of unpaid work. For example, unpaid workers are excluded from pension plans, including the Canada Pension Plan, and can have trouble getting credit. In addition, women who take time from careers to raise children can lose seniority or opportunities for promotion, and the ability to make workplace pension contributions. Failure to value women's unpaid work can also produce a subtle "wage discrimination" by devaluing women's work as a whole. Work considered traditional, unpaid female work—childcare, cleaning, cooking, and other 'domestic labour' for example—also fetches a low wage in the market economy. And overall, Statistics Canada reports that women still earn less than men on an hourly basis—an average of 87.4 cents for every male dollar—and that half the gender wage gap is "unexplained" and must therefore be attributed to "gender-based labour market discrimination." Fortunately, this gap has begun to narrow in recent years from 81 cents to the dollar in 2001 to 83 cents in 2004, to 87.4 cents today, largely due to the sharp improvement in women's formal educational qualifications.[26]

However, in those occupations traditionally performed for "free" in the household, and still dominated by women in the market economy, wages remain extremely low. In 2004, even unionized early childhood educators in Halifax were earning an average of just $10.51 an hour for an occupation that arguably requires higher levels of skill, responsibility, and constant alertness than most others. Since unionized childcare workers earn an average of 30% more than non-unionized ones, and only 16% of childcare workers belong to a union, the vast majority of Nova Scotia childcare workers (who are overwhelmingly female) earn even less than this and likely remain at minimum wage levels.[27]

Failure to value unpaid childcare and housework also results in a lack of adequate social support that especially penalizes lone-parent mothers, who carry the total burden of unpaid household work alone. When they also hold down paid jobs, single mothers spend three times as high a proportion of their incomes on paid childcare as their married counterparts and frequently suffer extreme levels of time stress and "time poverty" that give them considerably less dedicated time with their own children than their married counterparts.[28] For many of these women, the paid workforce is not a viable route to an adequate income that also leaves them time to raise their children properly and undertake essential household tasks. Yet the lack of adequate social support for unpaid workers often gives them little choice.

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

Statistics Canada has recognized that measuring unpaid work is essential to overcoming

gender discrimination through under-valuation of women's economic and social contribution: "Since women do most of the unpaid household and volunteer work, their significant contribution to overall production and economic welfare is grossly understated in the major economic aggregates."[29]

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

The GPI Time Use Accounts show that in 2005, Nova Scotians contributed 977 million hours a year in unpaid household work and childcare, or 1,241 hours per person over the age of 15. This is the equivalent of 509,000 fulltime jobs.[30] If this unpaid work had to be replaced for pay in the market economy, at the average rate of $10.87 an hour paid to domestic help in the province and $8.96 an hour for childcare, it would be worth $10.4 billion a year to the provincial economy—equivalent to 36% of GDP.[31]

Leisure time

Free time is one of the most basic conditions of wellbeing and quality of life. Without it, citizens have no time to relax with family and children, to appreciate nature, to pursue hobbies and interests, to reflect and read, to engage in the physical activity that is so essential to good health, and simply to enjoy life. Even more fundamentally, free time is the only time we have to do what we want, not what we have to do, and it thus constitutes a key condition for freedom. Nearly 2,500 years ago, Aristotle, in the *Politics*, described leisure as a prerequisite for democracy and citizenship, as it allowed time for contemplation and debate of vital state issues.[32]

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

A study published by the *American Journal of Health Promotion* found stress to be the costliest of all avoidable health risk factors,[33] and Statistics Canada found long work hours to be correlated with higher rates of smoking, physical inactivity, unhealthy weight gain, and depression.[34] Conversely, leisure has been found to ameliorate the stresses of work and daily life, and to have positive value and benefit for both physical and mental health.[35] And it is widely accepted that when free time gets squeezed out, the quality of life suffers.

In the accounting language of the GPI, leisure time is regarded as a human capital stock that can potentially be valued in both its quantity and quality, and that is also subject to depreciation if it is squeezed out by excessive work and other required tasks. While conventional analyses describe human capital only in terms of skills that enhance workplace

productivity, the GPI considers the full 24-hour use of time—including paid work, unpaid household work, voluntary work, personal tasks, study, and free time, and the balance between these activities—as a contribution to human wellbeing.

In sharp contrast to economic theories that see growth as limitless, the GPI sees a person's time—like the world's natural capital—as limited, and so the quality of life both in this and future generations depends on *how* that limited time is spent and how skilfully those finite natural resources are used. Each person has a finite life span and only 24 hours in a day to allocate to activities both required and chosen. In sharp contrast to GDP, which values only paid work, the GPI therefore reports time allocation far more comprehensively, and values unpaid work and free time alongside paid work.

Trends show that annual free time in this province has declined by an average of 186 hours per person 15 and older since 1998, as Nova Scotians work longer hours. The biggest losers of free time in the last decade were single working mothers, who saw their free time shrink by nearly 19 hours a week as they worked longer hours for pay while still struggling to maintain their household and childcare responsibilities largely alone. When we try to account for genuine wellbeing, leisure time lost or gained must register in the books. In this case, leisure time lost would register as a cost: According to the GPI Time Use Accounts, Nova Scotians are losing $1.25 billion worth of free time each year—when we value hourly leisure time at half the hourly average wage—compared to what they had ten years ago.

Policies designed to address this issue of shrinking leisure time will inevitably also need to delve into work time reduction options, which will in turn raise equity issues. Leisure time should be considered a basic right of *all* workers. To this end, minimum wage levels should be increased to a living wage, so that all workers can freely choose to reduce their hours and enjoy more leisure time. Presently, for example, a single parent with one child would have to work 57 hours a week at minimum wage just to reach Statistics Canada's low-income cut-off.

If low minimum wages and sharp income inequality persist in their present form, then the working poor will not likely choose a reduction in work hours. Instead, they will likely retain their hours or increase them as they became available in order to make ends meet. Those with financial resources would be able to reduce hours and enjoy more leisure time. But this would ultimately result in a leisured class working short hours and a low-wage class working long hours with virtually no gains in free time. In sum, it is essential to consider expansion of free time within this equity context.

Paid work hours / employment

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

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

Better and more comprehensive measures of progress that include indicators of population

health and work-life balance and that account for the value of voluntary work, free time, and family time, would not treat work-related stress and the cost of treating stress-induced illness as contributions to prosperity, as our current measures do. Rather, better measures of progress would recognize that higher levels of income, growth, and output in the industrialized world have not always increased levels of satisfaction, wellbeing, and economic security, and have come with both environmental and social costs, of which time stress is just one.

In the economic growth statistics conventionally used to measure progress, long work hours are indirectly counted as a contribution to wellbeing because they usually translate into increased output and income, and therefore higher levels of consumption. But there are economic, social, and environmental costs associated both with increased output and with long work hours. Longer work hours may exacerbate stress, produce adverse health outcomes, reduce time with family and friends, and diminish our quality of life, while increased output may place excess demands on our natural resources. At the same time, unemployment and underemployment waste precious resources and also produce substantial social, human, health, and economic costs.

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

The full costs of these and other changes in the nature of work are not properly captured in our current GDP-based measures of progress.

Unemployment, for instance, has been associated with stress, poverty, financial insecurity, poor health outcomes, and a wide range of social problems. Abundant evidence indicates that the unemployed suffer higher rates of physical and mental illness than those with jobs. In fact, both unemployment and overwork carry health problems and hidden costs, and one Japanese study found that the underemployed and overworked had equally elevated risks of heart attack.[36] Unemployment is also associated with crime. For example, a Canadian Centre for Justice Statistics survey of inmates in Nova Scotia prisons found that 67% were unemployed at the time of admission to the correctional facility.[37]

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

GPI Time Use /Living Standards Accounts indicate that the productivity (output loss) costs and fiscal costs associated with the 2006 official unemployment rate in Nova Scotia of 7.9% was $3.6 billion or $3,941 per Nova Scotian, compared to $4.4 billion ($4,846 per capita) in 2001 when the unemployment rate was 1.8 percentage points higher. The potential

economic burden of illness in Nova Scotia that may be associated with the 2006 official unemployment rate of 7.9% was estimated to be $162.2 million—down from $202 million in 2001 when the jobless rate was higher.

Because the GPI links livelihood security to other components like population health and community safety, it demonstrates the negative social consequences of layoffs and unemployment far more clearly than conventional economic analyses are able to do. Therefore, given the predictive quality of these historical links and trends to date, we can say with some certainty that massive layoffs due to the current recession will result in increased crime rates in the months and years to come.

We also know that overwork and loss of leisure are also extremely costly to society. When all this evidence is considered together, simple and straightforward solutions to the current economic downturn, which can easily avoid costly layoffs, present themselves. For instance, it makes a great deal of sense to shorten and redistribute work hours among a much larger portion of the workforce, rather than resort to costly layoffs. Work sharing—preferably instituted on a voluntary basis and offering a range of shorter work time options like 4-day weeks (3-day weekends), longer vacations, or shorter work days that allow parents to be at home when their children get home from school—would spread the burden of the economic downturn rather than placing it entirely on the shoulders of a few.

Indeed, five Nova Scotia firms, including Stanfield's in Truro, Composites Atlantic in Lunenburg, and Michelin, along with more than a thousand of their workers, have already avoided the layoff of hundreds of workers by redistributing work time among the employees. These firms and workers are taking advantage of a federal work-share program in place since 1977 that provides financial incentives to avoid layoffs by reducing work time and enabling employees to collect Employment Insurance benefits to supplement a portion of their lost wages. Thus workers moving to a 4-day week gain 20% more free time for only an 8-10% reduction in pay—a proposition attractive to many workers, especially if they know that this will save their own jobs and those of their fellow employees. The Nova Scotia government could actively seek to extend this program much more widely through the province by encouraging other firms to join.

Work-related policies need to be designed that address both the issues of underwork (among the unemployed and underemployed) and overwork (due to long work hours and chronic overtime) by removing disincentives to new hiring and creating incentive programs that encourage work time reduction. There is no evidence to suggest that shorter work hours carry the kinds of costs that have been well documented and proven for unemployment. On the contrary, there is abundant evidence that shorter work hours lead to improved labour productivity, reduced absenteeism, improved worker morale, better health, and enhanced quality of life.

A shorter work time solution to the present economic downturn would not only avoid layoffs but also conserve resources and give the natural environment a chance to rest and recover by reducing production, consumption, and waste generation. Rather than going deeper into debt for dubious 'stimulus' policies designed to restore an unsustainable growth rate, we could creatively shrink our lifestyles and consumption habits without compromising

the quality of our lives. Cooperative solutions might well reduce individual needs through a greater sharing of resources.

LIVING STANDARDS

Income distribution

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

For example, poverty and inequality are among the most reliable predictors of poor health. According to Statistics Canada, "The relationship between socioeconomic status and health is one of the most pervasive in the epidemiologic literature and has held up over time and in countries throughout the world."[38] The World Health Organization (WHO) states that people who are poor run at least twice the risk of serious illness and premature death when compared to those with higher incomes.[39] Socioeconomic status has been identified as a precursor to cancer, cardiovascular disease, arthritis and musculoskeletal disorders, diabetes mellitus, dental diseases, drug dependence and abuse, and infant mortality and morbidity.

Child poverty has also been linked to a wide array of physical, psychological, emotional, and behavioural problems among children, including higher rates of respiratory illnesses and infections, sudden infant death syndrome, obesity, high blood lead levels, iron deficiency anaemia, chronic ear infections, mental retardation, fetal alcohol syndrome, and dental problems.[40] Low-income children are more likely to consume less nutritious foods, and to have low birth weights, poor health, higher rates of hyperactivity, delayed vocabulary development, and poorer employment prospects.[41]

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

> What matters in determining mortality and health in a society is less the overall wealth of the society and more how evenly wealth is distributed. The more evenly wealth is distributed, the better the health of that society.[42]

And a November 2007 analysis in the *British Medical Journal*, concluded that: "Improvements in child wellbeing in rich societies may depend more on reductions in inequality than on further economic growth."[43]

According to Statistics Canada, there are two key reasons why income distribution may affect health. Socio-psychological research suggests that individuals at the bottom of the income ladder may feel greater "anxiety and shame" about their lot in comparison with those better off. Over time, this negative emotion can lead to chronic stress, which in turn can lead

to adverse physical health outcomes. The second key reason, based on what is called the neo-material approach, suggests that the poor suffer adverse health effects from not having access to the same resources or living conditions—such as health care, nutritious food, housing, secure employment, and a sense of social belonging—as those with higher incomes.[44]

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

In its most recent update of income distribution trends, GPI Atlantic found that the income gap between rich and poor in Canada overall has widened substantially since 1981, while it narrowed slightly in Nova Scotia during the same period. In 2004, the highest income 20% of Nova Scotians had 4.3 times the disposal income (after taxes and transfers) of the lowest-income 20% (compared to 5.1 times as much in Canada as a whole). Economic vulnerability remains highly concentrated among certain groups like single mothers, youth, Aboriginals, and the unemployed, and the regional income gap (between rich and poor provinces) has widened substantially in the last quarter century.

Policies dealing with taxation, minimum wage, social assistance, child benefits, employment insurance, and health promotion should be informed by the importance of income distribution in terms of both societal and human wellbeing.

Financial security and debt

The present financial crisis, which has sent shock waves around the globe, was triggered in 2006–2007 by high default rates on US sub-prime mortgages that in turn were an outcome of increasingly risky lending and borrowing practices in preceding years. In addition, individual and corporate debt levels had reached record high levels. The increase in housing default and foreclosure activity in the US—up nearly 80% between 2006 and 2007—eventually triggered the collapse of the asset backed market in that country. In September 2008, GPI Atlantic reported in its debt and financial security report that in Canada, household debt had been rising at a considerably faster pace than income or assets in the previous 'boom' decade, leaving many Canadians in an increasingly vulnerable financial position.

Since wealth is defined as assets minus debts, asset losses due to the current crisis mean there has been a loss of real wealth in Canada. Not only have assets held in the forms of stocks, mutual funds, pension funds, and other market-dependent resources been substantially affected by the decline in stock market values, but the decline in home prices has also diminished the value of the largest single source of household wealth. Using data from Statistics Canada's next Survey of Financial Security and from the National Balance Sheet Accounts, we will eventually be able to capture the overall impact of current events on the wealth or net worth of Canadians.

In the meantime, interim data from other sources contain troubling news. For example, a November, 2008 survey by the Certified General Accountants Association of Canada (CGA) found a sharp increase in household debt—due primarily to the increasing use of consumer debt (lines of credit and credit cards) to finance basic living costs rather than asset accumulation. The survey found that more than one in five Canadians in debt could no longer manage their debt load, and one in ten would have trouble handling an unforeseen expense of only $500.[45]

From a GPI perspective, wealth adequacy and disparities and the ability of individuals to manage their debt are the two key measures of progress in this area that directly affect individuals' financial security. Adequate wealth and savings can enhance financial security by enabling households to weather the financial crises that can result from job loss, sickness, death or disability of an income earning partner, or other unexpected circumstances. They can also provide a reserve for house or car repairs that are suddenly required, or for other unanticipated financial outlays that would strain normal income. Conversely, the inability to manage debt can seriously compromise financial security and wellbeing and cause a range of other problems including stress, anxiety, illness, and (in extreme cases) even crime and suicide. The sub-prime mortgage crisis in the US illustrates clearly that widespread inability to manage debt can also send massive shockwaves through the economy as a whole.

Conversely, a growing body of evidence links improvements in equity with positive economic, social, health, environmental, and political impacts. This basic understanding is backed by a growing body of research demonstrating, that greater income equality can enhance productivity and economic health, while sharp wealth and income inequalities can threaten social stability and cohesion and undermine productivity and health.[46]

Despite the proven links of both indicators to financial security and wellbeing, the evidence examined in the September 2008, GPI study points to a growing wealth gap in Canada and a growing inability to manage debt, as the rate of debt growth has fast outpaced both asset growth and income growth. Thus, household debt in Atlantic Canada increased by 62% between 1999 and 2005, while assets grew by 35%, and more than 77,000 households in the region were so deeply in debt by 2005 that they couldn't pay off their debts even if they sold everything they owned, including their homes. The GPI report noted that growing financial insecurity among Atlantic Canada's poor was due not to any lack of overall wealth in the region but rather to its very unequal distribution. Thus, the richest 10% of Atlantic Canadian households own about half the region's wealth and have seen their wealth expand substantially over time, while the poorest 40% together own only 3.6%. These trends, unfortunately, do not signal genuine progress in the GPI.

The trends point to a need for policies that regulate the financial sector, reduce over-indebtedness among the poor by creating interest rate ceilings, requiring responsible lending, preventing illegal lending, and advising and educating households on budget management. A step in the right direction was taken in Nova Scotia with the 2006 passage of legislation authorizing the province to enforce stricter guidelines and penalties on payday lenders. Student debt relief and lowering costs of postsecondary education are particularly important priorities in the province in light of rising student indebtedness and unprecedented levels of

government and private debt upon graduation. In the longer term, the deeper issues of growing wealth inequity and a guaranteed living income will need to be addressed if financial security is not to become the preserve of those who already have adequate wealth.

Economic security

Economic security means that individuals have a sense of confidence, protection, and even certainty about their economic safety both in the short term and for the foreseeable future. The economically secure do not worry about finding adequate economic resources to support themselves and their families, especially when encountering the economic losses that may result from being unemployed, ill, separating from an income-earning partner, or growing old. Thus, they do not feel overly anxious about potentially adverse circumstances that they may encounter in the future, and they have confidence that existing social mechanisms will provide adequate protection against such circumstances and conditions.

However, public opinion polling reveals that many Canadians do not have that confidence, that they feel economically insecure, and that they experience such insecurity that their subjective state of wellbeing is diminished. Lars Osberg has argued that economic insecurity is, in a general sense, "the anxiety produced by a lack of economic safety—i.e., by an inability to obtain protection against subjectively significant potential economic losses."[47] Since individuals' perceptions of economic insecurity in the future affect their present feelings of wellbeing, economic security is an important component in the measurement of individuals' wellbeing and a key indicator in the GPI.

For this component, the GPI references the aggregate Index of Economic Security, developed by Lars Osberg and Andrew Sharpe, which is based on security from the economic risks imposed by four key factors—unemployment, illness, old age, and single parenthood. These trends show that overall, Nova Scotians (like other Canadians) were considerably less economically secure in 2007 than they were in 1981—due largely to the higher share of household budgets spent on private health care and thus to the increased economic risks associated with illness. In 2007, the overall index of economic security in Nova Scotia was 0.581, a decline of 12.9 % from 0.667 in 1981.

The GPI study also found that sharp declines in social assistance benefits and employment insurance eligibility had compromised the effectiveness of the social safety net both in Nova Scotia and nationwide. On the positive side, the study noted recorded substantial increases in child benefit investments. Also, in May, 2008, employees earning minimum wage in Nova Scotia began receiving annual increases that, by 2010, will place them above the low-income cutoff. In general, actions that strengthen the social safety net enhance economic security.

Population health

Health is the outcome of a wide range of social, economic, and environmental factors. In a very real sense, the entire Genuine Progress Index, and all the components of the GPI can therefore be seen as constituting, in effect, the social, economic, and environmental determinants of health.

Thus, while we do not break down the health data in the GPI according to their social, economic, and environmental determinants—such as education, income, pollution, etc.—the population health component must be seen in the context of all the other components of the GPI. In other words, the entire GPI is quite literally about health, since the other components of the GPI—on income and its distribution, employment, financial security, education, crime, free time, air quality, greenhouse gas emissions, and more—*all* constitute determinants of health. This statement is not rhetorical, but is entirely based in hard evidence.

Thus, socioeconomic status, poverty, inequality, and environmental factors, have all been demonstrated to be important determinants of population health. Health is also directly linked to the other components of the GPI—including employment, education, crime, and various aspects of time use, including the social supports that result from high levels of voluntary work and the stresses that stem from lack of free time and the incapacity to juggle the competing demands of paid and unpaid work. For example, the epidemiological literature points to higher levels of sickness, disability, and premature death among the unemployed, and to the close association between high levels of literacy and good health outcomes.

In sum, health is quite literally the outcome of all components of the Genuine Progress Index. Indeed, one of the key purposes of the GPI is to demonstrate the close linkages and relationships among the social, economic, and environmental determinants of health and wellbeing. Thus, several other GPI components quite specifically assess related health impacts and costs. The components on work hours, crime, air quality, water quality, energy, greenhouse gas emissions, and transportation, for example, all include economic cost estimates for hospitalization, other direct health care costs, productivity losses due to disability and premature death, and other costs associated with illness or injury related to unemployment, work stress, crime, accidents, air and water pollution, fossil fuel combustion, and other health determinants.

As well, the GPI component on income describes the health impacts of poverty and inequality; the debt and financial security component notes that inability to manage debt has been associated with illness and even suicide; the economic security component assesses the economic risks associated with illness; the educated populace component references health literacy as a key attribute of an educated populace, etc.

While it would be naïve to draw simplistic cause-effect inferences between particular health determinants and particular health outcomes, the overwhelming weight of evidence clearly indicates that wise investments in natural, human, economic, and social capital, and

concomitant improvements in economic and financial security, environmental quality, education, safety, community wellbeing, and work-life balance, can all improve population health outcomes.

The GPI Population Health Accounts include full-cost accounts of the costs of chronic disease, tobacco, obesity, and physical inactivity in Nova Scotia. Thus, a GPI analysis found that half a billion dollars a year in direct taxpayer-funded health care costs could be attributed to these three preventable risk factors—tobacco, obesity, and physical inactivity. In other words, the province could potentially save $500 million a year in excess health care expenditures if Nova Scotians didn't smoke, had healthy weights, and exercised regularly. That finding has been credited with prompting the Nova Scotia government to create the new Department of Health Promotion and Protection, with its own minister, budget, and mandate to improve the health of Nova Scotians.

A 2000 GPI finding that smoking cost the province $168 million in direct health care costs and a subsequent GPI study on the economic impact of smoke-free workplaces have also been credited as strong inputs to the province's comprehensive tobacco control strategy that helped bring Nova Scotia's smoking rate down from 30% (the highest in the country) to 22%, and that halved the rate of teenage smoking. In sum, the evidence quite clearly shows that investments that reduce preventable chronic diseases[48] and risk behaviours will produce a very substantial rate of return and long-term benefits to Nova Scotians in lives saved, better long-term health outcomes, and significant cost savings.

Safety and security

A peaceful, harmonious, and secure society is an important social asset and makes a vital contribution to our quality of life. Public opinion surveys, nationally and internationally, consistently report that physical security is a top priority for citizens.[49] In addition, the Canadian Institute for Health Information (CIHI) and Statistics Canada both acknowledge that physical safety and security are key non-medical determinants of health, and Statistics Canada now regularly reports crime rates among its health indicators.

In our conventional economic accounts, however, most crime costs are counted as contributions to economic growth, and are therefore perversely interpreted as contributions to economic prosperity and wellbeing. The higher the crime rate, the more we spend on prisons, police, criminal trials, burglar alarms and security systems; and the more we spend, the more our economy grows, so that crime costs are conventionally interpreted as a sign of progress in GDP-based measures.

By contrast, the GPI counts crime as a liability rather than an asset, and its costs as an economic loss rather than gain. Lower crime rates are seen as a sign of progress and reduced crime costs are seen as savings that can be invested in more productive activities that build communities and enhance wellbeing. As well, it is now widely recognized that safety and security are themselves outcomes of a wide range of social and economic conditions and circumstances, and are linked to income, employment, social supports, and other key variables. For example, regression analyses conducted by the Canadian Centre for Justice Statistics (CCJS) demonstrate a strong statistical link between crime and unemployment.[50] As well, a CCJS survey of inmates in Nova Scotia prisons found that more than two-thirds of

inmates were unemployed at the time of admission to the correctional facility.[51]

From this perspective, money spent on crime prevention—including decreasing poverty, income inequality, social exclusion, and unemployment, for instance—should be seen as investments in a peaceful and more secure society, rather than as a cost.

From the GPI full-cost accounting perspective, measuring the costs of crime also raises the very practical question of how much we have to spend as citizens for an acceptable level of security. If we need to spend less to maintain the same level of security, then our quality of life may be considered to have improved, and our standard of living to have increased in direct proportion to the drop in intermediate expenditures. If the cost of maintaining the same level of security goes up, our quality of life may be considered to be eroding and our standard of living to be declining.

The most recent GPI Safety and Security Accounts provide a comprehensive estimate for the cost of crime in Nova Scotia of $1.5 billion. This comprehensive estimate includes a wide range of crime costs not included in more conservative estimates, such as costs associated with unreported crimes, the value of lost unpaid work attributable to crime, retail business 'shrinkage' due to employee theft and shoplifting, insurance fraud, and an estimate—based on court awards—for the cost of pain and suffering attributable to crime. By contrast, more conservative crime cost estimates include only public justice costs, victim and productivity losses due to reported crimes, defensive expenditures on security systems and guards, and the gap between theft insurance premiums and claims.

The $1.5 billion comprehensive crime cost estimate for Nova Scotia represents a marginal decrease over the last decade due to lower crime rates that accompanied the decline in unemployment during this period. This comprehensive estimate is also approximately twice the magnitude of the conservative crime cost estimate of $704 million.

By failing to identify and measure economic costs, and by misleadingly counting them as gains (as occurs when we mistakenly use GDP-based measures to assess progress and wellbeing), we lose sight of both the value and the potential deterioration of our social assets. That, in turn, can lead to serious policy failures when we fail to take preventive action and action to remedy trends that undermine our quality of life and standard of living. No blame attaches to this failure because our economic accounting system has been sending misleading messages to policy makers and the general public alike. In fact, we have all been trapped in the materialist illusion that more output and spending necessarily produce greater wellbeing.

Conversely, the measurement and valuation of non-material human, social, and environmental assets not only draws attention to the true sources of genuine prosperity, but can allow us to focus clearly and unambiguously on the legacy we are leaving our children and on the society we want to create and inhabit in the future. Such a society clearly includes high levels of physical safety, security, and peace. Trends in crime rates and perceptions of crime and safety are among the most well accepted measures of such societal peace and security.

Educated populace

The GPI is based on the understanding that the wellbeing of Canadian and Nova Scotian society is correlated with certain key conditions, including physical and mental health, healthy ecosystems, decent living standards and economic security, strong social ties, safe communities, a vibrant culture, and the ability to balance the often competing demands of paid and unpaid work with ample leisure time. Wellbeing in the GPI is also explicitly defined to include the welfare of future generations as well as that of the present generation. Whether Canadians and Nova Scotians have the knowledge required to improve wellbeing and sustainability is seen as a key connection among all the above conditions. In this sense, the GPI educated populace indicators serve as vital connective tissue linking all the components of the Genuine Progress Index.

Abundant evidence indicates that education has a significant effect on quality of life in impacts on income, population health, environmental quality, civic engagement, and other dimensions of wellbeing. Therefore, the evidence of whether or not Canadians and Nova Scotians are learning what they need to know to create a healthy, wise, and sustainable society should be seen in desirable social outcomes such as peace, equity, environmental stewardship, good health, and tolerance. To take just one example, if people learn about and understand the connection between burning fossil fuels and climate change, they are more likely to be motivated to reduce their fossil fuel use. This overall view of educational objectives and indicators is considerably broader than that found in conventional education indicator systems that generally focus on graduation and participation rates and other formal schooling measures.

From this perspective, and in order for a society to assess social progress in general, and advances in learning and education in particular, it must first identify and define the kinds of knowledge required to create a healthy and sustainable society. In this endeavour, the key question in constructing the GPI education indicators was: What *is* an educated populace?

An extensive review of the research in this field revealed the following general consensus among a wide body of analysts, educators and commentators about the key characteristics that constitute an educated person or populace:

- Engagement and capacity to learn throughout life with an attitude of openness, interest, and curiosity;
- Awareness of contextual situations and systems, social and economic interconnections, current world events, the processes of the natural world, the influence of current lifestyles on population health, and the choices and quality of life of future generations;
- Ability to analyse, communicate, and integrate ideas;
- Ability to solve problems collaboratively;
- Willingness to engage in personal and social transformation;
- Knowledgeable in areas required to improve societal wellbeing, and using that knowledge for the public good.

In other words, an educated populace has the knowledge and skills required to foster wellbeing in individuals and in the population as a whole—that is, to live healthy lives, have

decent jobs, participate actively in their communities as citizens, and understand the interdependent nature of the world in which they live—without imperilling these prospects for future generations.

The effective transmission and use of knowledge for societal benefit requires both basic literacy (reading, writing, and numeracy) and multiple literacies in relevant areas such as ecology, civics, arts, science, health, and culture. Thus, an educated populace would have a reasonable understanding about important issues that affect daily life, which, in turn, requires practical skills like the ability to understand the meaning of statistics, how the media present information, and how to make informed decisions when voting.

From the perspective presented above, an educated populace indicator framework should be able to track changes over time not only in the store of factual knowledge, but also in the values, attitudes, and wisdom of the populace. Sadly, those key dimensions of an educated populace are virtually absent from most conventional indicator systems. As well, and with few exceptions, like basic literacy assessments, most conventional education indicators also provide very little information about learning *outcomes* or social *outcomes*, which are the key concern of GPI Atlantic in all of its indicator work.

A literature review found that the conventional education indicators that currently exist to assess educational attainment are too limited, and that many key learning outcomes are not adequately represented. As well, those indicators—focusing as they generally do on formal schooling—do not adequately account for the role and outcomes of non-formal and informal learning processes and contexts, including the roles of the family, community, television, the Internet, and other media.

In addition, the evidence indicates only a weak—and often misleading—link between many conventional education indicators and actual educational attainment. For example, GPI Atlantic found that graduation rates are a better indicator of labour market conditions than of educational attainment, since an abundance of well-paid job opportunities will tempt students to leave school early, while lack of such opportunities will more likely keep students in school. Similarly, standardized test scores were found to be a better indicator of socio-economic status than of educational capacity.

For example, Table 2 indicates that in general, younger people have considerably less political knowledge than older people, and that the political knowledge of younger people is decreasing over time and at a faster rate than for any other group. Thus, between 1984 and 2000, scores fell by 20% for the youngest group (aged 18–23), by 17% for the next youngest group (24–29), by 8% for those aged 30–34, and by between 4% and 6% for middle-aged Canadians, while knowledge scores improved for those 50 and over.

The results here contradict the conventional wisdom that graduation indicates educational attainment and that higher rates of graduation should therefore predict higher levels of knowledge. In this case we see that the very age cohort that has the highest levels of formal education in Canadian history also has the lowest levels of political knowledge ever recorded.

Table 3. Percentile scores of correct answers to general political knowledge questions, by age group, 1984, 1993, 1997, and 2000

	Age Group						
Year	**18–23**	**24–29**	**30–34**	**35–39**	**40–49**	**50–59**	**60 +**
1984	39.3	43.7	51.9	51.4	54.4	57.9	52.4
1993	36.7	46.7	47.1	50.3	55.5	53.1	56.0
1997	37.8	41.0	46.1	47.7	53.2	58.4	57.0
2000	31.4	36.2	47.6	49.5	51.4	59.7	58.3

Source: Adapted from Howe, Paul. "Political Knowledge and Electoral Participation in the Netherlands: Comparisons with the Canadian Case." Paper presented at the Annual conference of the Canadian Political Science Association, Winnipeg, June 3–5, 2004; accessed July 2005; available from http://www.cpsa-acsp.ca/template_e.cfm?folder=conference&page_name=agm-papers-2004.htm, based on the 1984, 1993, 1997, and 2000 CES surveys.

Notes: Knowledge scores for each election year are based on the number of questions respondents answered correctly in each year, with results then converted to percentile scores. Relative knowledge levels of the different age groups were calculated based on the mean percentile scores within each age group.

The authors of the GPI Atlantic Education Indicators report (2008) strongly recommended the development of a new Canadian Knowledge Survey (CKS) that would indicate levels of knowledge and lifelong learning in the Canadian populace in 10 specific knowledge areas — ecological literacy, scientific literacy, arts literacy, health literacy, food and nutrition literacy, civic literacy, multicultural literacy, media literacy, Indigenous knowledge literacy, and statistical literacy. Administered regularly, the proposed new CKS would assess whether or not knowledge in these additional areas is improving, deepening, and expanding and its results would be of great interest not only to statisticians, but also to educators, educational institutions, and policy audiences nationwide, as well as to the general public. Such a survey, which could be separately undertaken in this region if Statistics Canada does not do it, would effectively constitute an important and highly practical outcome of the GPI education research.

The quantitative results finally presented in the GPI educated populace component deal only very partially with just two of the key dimensions of an educated populace explored in the background research and reflected in the GPI education indicator framework. Those two dimensions are the formal education system (where nearly all existing data currently exist) and multiple literacies (broadly conceived to encompass the knowledge required to enhance wellbeing). Please see Appendix A for a summary of key GPI education indicator results released in 2008. In the broader multiple literacy area, and in the absence of the Canadian Knowledge Survey recommended above, the indicators that could be reported were severely constrained by very limited data availability. For that reason, GPI Atlantic developed a far more extensive list of desirable education indicators for which data still need to be collected and developed. This "*ideal comprehensive indicators"* list can be found in the Appendix of the *Education Indicators for the Nova Scotia Genuine Progress Index* report available from http://www.gpiatlantic.org/pdf/education/nseducation.pdf.

NATURAL CAPITAL

Soils and agriculture

If Nova Scotia has ample good quality land suitable for agriculture, and if farms have a high level of biodiversity, healthy soils, and economic viability, then we can conclude both that Nova Scotia agriculture is healthy and viable, and that the Province has rich natural capital in its agricultural soils.

Agricultural production first and foremost depends on a healthy, fully functioning ecosystem. In other words, the production of food depends on the services nature provides, such as soil formation, nitrogen fixation, nutrient cycling, pollination, waste decomposition, pest control, bioremediation of toxins, and many others. Biodiversity refers to both the diversity of living organisms, and the interactions among those organisms. In order to understand biodiversity and its importance for maintaining healthy, functioning ecosystems—including agricultural ecosystems—we need to study those organisms, and ascertain their numbers, diversity, functions, and preferred habitats. We particularly need to understand and value the productive work that these organisms do, and how that work may be supported, nurtured, and encouraged on farms to produce ample, high quality farm products. In fact, biodiversity is the foundation upon which the earth's productive capacity is based. We might be able to produce food with diminished biodiversity, but it would become a progressively more expensive enterprise—both financially and ecologically—as it would increasingly depend on costly synthetic inputs that are likely further to undermine soil quality. Thus, an evaluation of progress in agriculture must also include evaluations of the state of biodiversity on farms.

One way to assess the health of agricultural biodiversity is to monitor the habitats of organisms that we know are beneficial. Certain types of land use can create critical and excellent habitat for a myriad of organisms. In return, these organisms can be harnessed to provide vital, productive ecosystem services for the farm.

In addition to biological diversity, soil is the key natural capital asset in which our agricultural system is rooted and without which it cannot function. It is vital to maintain healthy and productive soil if our agricultural system is to continue to function optimally. And yet, although its importance is obvious, soil is currently undervalued in our food production system. In fact, methods of agriculture that degrade the soil are profitable in the short term under our current conventional system of accounting and valuation. This perverse outcome occurs because losses of natural capital due to soil erosion or degradation are invisible in conventional economic accounts, and their costs—though very real and scientifically demonstrable—are therefore not included directly in the costs of food production.

The GPI Natural Resource Accounts explicitly recognize the *long-term* value of our soil assets, and they count their depletion or degradation as depreciation in natural capital. In order to assess and achieve genuine progress in agriculture, society as a whole must have a measurable way of ensuring that soil quality is maintained or improved.

Farming and food production require a special combination of elements to be successful—including the best and most fertile available land. GPI Atlantic found that some scarce fertile land in Nova Scotia is being converted to residential and commercial development at the very time that the need and demand for local fresh farm produce is increasing. The 2008 GPI Land Capacity study reported an 18% decline in Nova Scotia's farm land area since the 1970s. Recent sharp increases in global food prices and (just prior to the current economic downturn) in the price of fuel, commodity price fluctuations due to storms, climate change, drought, and other events, and recent serious safety concerns related to imported food, have together led to renewed insecurity about food supplies and to interest in reducing dependence on imported food supplies that may be uncertain and subject to increasingly expensive transportation costs. As well, national security experts warn that secure local food supplies may be more essential to national security than large armies.

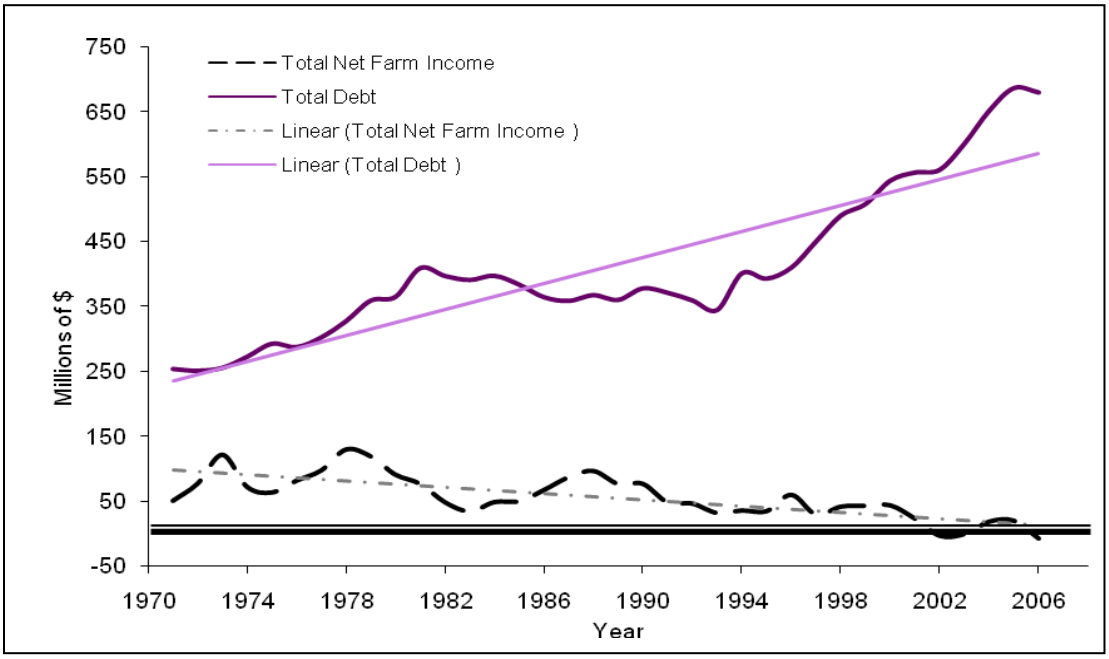
These circumstances give new importance to the issue of land capacity, and to the question of whether Nova Scotia has sufficient farm land to enhance food self-reliance. The GPI Land Capacity report recommends that the best and most threatened working farm land be removed from the speculative or real estate market by purchase of development rights or Working Land Conservation Easements, which would guarantee the land's continued use for farming while compensating farmers for potential losses incurred by being unable to sell it for other uses. The GPI study calculates the average provincial value of such conservation easements at $1,339 per hectare, based on the difference between the real estate value of fertile land and its productive value (the ability of the land to generate net income for farmers).

Despite the very considerable economic benefits generated by farms both for the rural communities in which they are situated and for the larger economy, these benefits are now seriously endangered, because all key indicators of farm economic viability in Nova Scotia are trending sharply downward. The results of four key economic indicators (see Appendix A of this manual) show clearly that—except in supply managed sectors like dairy and poultry—farming is no longer economically viable in Nova Scotia, and is now in a state of serious crisis. In fact, a 91% decline in Nova Scotia net farm income since 1971—with net farm income dipping below zero in four of the last six years—an expense to income ratio hitting 100% in 2006, a precipitous 146% increase in farm debt since 1971, and a corresponding 106% increase in the farm debt to asset ratio, shows that farming in Nova Scotia is in actual danger of demise as an economic, social, and cultural institution. These trends are mirrored throughout the Maritimes, pointing to potential serious economic and social consequences for Maritime rural communities.

While net income for farms in Nova Scotia has been declining over time, total debt has been rising (Figure 1 below). For the first time historically since data collection for this time series began 35 years ago, negative total net farm incomes (less than zero) have been reported for Nova Scotia farms in four of the last six years.

While net farm income has been declining, total farm debt has risen very sharply indeed in Nova Scotia particularly since the early 1990s. Over the 35-year period from 1971 to 2006, debt increased by 146% in Nova Scotia.

Figure 1. Total net farm income and total debt, with trendlines, Nova Scotia, 1971-2006 (millions of $2007)



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

These and other troubling trends were noted in GPI Atlantic's 2001 farm viability report and have continued unabated since then, as have the underlying causes of these trends. A key purpose of the Genuine Progress Index is to provide an early warning system of potentially troubling trends so that corrective interventions and remedial action can be undertaken before development of a real (and potentially irreversible) crisis. Unfortunately, the adverse trends reported in the 2001 GPI farm viability report did not spur sufficient public, government, industry, and corporate action to reverse those trends and enhance the economic viability of farming in Nova Scotia. Instead, those adverse trends have been allowed to continue to the point where recovery is no longer an option for many farmers, who are now being forced either to abandon farming or to sell off portions of their farms.

Sound agricultural policies aimed at enhancing local food security should address these key issues of protecting fertile land, and enhancing soil quality, biodiversity, and economic viability in agriculture. Shifts from reliance on food imports to local food, for instance, will require the collaboration of all economic, government, and social sectors, including the media and a public more discerning and determined to buy and eat local food and to support Maritime farmers. A positive development that may help initiate actions to restore farm viability before it is too late is the new awareness and understanding of these issues that has emerged within government in recent years. Thus, the potential for positive, corrective

action is now very much greater than it was at the time of the original 2001 GPI report on this subject.

Forests

In our current national accounting system and GDP-based measures of progress, the intrinsic value of the natural environment is ignored, and forests are only given a monetary value when they are cut down and the timber is sent to market. Forests are not valued for the essential services they provide when left standing.

Our natural world provides and performs a wide range of ecological, social, and economic functions, providing people with both direct goods and services like wood, food, minerals, and recreational opportunities, and indirect goods and services, including life support functions, that enable human society and the economy to function. For example, an intact, optimally functioning forest ecosystem provides, at no cost, a long list of vital services, including climate regulation, habitat and watershed protection, flood and natural pest control, prevention of soil erosion, formation of topsoil, nutrient recycling, and long-term storage of carbon. It also provides us with high quality wood, wild foods, and a place to relax and rest our minds.

Preservation of the capacity of nature to yield a full range of economic, ecological, social, and cultural benefits is sometimes called "holistic" forest use because this approach seeks to optimize the full range of forest functions. It also recognizes that long-term timber productivity is itself dependent on the preservation of healthy forest soils, age and species diversity, and other vital non-timber functions. This broad view of sustainable forest use contrasts markedly with the current and historical "industrial" approach to forestry in Nova Scotia, in which the primary focus of forest management is to harvest enough wood fibre to meet all available and desired markets.

"Sustainability," in an industrial model, is largely measured in terms of how much forest land is regenerated to commercial species. Water resources, wildlife, biodiversity, and ecosystem services receive only token consideration, if at all. When a forest is degraded, however, its ability to provide vital "free" services is compromised. Such services may be lost irreplaceably or diminished in quality and effectiveness, or efforts may be made to replace them through often expensive feats of human engineering. An accurate accounting system would recognize and count such losses as a depreciation of natural capital, just as a factory owner currently counts a depletion or degradation in plant and equipment as depreciation of produced capital.

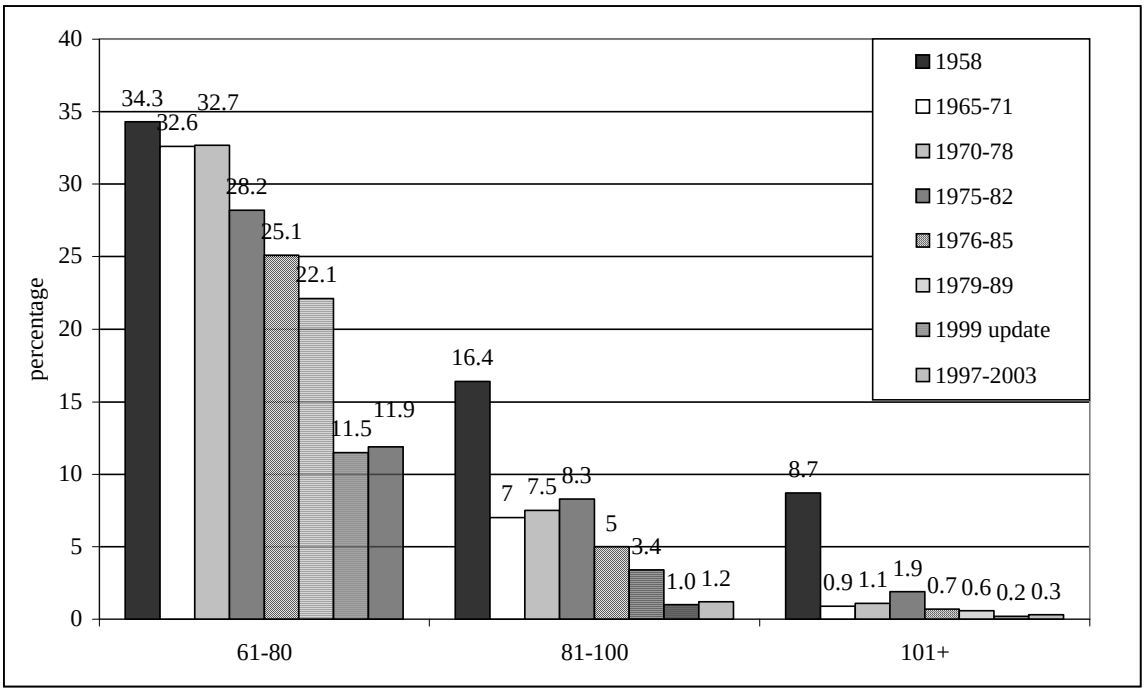
In 1997, an international team of scientists headed by Robert Costanza of the Maryland Institute of Ecological Economics conservatively estimated the average annual value of many of the world's key ecosystem services to be $33 trillion—almost twice the total annual GDP of all the countries on earth. It should be noted, however, that putting a price tag on the value of forests is highly problematic, in large part because there are many forest values that simply cannot be quantified.

Despite the acknowledged limitations of monetization, GPI Atlantic does use the technique, to the extent possible, to make the intrinsic values of natural forests more clearly visible, and

to ensure that these values are duly and properly considered and taken into account in the policy arena. In other words, monetization can be seen as a necessary strategy as long as most key values of standing natural forests are ignored by policy makers and so long as these standing forests continue to be assigned a value of zero in conventional accounting mechanisms.

The 2008 GPI forest study reports a sharp decline in Nova Scotia's old forests in the last 50 years, with forests over 80 years old declining from more than 25% of total provincial forest area in 1958 to just 1.5% today (see Figure 2 below), and young forests (under 20 years old) increasing sharply from 5.6% to nearly 24%.[52] Recent years have seen a marginal increase in more sustainable selection harvest methods, but clearcutting still accounts for 94% of all timber harvesting in the province. The GPI report also notes that Nova Scotia presently has the second lowest level among the provinces of value added forest product per cubic metre of wood harvested. On the positive side, there was an increase in the proportion of Nova Scotia's total landmass under protection—to 8.5% in 2007. The province's goal is 12% protection.

Figure 2. Forest area by age classes over 61 years, percentage of total forest area, Nova Scotia, 1958–2003



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

In order to restore the health of Nova Scotia's forests and their capacity to perform their functions optimally, it is essential to restore their age diversity, which in turn will enhance

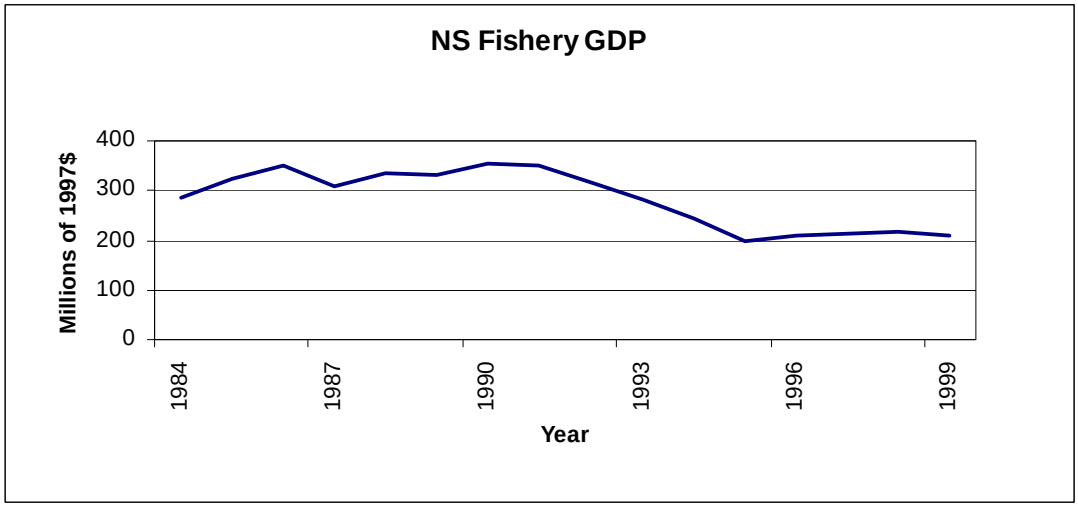
forest functions like protection of soils, watersheds, biodiversity, and aesthetic quality, climate regulation and carbon sequestration, and provision of high quality timber and habitat for species. Restoration of forest health and age diversity, in turn, requires both a further expansion of protected areas and shifts in forestry policy and harvest practices. The latter include a greater reliance on selection harvesting rather than clearcutting, and a greater emphasis on value-added production rather than on export of raw timber and current over-reliance on production for pulp and paper manufacturing. These changes, accompanied by a supporting tax and silvicultural credit regime, would produce more jobs and more value per unit of biomass harvested, thus both ensuring the economic resilience of forest industries and enabling a reduction in current rates of over-harvesting.

Fisheries and marine environment

If there is one area where we have already witnessed the failure of the GDP as a measure of progress, including its inability to provide timely early warning signals to policy makers, it is with regard to the fishery. Conventional GDP-based measures have assessed the economic performance of Nova Scotia's fishery according to the annual revenue obtained from catching and selling fish. This practice misses a critical dimension of fisheries health, in that it does not account for the value of fish remaining in the ocean nor register any damage incurred to the natural system that maintains the fishery. The fish in the sea, the quality of the water, the ocean bottom habitat, and all the other elements of the marine environment constitute "natural capital,"—which keeps the fishery functioning and must therefore be recognized as having real value.

In the late 1980s, according to GDP, Nova Scotia's fishery for cod and other groundfish seemed to be booming. Government and media reported steady catches, high exports, and strong contributions of the fishery to the province's GDP—the conventional measuring stick of the economy. However, fish stocks were dropping, and by the early 1990s, many fisheries were collapsing, 40,000 jobs were lost, and the fabric of coastal communities began to unravel—exposing the myth of the old jobs vs. environment debate and revealing that a healthy economy ultimately depends entirely on healthy natural resources. The fishery GDP—our conventional economic measuring stick, and related measures such as catches and exports, did not warn of the impending disaster. These measures counted only what we took out of the sea but gave no reckoning of what was left behind. While catches were kept high, the decline of the groundfish stocks remained hidden from public view as we focused excessively on a narrow set of economic measures that failed to incorporate all that we value in the fishery—notably healthy fish stocks, a healthy ecosystem, strong fishing communities, and a sustainable fishing economy.

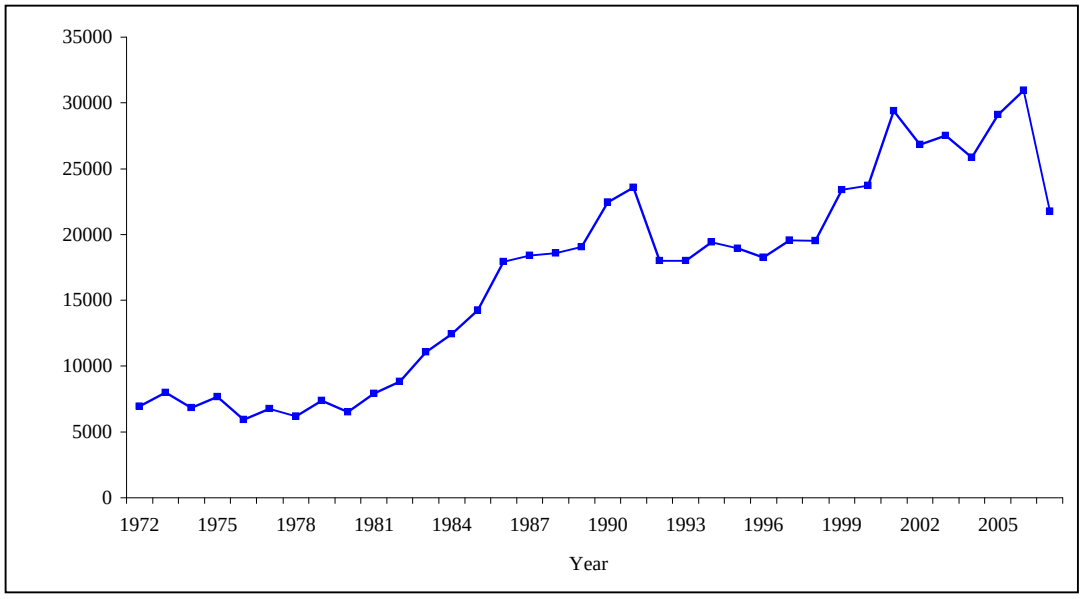
Figure 3. Fishery GDP, Nova Scotia, 1984-1999 (1997$ millions)



Source: NS Department of Finance (2001).

Fifteen years after the collapse of the groundfishery, the trends in some indicators of fish stock and marine environment health, coupled with renewed increases in fisheries GDP, are again sounding a familiar warning bell. For instance, a number of indicator fish species continue to show a decline while others show limited or no recovery. At the same time, lobster landings have increased nearly five-fold since the 1970s, leading to the perception that lobster stocks are healthy. But increased levels of fishing effort on lobster have contributed considerably to the increased catches since 2001 and may potentially threaten stock levels (see Figure 4 below). It is noteworthy that 2007 lobster landings in Nova Scotia suddenly dropped by 30% from 2006 levels, though it is still too early to determine the cause of this decline, to tell whether it is an anomaly or part of a new trend, or to assess whether the high catches of previous years exceeded sustainable limits.

Figure 4. Lobster landings (metric tonnes), Nova Scotia, 1972–2007



Source: Department of Fisheries and Oceans. 2008. Canada Provincial Quantities, Commercial Landings, Seafisheries. DFO Statistical Services, Department of Fisheries and Oceans.

If healthy fisheries and protection of the marine environment are important to us, we clearly need a set of measures that better reflect the reality of what we value and that assess the wellbeing of the fishery and the marine environment more accurately. Unlike the confusing signals sent by our economic growth statistics, genuine indicators of fisheries and marine environment health would move in a positive direction to reflect positive outcomes, and decline in response to declining fish stocks, oil spills, destruction of ocean bottom habitat, and other liabilities. Such declining indicators would also send early warning signals to policy makers that could trigger timely remedial action, thus potentially avoiding disasters like the collapse of the groundfish stocks.

Such genuine indicators of fishery and marine environmental health would enable us to track over time the state of Nova Scotia's fish stocks, the fishery's contribution to our economy, the quality of the marine environment, the wellbeing of the communities that depend on the ocean for their livelihood, and the effectiveness of the institutions that govern fishing activities and ocean use. In other words, an appropriate set of indicators will allow us to assess more comprehensively the entire fishery and marine "system."

Other key results from the GPI accounts include a doubling in shellfish closures since 1985, a steady decline in the mean trophic level of the species landed in Nova Scotia's fisheries since the mid-1980s, a decline in numbers of fishers employed, and an increase in the average age of fishers.

The GPI Fisheries and Marine Environment accounts and their corresponding indicators can and should be monitored and applied on a regular basis to evaluate the wellbeing and

sustainability of fisheries and the marine environment. Indeed, each indicator in the accounts is selected to measure one of the fundamental components of wellbeing and sustainability that must all be simultaneously achieved in a process of sustainable development. Together, the indicators cover crucial aspects of the marine system, including ecosystem health, socioeconomic progress, the wellbeing of coastal communities, and the institutional integrity of fishery and ocean management. Together, the indicators demonstrate clearly that these environmental, economic, social, and institutional dimensions of sustainability and wellbeing are inextricably linked.

Energy

This component falls into both the Natural Capital domain that deals with supply and the Human Impact on the Environment domain that deals with demand.

Energy is essential to all life on earth. Whether as nourishment to sustain individual organisms or as fossil fuels to run modern societies, every activity on earth is dependent on constant, abundant, and reliable sources of energy. Any interruption to modern energy supplies can have serious consequences for the economy and society, jeopardizing standards of living.

But the intensive use of energy, especially energy obtained from fossil fuels, is also the primary cause of a number of environmental, social, and economic concerns. Current energy production and consumption patterns have been linked to global climate change, local health effects, and regional impacts such as air and water pollution, damage to marine and other wildlife, land-use conflicts, security concerns, resource depletion, and soil contamination.

Until recently however, attention on energy matters has been focused predominantly on discovering and developing new fossil fuel based energy sources and securing existing ones, with little regard for the health and environmental impacts these create. The benefits of abundant supply were considered to outweigh the social and environmental costs of maintaining that abundance. The potential perils of global warming in particular have changed that understanding. When the full costs of energy use are now included in the equation the current model is seen to be unsustainable.

From a GPI perspective, a sustainable energy system is defined as one that has the following components:

- Reduces demand for and dependence on conventional fossil fuel based energy supplies through changes in consumption patterns, including changes in behaviour and more efficient use of energy;
- Increases reliance on renewable sources of energy;
- Uses cleaner sources of conventional energy, such as natural gas, as bridging fuels, and develops ways to reduce the impacts of more polluting sources;
- Ensures accessibility to adequate energy services at a reasonable cost for all sectors of the population in the most environmentally sustainable way.

For Nova Scotia to move toward sustainability and security in the energy sector, it must reduce its high present levels of energy consumption and make immediate investments both

in improved efficiency and in renewable energy sources in order to reduce its present reliance on imported fossil fuels, such as foreign oil and coal.[53]

Nova Scotia's continued reliance on imported coal to generate electricity raises a number of concerns in relation to the long-term economic viability of the energy sector, energy security, serious social and environmental issues in the coal-supplying countries, environmental and health impacts at home, and other issues. The growing insecurity of global fossil fuel lines coupled with impending peak oil (when global demand exceeds available supply)—which many analysts have estimated will occur as soon as 2010—indicates an urgent need to take action now, to undertake serious and far-reaching conservation efforts, and to make investments in renewable energy sources to improve self-sufficiency, and thereby reducing our dependence on foreign fuel supplies.

Results released in the 2008 Genuine Progress Index indicate that Nova Scotia is far from energy sustainability and security. Nova Scotia's total energy demand grew by 25% from 1991–2005 and then fell by 11% between 2005 and 2006. 2006 marked the apparent end of a period of steep increases in energy consumption between 1996 and 2005, during which total energy use increased by 21%. Between 2001 and 2005 alone, total energy consumption in the province increased by 13%. Higher fuel prices may now be reversing this trend and initiating new efforts towards conservation and increased efficiency. Transportation accounts for the highest share of energy demand in the province—34%, up from 26% in 1978.

Primary energy production in Nova Scotia increased sharply from 1999–2001, due to Sable Island natural gas production, but has declined by 29% since then. The province is again a net importer of energy—with the vast majority of its energy needs dependent on foreign oil and coal. In 2006, 80.4% of Nova Scotia's electricity was from coal—the highest share since 1993. Renewables accounted for just 8.8%—relatively unchanged since 1993 and mostly from older, small-scale hydro projects. In 2006, wind energy production had not yet significantly changed the mix. Damage costs attributable to air pollutant and GHG emissions from Nova Scotia's stationary energy sources (power plants and refineries) in 2005 are estimated at more than $380 million, or $400 per Nova Scotian.

Air quality

The atmosphere supports the lives and activities of human beings and of millions of other species of plants and animals. Despite its vastness, even the farthest reaches of the atmosphere, such as the ozone layer in the upper atmosphere, have become contaminated and altered through pollution, partly from natural causes but primarily as a result of the activity of a single species—human beings. The air we breathe is, therefore, never completely unpolluted, and contains elevated levels of dust particles, pollen, fibrous minerals, ash, and gases and compounds such as sulphur oxides, nitrogen oxides, ozone, carbon monoxide, and organic gases and vapours.

Without clean air, we can expect ongoing damage to our ecosystems, our health, and our economy. Air pollutants are known to have substantial impacts on the health of waterways, the productivity of forests, and agricultural crop yields. They also reduce visibility through haze formation that impacts our enjoyment and experience of our environment.

Extensive research in the last two decades has established a strong correlation between air pollution and many health ailments. Statistics show that more people die and are admitted to hospital for heart and lung problems on days with elevated levels of air pollution, and that people, on average, do not live as long in cities with high levels of air pollution when controlling for other factors like socioeconomic status. If air pollution increases susceptibility to sickness, as the evidence clearly indicates, then it also contributes to the social and monetary cost of caring for those affected, and it correspondingly diminishes individual quality of life.

One of the most significant environmental impacts of air pollution in Nova Scotia is in the damage caused by acid rain to lakes, rivers, soils, plants, and forests. Acidic water bodies can support fewer living species and reduce fish reproduction, which in turn affects loons and other water birds that feed on them. Nova Scotia is particularly sensitive to acid rain because many of its water and soil systems lack natural alkalinity (such as an adequate lime base) and therefore cannot neutralize or 'buffer' against acid rain naturally. Almost 80% of Nova Scotia's larger lakes are susceptible to acidification. Although there are likely additional causal factors and conditions, like loss of forest cover, climate change, and over-fishing, the dramatic decline in salmon and brook trout populations in Nova Scotia in the last 20 years is consistent with expected acid rain damage. Sulphur dioxide (SO_2) and nitrogen oxide (NO_X) emissions are key precursors of acid rain.

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

Nova Scotia's own emissions of carbon monoxide, particulate matter, volatile organic compounds, mercury, and sulphur oxides have all declined in recent years. Due, however, to its heavy reliance on coal for electricity generation, per capita SO_X emissions in Nova Scotia remain more than double the Canadian average and higher than in all other provinces and all other industrialized countries—more than three times the level in the United States and more than 20 times that in Germany. Nitrogen oxide emissions increased by more than 20% between 2000 and 2005 to reach their highest level since the 1980s but are forecast to decline by more than 40% from peak 2005 levels in the coming decade. Nova Scotia's 2007 Environmental Goals and Sustainable Prosperity Act mandates emission declines for several key pollutants.

Apart from the direct physical damage by air pollution to health, the environment, and materials, the available evidence also points to known, less tangible, pollution-induced economic costs related to lost productivity, diminishing availability of natural resources, and social disruption, which must also be taken into account when assessing the overall effect of air pollution on human society and on the planet. One key goal of GPI Atlantic's Ambient Air Quality Accounts, in addition to providing trends in air contaminant emissions and ambient air quality, is, therefore, to produce a basic ratio between unit changes in ambient air pollution and costs, so that policy makers can, in a simple way, be provided with a snapshot

of the full range of environmental human health and economic costs associated with poor air quality.

Health and environmental damages due to Nova Scotia's air pollutant emissions in 2005 are valued at more than a half billion dollars, or $560 for each Nova Scotian. Sulphur oxide emissions—primarily from Nova Scotia Power's coal-fired power plants—accounted for more than 40% of all air pollution costs. As emissions continue to decline, estimated air pollution costs in 2015 are projected to be 25% less than in 2000 and 40% less than in 1990.

Water quality

Water is essential for human health—in fact, about 2.5 litres per person each day are necessary for survival and health (Health Canada 1997). We use water not only to sustain physical health, but also as the most basic cleaning agent, as a source of food such as fish and shellfish, and for relaxation and enjoyment. As well, lakes, rivers, wetlands, and coastal areas provide habitat for thousands of organisms from bacteria and fungi to amphibians, fish, birds, and mammals, and provide a wide range of vital ecosystem services that support life, protect against erosion, cycle nutrients, filter and absorb wastes, and much more.

Some contaminants are found naturally in water—for example, some water bodies may have traces of arsenic present. However, most current aquatic and human health hazards result from contaminants released to the environment by humans. These include pesticides and other organic compounds, metals, fluoride, radionuclides, microorganisms, nutrients (nitrates, phosphates), and other substances.

There are many sources of water pollutants. Substances in the air, such as toxic chemicals, sulphur and nitrogen oxides, and lead, are collected in the rain that falls. Water collects substances as it runs across natural and man-made surfaces, producing runoff. In urban areas, water runoff increases the concentration of substances such as nutrients, sediments, petroleum products, and road salts in lakes, rivers, and groundwater—degrading their quality. Industrial, farming, and forestry activities can also increase concentrations of toxic chemicals, nutrients, pesticides, and suspended sediments in water sources, which in turn can lead to increased erosion, habitat degradation, eutrophication of lakes and rivers, and low dissolved oxygen in water ways. Improper treatment of municipal sewage wastes can also lead to increased concentrations of pathogens such as bacteria and viruses in waterways.

All of these potential impacts of water pollution impose various economic and social costs—including the cost of treating illnesses that range from typhoid, cholera, and dysentery in countries where contaminants enter the drinking water supply to minor respiratory and skin diseases, costs to restore and clean contaminated drinking water supplies, costs of reduced fish and shellfish catches, increased flooding and flood control costs, and loss of opportunities for recreational water use.

While Canadians generally took the quality of their drinking water for granted until the late 1990s, the tragedy of Walkerton, Ontario, which resulted in seven deaths and 2,000 serious illnesses when E.coli contaminated the town's water supply, brought renewed attention to the issue, and indicated the very serious potential consequences and costs of water contamination even in advanced industrialized economies. Beyond the human suffering, the

economic costs of this tragedy were enormous, including a billion dollar lawsuit on behalf of injured families, hospital and medical costs to treat E.coli victims, business revenue losses, legal costs and a Commission of Inquiry, repairs to the drinking water supply and infrastructure, costs of bottled water, bussing students to nearby schools, property price declines, and the cleanup of cattle and pig farms and feedlots.

Historically, increasing water demand and declining water quality have been addressed by developing new sources of water. However, the economic and environmental costs of developing new water sources have increasingly been seen as unsustainable to meet future needs and demands. Instead, policy attention has increasingly focussed on protecting and improving existing water supply systems to make them more efficient, equitable, safe, accessible, and environmentally benign.

In Canada, water quality is generally assessed and analysed according to three main categories:

1. Drinking water
2. Recreational water
3. Aquatic habitat

All three relate to the health of both aquatic ecosystems and the living organisms, including humans, which depend on their water resources. The 2008 Nova Scotia Genuine Progress Index reported that all drinking water quality indicators have improved in the past decade. However, this could well be due largely to engineering, filtration, and treatment improvements before drinking water is consumed, rather than to improvements in the quality of water sources. In fact, insufficient evidence is currently available to reach definitive conclusions about surface water quality in the province.

To remedy these present data gaps, Nova Scotia has been working collaboratively with federal and provincial partners in reporting on water quality through the National Canadian Environmental Sustainability Indicators (CESI) program. This new database, which did not exist when GPI Atlantic developed its first GPI Water Quality Accounts for Nova Scotia in 1999-2000, now provides data on water quality across Canada, in the Maritimes, and for selected water bodies in Nova Scotia—thereby providing an important new source of information for the Nova Scotia Genuine Progress Index. In particular, the Canadian Water Quality Index (WQI) developed through CESI, provides data on five Nova Scotia water bodies that are assessed for the protection of aquatic life, drinking water quality, livestock watering, and crop irrigation uses.

Despite these positive developments, there is still not nearly enough readily available and current data to construct a definitive physical account of water quality for the Province. For example, the most recent detailed WQI information available for Nova Scotia through CESI, is for 2000-01. More research will certainly need to be conducted to develop and populate appropriate indicators of water quality and a full cost account of the value of water resources and the costs of water pollution in Nova Scotia.

Based on the limited data currently available, the 2008 Nova Scotia Genuine Progress Index found that the main sources of water pollution in the province can be attributed to the release of industrial effluents, discharge from municipal sewers, and run-off from agricultural fields. Available data appear to show that pollutant releases to surface waters in Nova Scotia in 2004 increased by over 300% when compared to releases in 1995. However, changes in inventory methodologies and the pollutants included in the inventory are likely largely responsible for this large increase. In the same time period, on-site pollutant releases to land appear to have decreased by over 400% from 435 tonnes in 1995 to 30 tonnes in 2004.

One key issue of concern raised in the GPI Water Quality Accounts is the loss of wetlands, which provide many important ecological services to the people and province of Nova Scotia. A comprehensive inventory of Nova Scotia's wetlands has been completed since GPI Atlantic released its original report on the subject in 2000. This shows that, as of 2007, there are estimated to be approximately 377,000 hectares of wetlands in Nova Scotia—an estimated loss of 17% of freshwater wetlands and 62% of saltwater wetlands from the original area of wetlands in Nova Scotia. An estimated total of $3.45 billion per year ($2006) in damage, restoration, and health costs is associated with wetland loss and water pollution in Nova Scotia. By far the largest component of this overall cost is the value of lost services once provided by the province's wetlands.

HUMAN IMPACT ON THE ENVIRONMENT

Solid waste

One area in which Nova Scotia seems to have embraced the principle of full-cost accounting is in the area of solid waste management. In fact, the province has become a leader both nationally and internationally in waste diversion, and has used GPI Atlantic's full cost benefit analysis of the province's solid waste management system extensively in order to demonstrate the economic benefits of the system. In 2000, for a six-month period, Nova Scotia succeeded in disposing half as much waste to landfills as it did in 1989—becoming the first and only province in Canada to achieve this 2000 CCME (Canadian Council of Ministers of the Environment) target on schedule, and indeed the first province or state in all of North America to divert half of its waste from landfills.[54]

In 1995—following extensive citizen and expert consultations—the Nova Scotia Department of Environment developed, and in 1996 implemented, a new Solid Waste Resource Management Strategy—a system that involves recycling, composting, and improved ("second generation") landfills, and that effectively combines regulation with citizen education and participation. Nova Scotia's high waste diversion rate is largely due to its high rate of composting, which in turn results from the province's 1998 ban on compostable organic material from landfills. Nova Scotia remains the only jurisdiction in North America to have implemented such a ban, which substantially reduces greenhouse gas (GHG) emissions resulting from methane gas and protects surface and groundwater from leachate contamination. In 2006, 69% of Nova Scotia residents composted, well over double the 27% Canadian average, and surpassed only by the 91% rate in Prince Edward Island.

In 2004, GPI Atlantic reported that, from a full-cost accounting perspective, despite the increased operating and amortized capital costs of the new system, the new solid waste resource system in the fiscal year 2000/01 provided a net saving of between $31.2 million and $167.7 million ($2000) compared to the old system in place in fiscal year 1996/1997. This translates into a saving of $33 to $178 for each Nova Scotian. The wide range is largely explained by the use of both conservative (optimistic) climate change models that yield lower-end estimates, and more pessimistic models that yield higher-end estimates.

From a full cost–benefit perspective, however, the new system more than paid for itself even using the most conservative assumptions, while producing new jobs and substantial environmental benefits. Costs considered in the GPI analysis included operating and amortized capital costs, costs of managing the new systems for beverage container and used tire recycling, education, and even 'nuisance' costs to households reflecting the additional time required to sort waste. Benefits included reduction in greenhouse gas and pollutant emissions, energy savings, extended landfill life, employment, and avoided liabilities.

Since 2001, however, Nova Scotians have been generating and disposing more garbage per capita—and doing so at a faster rate than they are diverting it. Thus, in 2006/2007, the Nova Scotia waste diversion rate was just 36%—well below the 50% peak achieved in 1999/2000 but still higher than the other provinces. This upward trend in waste disposal was a disappointing turn of events given the province's notable earlier achievements. Thus, between 1996-1997 and 1999-2000, waste disposal per capita in Nova Scotia decreased by a remarkable 34%—from 543 kg to 357 kg per person—by far the sharpest decline in the country. But the disposal rate then crept steadily back upwards, to 488 kg in 2005–2006 before dropping marginally to 477 kg in 2006–2007.

Evidence points to economic growth and increased consumption, rather than any reduction in diversion effort, as key factors contributing to the increased waste generation.[55] In fact, residential recycling and composting rates in Nova Scotia have increased since 2001, and Nova Scotia continues to boast the highest rates among those provinces reporting. Thus, Nova Scotians recycled 157 kg of residential waste per capita, compared to 112 kg per capita in Canada, and almost double the 80 kg per capita recycled in Nova Scotia in 2000. So neither the province nor the people of Nova Scotia appear to be backtracking in their commitment to waste diversion. Rather, it appears that they simply cannot keep up with the quantity of waste generated. Thus, the evidence points to a nearly 35% growth in per capita spending on goods and services in Nova Scotia between 1996 and 2006. The current economic downturn may well be the greatest impetus for a return to the lower disposal rates of eight years ago.

In 2007, the Nova Scotia government passed the Environmental Goals and Sustainable Prosperity Act—legislation that commits the province to 21 goals, including reducing the amount of waste sent to landfills by a further 37% by 2015. This means that, in order to meet these goals, the 2006/2007 disposal rate of 477 kg per person will have to be reduced to 300 kg per person per year—a further reduction or diversion of 177 kg of waste per Nova Scotian.[56] This significant step should lead to the development of new policies to reach this goal—including a reduction in packaging and other actions designed to reduce waste at source.

Ecological footprint

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; the greenhouse gases and pollutants emitted by our power plants; and the garbage we put out on the curb each week all end up in our environment.

Human beings have an impact on the earth simply because they consume nature's products and services. Our personal Ecological Footprint, therefore, corresponds to the amount and type of nature's resources we use or occupy in order to live. This need not be of concern as long as the human load remains within the "carrying capacity" of nature. "Carrying capacity" refers to the ability of the natural world to support human activity, absorb waste, and renew itself without depleting natural resource stocks. The sustainability challenge, in short, is to attain a high quality of life for all while ensuring that resource consumption and waste generation remain within the carrying capacity of nature.

But are Canadians and Nova Scotians currently living in such a way? Ecological Footprint analysis was designed to answer this question by determining the extent of human impact on nature and whether this impact can be sustained into the future. It shows how much productive land and water a given population requires to produce the resources it consumes and to absorb the wastes it creates. The Ecological Footprint therefore becomes a benchmark for measuring the "bottom line" of sustainability—human activity in relation to nature's carrying capacity. A Footprint that corresponds with the capacity of nature to renew itself, to continue providing a flow of goods and services into the future, and to assimilate wastes without overloading the environment is an essential precondition for securing the wellbeing of present and future generations.

One particular power of Ecological Footprint analysis is that it explicitly links environmental sustainability and social justice, not as a matter of ethics, advocacy, or ideology, but as a simple matter of empirical description. If wealthy nations and wealthy individuals consume more resources and produce more waste and greenhouse gas emissions than less affluent nations and individuals, then their impact on the environment is also proportionately greater. In a world of limited resources and limited waste assimilation capacity, excess consumption by the rich literally requires that others live in poverty if we are not, in aggregate, to exceed the earth's physical carrying capacity.

Conversely, improved living standards and a reduction in poverty for those currently suffering deprivation and living in straitened circumstances also require that excess consumption be curbed if nature's aggregate carrying capacity is not to be exceeded. In sum, Ecological Footprint analysis cuts through the illusion that we can improve the living standards of the poor without also examining closely the consumption patterns of the rich,

and it thus inevitably supports greater equity among the earth's inhabitants.

Most measures of sustainable development subtly place responsibility for greater sustainability on producers. While essential to assess the "supply" side of the sustainability equation, natural resource accounts for forests, fisheries, soils and agriculture, and energy, for example, inevitably focus on whether current harvesting practices are sustainable, thus subtly placing the onus of responsibility for sustainability on those who carry out those activities—like loggers, fishermen, farmers, and utility companies. Ecological Footprint analysis, by contrast, assesses the "demand" side of the sustainability equation, and thus, shifts responsibility to consumers by assessing the impact of consumption patterns on the natural world. The critical importance of this component of the GPI, therefore, is that it clarifies that the sustainability challenge is the shared collective responsibility of all Nova Scotians and Canadians.

Ecological Footprint calculations are based on two simple facts and measurable/quantifiable realities: first, most of the resources consumed by a population, and the wastes that are generated by that population, can be accounted for. Second, this resource consumption and waste generation can be converted into the biologically productive area necessary to sustain these functions. The Ecological Footprint of any defined population (a single person, household, province, or country) is the biologically productive area required to:

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

To provide results in comparable units of measure, all components of the earth's productive area are adjusted for their biological productivities. This means that land with higher than average productivity appears larger in Footprint accounts in terms of the level of human activity it can support than resource-poor land. Since the resources we consume come from all corners of the planet, and since the wastes we generate, like greenhouse gas emissions, affect distant places, Ecological Footprint analysis considers the sum of all our ecological impacts no matter where they occur on the planet. For example, if Nova Scotians eat bananas from Guatemala and use wood from the Amazon rain forest, the land area required to produce these commodities consumed in Nova Scotia—regardless of where they are produced—is counted as part of the Nova Scotia Footprint.

It is also important to recognize that current Ecological Footprint estimates err on the conservative side. Low-end figures have been consistently used whenever available data indicate a likely range of estimates; areas set aside for the protection and treatment of water resources are not included in Ecological Footprint estimates, and areas required for the absorption of wastes, pollutants, and toxic materials other than carbon dioxide have been omitted due to methodological and data limitations. In addition, the Footprint analysis takes no account of the probability that chemical pesticide and fertilizer use, soil compaction, clearcutting, and other unsustainable harvesting practices will reduce future soil productivity. These assumptions render current Footprint analyses highly conservative.

However, possibly the most conservative assumption in current Footprint calculations is that

they provide no allocation of biocapacity to other species, but rather assume that all the earth's biocapacity is available for a single species alone. Since we share the planet with over ten million other species, it is clearly not possible to use the entire bioproductive ecological space of the planet solely for human consumption. Indeed, it is doubtful that the human species itself could survive if it used all productive resources for its own needs at the expense of all other species. Since Nova Scotia, along with many other jurisdictions, has committed itself to set aside 12% of its land in protected areas not available for timber, agriculture, mining, and other human activities, estimates of bioproductive capacity should actually be reduced to reflect such consumption-related exclusions. Indeed, even such a 12% exclusion from human resource consumption might be regarded as minimalist and overly conservative in light of dramatically high ongoing rates of species extinction and the recommendation of many conservation biologists that a minimum essential set-aside of 30% of land is required for effective biodiversity preservation and to slow the current extreme rate of species extinction.

When GPI Atlantic in 1999 embarked on the task of estimating Nova Scotia's Ecological Footprint, the Global Footprint Network—with its mandate to ensure the highest standards in Footprint calculations and reporting—did not yet exist. The idea and potential feasibility of assessing humankind's Ecological Footprint was first conceived in 1990 by Mathis Wackernagel and William Rees at The University of British Columbia, but it was only in 2003 that Wackernagel created the Global Footprint Network (GFN) to establish a consistent, rigorous, and comparable methodology for calculating Footprints, and a straightforward and non-misleading manner for reporting results. GFN now produces annual National Accounts that ensure that the Footprints of different nations are calculated, presented, and reported comparably, and in June 2006, GFN launched the first *Ecological Footprint Standards*, which govern the way in which Footprints are now calculated. As a member and partner in GFN, and in recognition of the vital importance of this key indicator to assess sustainability, GPI Atlantic is fully committed to this ongoing effort to deepen and further strengthen Footprint estimations and analysis.

The most important sub-national Canadian Footprint work currently under way is that being conducted by the City of Calgary in collaboration with GFN. GPI Atlantic remains in close touch with this work and its architects in the hope that the Calgary initiative will lead to the development of comparable provincial and sub-provincial Footprint estimates that reveal how particular lifestyles, behaviours, consumption patterns, and types of energy use both in Nova Scotia and in other parts of Canada differentially impact the environment.

According to the 2008 *Living Planet Report*, the global Ecological Footprint in 2005 was 17.5 billion gha, or 2.7 gha per person on the planet, while the total supply of biologically productive area was 13.6 billion gha, or 2.1 gha per person. This ecological "deficit," or "overshoot," of the earth's carrying capacity means that it takes the earth approximately a year and four months to produce the resources humans use in one year. Canada's 2005 Ecological Footprint was 7.1 gha per capita—69% larger than Germany's and nearly eight times larger than India's. This means that, if everyone in the world lived and consumed like Canadians, we would need 3.4 planets to support that lifestyle.

Greenhouse gas emissions

Arguably, the most critical area in which action is urgently required is in the reduction of greenhouse gas emissions (GHG). The Intergovernmental Panel on Climate Change (IPCC) notes that eleven of the last twelve years rank among the warmest since 1850, and the warming trend in the last half-century (between 1956 and 2005) has been nearly twice that of the century-long trend between 1906 and 2005. Global average sea level has risen at a rate of 1.8 mm per year since 1961, and 3.1 mm per year since 1993. Annual average Arctic sea ice has shrunk by 2.7% per decade since 1978 and mountain glaciers and snow cover have declined in both hemispheres.[57]

According to the IPCC, global atmospheric concentrations of greenhouse gases have increased markedly as a result of human activities since 1750. Global greenhouse gas (GHG) emissions due to human activities grew by 70% between 1970 and 2004 alone, and the IPCC has determined that it is very likely that most of the observed increase in globally averaged temperatures since the mid-20th century is due to the observed increase in anthropogenic (human-induced) GHG concentrations.

Not only are humans contributing to climate change that is already occurring, but the IPCC projects that global GHG emissions will continue to grow over the next few decades as a result of current management and policies, and that continued GHG emissions levels at or above the current rate will result in positive feedback loops, causing further warming and inducing many more changes in the global climate system.

In short, climate change is now widely acknowledged as the most serious environmental challenge of the coming century and perhaps the most serious economic and social challenge as well. Predicted impacts of climate change in Nova Scotia include an increase in extreme weather events, particularly hurricanes, floods, and droughts, as well as adverse impacts on the province's fisheries, forests, and agricultural industries. Other serious impacts predicted for Nova Scotia include flooding in low-lying areas, coastal erosion, saltwater infiltration of groundwater, and falling lake and groundwater levels.[58] Very recently, several climate change models and studies have warned of potentially devastating impacts of sea level rise on low-lying areas such as Truro. Other lowland areas at the head of the Bay of Fundy are also at risk from storm surges.[59, 60] In addition to environmental impacts, climate change also poses serious health concerns for Canadians, including temperature-related illnesses, vector-borne diseases, and air-pollution health effects.[61]

Radical changes are still required in Nova Scotia in order to meet GHG reduction targets. Policy makers often argue that addressing climate change through large cuts in GHG emissions will be too costly and will weaken the economy. However, these arguments rarely weigh the short-term costs of action (generally the sole policy consideration) against the long-term costs of predicted environmental and economic damages resulting from climate change. Both sides of the equation must be considered in any assessment of the true costs of climate change and in order to assess whether damage avoidance may provide substantial long-term economic benefits when all costs are considered.

A GPI cost-benefit analysis found that when the costs of reducing Nova Scotia's GHG emissions to reach the Province's Environmental Goals and Sustainable Prosperity Act

target of a 10% reduction in GHG emissions below 1990 levels by 2020 are subtracted from the benefits attained from that reduction in avoided climate change damages and cleaner air, the net cumulative benefit to society is likely to exceed $846 million. Achieving the more ambitious David Suzuki Foundation and Pembina Institute target of a 25% reduction of GHG emissions below 1990 levels by 2020 would produce a net cumulative benefit of more than $1.8 billion. The analysis found that every $1 invested in reducing GHG emissions between 2008 and 2020 will save at least $29 in avoided climate change damages.

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

This GPI conclusion is strongly supported by the most thorough and comprehensive analysis of the economics of climate change ever undertaken. Lord Nicholas Stern, former Chief Economist and Senior Vice-President of the World Bank, concluded: "The benefits of strong early action on climate change outweigh the costs….The costs of stabilizing the climate are significant but manageable; delay would be dangerous and much more costly."[62]

However, despite the challenge of meeting the 10% reduction target outlined in the Province's Environmental Goals and Sustainable Prosperity Act, it is now widely accepted in the scientific community that considerably more drastic cuts in GHG emissions than previously envisioned will be required to stabilize the world's climate and to prevent potentially catastrophic damage. In light of this evidence and these recent developments, the higher Suzuki-Pembina target (25% reduction by 2020) may well reflect the most realistic set of targets that the province will need to consider on the basis of the actual scientific evidence rather than from the perspective of political feasibility or expediency.

Therefore, monitoring GHG emissions in Nova Scotia is a top priority and an integral component of the Nova Scotia Genuine Progress Index (GPI). Improvements in energy efficiency and conservation, and substantial shifts to renewable energy are still required for the province to meet its own emission targets.

For example, among all forms of energy production and consumption, electricity generation in particular is the single most dominant source of GHG emissions in Nova Scotia, accounting for just over 31% of total provincial GHG emissions in 2006. Therefore, the generation of electricity is an area where Nova Scotia could make significant reductions in GHG emissions if it switched to greater reliance on renewable energy sources. Neighbouring Prince Edward Island, for example, has a target of 100% reliance on renewable energy, particularly wind, for electricity generation by 2015, and already produces about 40% fewer greenhouse gas emissions per person province-wide than Nova Scotia. Coal accounted for 80.4% of the electricity generated in Nova Scotia in 2006, whereas two thirds of Canada's electricity needs are met with hydropower. Thus, there need to be significant shifts in Nova Scotia's energy sector in order for GHG emission reduction targets to be reached.

The transportation sector was the second largest contributor to provincial GHG emissions in 2006, accounting for 29% of emissions. Road transportation accounted for nearly 70% of transport related GHG emissions in the province. Light-duty trucks (including vans and SUVs) accounted for 31.4% of GHG emissions from road transport, followed by automobiles (27.5%), heavy-duty diesel vehicles (23.2%), and off-road diesel vehicles (11.5%).[63] Shifts to more sustainable transportation modes and integrated land use / transportation planning designed to reduce sprawl are required to reduce GHG emissions from this sector.

Despite the province's small size and population, Nova Scotians are among the highest per capita emitters of GHGs in the world, so the magnitude of damage caused by our GHG emissions is significant and the need for change urgent.

Transportation

Transport and residence patterns, as well as lifestyles, in Canada and Nova Scotia—like those in most developed countries—have become increasingly automobile-dependent, with high levels of per capita vehicle ownership and use, and declining transport options. During the last half century, transit service has generally declined in North America; homes and businesses have become more dispersed; more neighbourhoods have been built that lack sidewalks; roads and paths have become less connected (with larger residential blocks and more dead-end streets); and the barrier effect (delay and risk that motor vehicle traffic causes non-motorized modes) has increased, making non-motorized travel more difficult. As well, alternative modes of transportation have often been stigmatized. The overall effect of these trends—at least in Canada and the U.S.—is that people drive more kilometres each year and spend more money on transportation, while non-drivers have fewer alternative options.

These trends are, in part, a result of various market distortions that encourage private motor vehicle travel—including under-pricing of road and parking facilities, fixed insurance premiums and registration fees that are unrelated to kilometres driven or vehicle fuel efficiency, uncompensated crash risks and damages, un-priced environmental and social impacts, planning and investment practices that favour improvements in private motor vehicle travel, and various land use policies that favour more dispersed development practices. Although individually some of these distortions may seem modest and justified, their impacts are cumulative and synergistic (i.e. total impacts are greater than the sum of individual impacts).

As a result of these market distortions, a significant portion of current motor vehicle travel is economically inefficient. In other words, in a more efficient and equitable market that accounted accurately for the full benefits and costs of different transportation modes, Canadians and Nova Scotians would choose to drive significantly less, rely more on alternative modes of transportation, and be better off overall as a result. The present 'economically excessive' private motor vehicle travel—defined here as motor vehicle travel that results from market distortions—contradicts sustainability objectives. As a result, at the margin, and compared with current transport patterns, inclusion of environmental and social costs in transportation pricing mechanisms will not only reduce private motor vehicle travel but also increase sustainability.

To take just one example of the necessity of including environmental costs in transportation and road pricing, it was previously noted that the transportation sector is the second largest contributor to GHG emissions in Nova Scotia, accounting for 29% of emissions in 2006. Given potential climate change damages in Nova Scotia and the warnings in recent studies and climate change models that rising sea levels may potentially devastate communities such as Truro, it is no longer an option to exclude or ignore climate change damages in transportation cost analyses.

The GPI analysis of transportation costs in Nova Scotia conservatively estimated that the full cost of private automobile use in the province is more than $7.2 billion a year ($2007), or $8,541 per capita, when a full range of economic, social, and environmental costs is considered. About one-third of these costs are "external"— borne by society rather than by car users. Costs included in the GPI analysis include vehicle operating and ownership costs, travel time and congestion, parking (user-paid and subsidized), crashes, climate change, air and water pollution, resource use, land value, road facilities and traffic services, and waste generation.

The GPI analysis found that improved walking and cycling conditions, better public transit services, and more efficient pricing can help reduce traffic congestion, road and parking facility costs, consumer costs, accident risk, energy consumption, and pollution emissions, while improving public fitness and health, increasing beneficial economic activity, supporting strategic land use objectives (such as reducing sprawl), and even supporting specific objectives such as urban redevelopment, tourism activities, and heritage preservation.

To that end, the GPI transportation report included a wide range of practical, tested, and proven policy and planning reforms that can help provide such benefits. We have called these "win-win transportation solutions" because each intervention achieves multiple benefits across economic, social, and environmental dimensions. They are cost-effective and technically feasible market reforms that help solve transportation problems by increasing consumer options and removing market distortions that encourage inefficient travel behaviour.

Unfortunately, many recent transportation trends in Nova Scotia have moved away from rather than towards sustainability. For example, total road passenger movement in Nova Scotia increased by 19% between 1990 and 2006. The use of light trucks (including SUVs and minivans) increased by 65%, while passenger movement by bus decreased by nearly 10% in that same time period.

4.4 Examples of enlightened public and private sector policy-making

Work sharing instead of layoffs

Because the Genuine Progress Index explicitly values free time, voluntary time, and time spent raising children—in addition to paid work—and because it explicitly acknowledges and reports the costs of time stress, the GPI naturally and inevitably points policy makers towards solutions that enhance work-life and work-family balance. As well, the GPI critique of the narrow economic growth dogma naturally leads users to look beyond conventional assumptions that link employment solely to the business cycle. In fact, GPI studies provide considerable detail on employment creation and maintenance strategies that are independent of the business cycle, and that are particularly relevant to a time of economic downturn.

For example, the 2004 GPI work hours report—published incidentally at the height of the so-called 'economic boom'—quite explicitly urges consideration of a redistribution of work hours and shorter work time solutions, in large part to reduce stress and enhance wellbeing and quality of life, but also as an employment creation strategy. Thus, the 2004 GPI study cites the Netherlands' successful reduction of unemployment from 12% in the early 1980s to less than 3% in 2001 largely through work redistribution strategies such as job-sharing and an increase in part-time work. However, in the Netherlands part-time work is considered "good" work as Dutch laws ensure equal hourly pay for part-time workers, along with pro-rated benefits and equal opportunity for career advancement. That has made part-time work more attractive and provided Dutch workers with some of the shortest average work hours of any industrialized nation, while labour productivity improved substantially.[64]

We currently have some home-grown examples of this option right here in Nova Scotia. In response to the current economic crisis, five Nova Scotia companies have opted to reduce the work hours of their employees rather than lay them off. Michelin in Waterville decided to offer a reduced work week to its employees in order to save the jobs of 95 employees whose jobs were "flex" or contingent. The company applied for the Service Canada program that allows employees to work a four-day week with employment insurance benefits covering the fifth day.[65] Similarly, Stanfield's, an underwear manufacturer in Truro, and Composites Atlantic in Lunenburg, have also opted to avoid layoffs by offering a work-sharing plan to hundreds of their employees who will work four days instead of five.[66]

In this way, work sharing can be used at times of economic downturn as a short-term strategy to avoid layoffs in firms, by reducing the number of hours worked by each employee in a group and enabling each employee to collect Employment Insurance benefits for part of the time not worked.[67] The rationale is that instead of laying off 20 out of 100 employees, all 100 employees work 20% fewer hours each week, with each receiving EI benefits pro-rated for the time they don't work. This way, the same EI benefits that would have gone to the 20 laid-off employees are simply divided up among the 100, with no net gain or loss to government or the taxpayer. This form of work time reduction is seen as a

temporary measure intended to prevent layoffs when there is a short-term reduction in the demand for labour.

In Canada, a Work Share Program was first introduced in l982. Under this scheme, there is usually no waiting period for EI benefits, and the shortage of work must be expected to last for at least six weeks to a maximum of 52 weeks.[68]

Typically, the manufacturing industry is disproportionately affected by business cycles and has participated more often in work sharing agreements than other industries. According to Statistics Canada, in the first quarter of l991, roughly 72% of the work sharing agreements were in the manufacturing sector. In total, more than 5,300 firms participated in the program at that time, and nearly 33,000 layoffs were avoided as a result.[69]

The scheme can also serve to enhance workers' quality of life through provision of more free time, family time, and time for community involvement in exchange for a manageable cut in pay. Typically, after EI benefits, participating workers receive 20% more time off—often in the form of a 3-day weekend—in exchange for less than a 10% cut in pay. Since workers still collect 90-92% of their former salary, this income-leisure trade-off can frequently be an attractive proposition.

Indeed, as an alternative to potential joblessness and job insecurity, workers facing potential layoffs generally welcome work sharing. The obvious benefit is that workers can avoid the substantial loss of income that accompanies job loss—particularly at a time when only 43% of unemployed Canadians are receiving regular EI benefits. Since work sharing produces a more equitable distribution of hours and income reduction, workers also avoid the loss of self-esteem, relative to their peers, that frequently accompanies layoffs, and produces social benefits in the form of greater equity and inclusion.

There are also substantial benefits to employers. Even though employers continue to incur fringe benefit costs for all the employees (even though they are now working fewer hours), the benefits have generally been found to far outweigh the costs. These benefits include:

- Productivity increases due to reduced absenteeism, high worker morale, and increased commitment to the job;
- The retention of valued and skilled employees;
- Improved labour relations;
- Reduced costs when demand increases, since there will be no need to hire and train new workers, who are generally less productive due to inexperience. These hiring and training costs can be substantial. Re-hiring of previously laid off workers—assuming they are still available—may also result in costs and productivity losses either from a deterioration in the skills of these workers during the lay-off period or from diminished morale.

As earlier GPI evidence and analyses have made clear, work time reduction strategies can be considered by the public and private sectors at all times, not just as a reaction to an economic downturn or reduction in demand. In 1994 the Advisory Group on Working Time and the Distribution of Work in Canada recommended that the redistribution and reduction of working time be a "new public policy priority." Based on a review of evidence, the

Advisory Group determined that a 10% reduction in work hours would produce a 5% net increase in productivity (output per hour) through a reduction in absenteeism, lateness, turnover, fatigue, and costly errors, and through improvements in morale and industrial relations. It would also create a substantial number of new jobs and significantly increase leisure time.

The Advisory Group urged governments, employers, trade unions, and employees to place "more emphasis on working time issues in collective bargaining and workplace decision making."[70] Interestingly, there are countries where this is already the case, and which can act as models for Canada. In the Scandinavian countries, the key issues at the bargaining table are often flexible and family-friendly work arrangements and more leisure time rather than wages.

In 2004, GPI Atlantic recommended in its *Work Hours* report that Canadian governments should amend current provincial and federal employment standards to give workers the *right* to voluntary work-time reductions with a proportionate reduction in pay without imperilling career advancement opportunities. The literature on this subject shows that this would improve employee autonomy, quality of life, employee morale, and productivity. GPI Atlantic also recommended that a wide range of work-reduction options be made available, including four-day work weeks, longer vacations, and shorter work days that allow parents to be at home when their children get home from school. Evidence indicates that the wider the range of work time reduction options, the higher the rate of voluntary take-up by employees.[71]

In one of its earliest reports, titled *Work Time Reduction in the Nova Scotia Civil Service,* released in November, 1999, GPI Atlantic made recommendations to the Nova Scotia Government and public sector unions to consider cost saving voluntary work reduction options as an alternative to the civil service layoffs implemented at the time. The report, which can be accessed at http://www.gpiatlantic.org/pdf/misc/worktime.pdf, described successful work time reduction experiments in Europe and North America that could act as a model for Nova Scotia, and discussed the legislative and policy implications of such actions here in Nova Scotia. These issues are described in more detail in the 2004 GPI *Work Hours* report, and are particularly relevant to present economic circumstances.

Healthy food policy at Nova Scotia schools

While GDP-based measures of progress misleadingly count increased sickness costs—as reflected in higher spending on hospitals, doctors, and drugs—as economic gain and thus as contributions to prosperity and wellbeing, the Genuine Progress Index explicitly measures and values the health of the population as a contribution to true wellbeing, and counts higher sickness rates as a cost not gain to the economy. To that end, GPI Atlantic has released numerous reports over the last decade addressing the social determinants of health, estimating the economic costs of chronic disease, tobacco, physical inactivity, and obesity, and highlighting the cost-effectiveness of investments in health promotion.

This GPI work has been used extensively by Nova Scotia government agencies and by non-

governmental organizations like the Heart and Stroke Foundation of Nova Scotia, the Cancer Society, and the Lung Association. For example, GPI Atlantic's study on *The Economic Impact of Smoke-Free Workplaces* was widely referenced in the Nova Scotia Legislature during the passage of the province's 2002 Smoke-free Places Act, and the government regularly cites the GPI estimate of $170 million as the cost of tobacco to the province's health care system. The GPI estimate that Nova Scotia could potentially save $500 million a year in excess, preventable health care costs if Nova Scotians didn't smoke, exercised regularly, and had healthy weights, led the government to create a new Department of Health Promotion and Protection with its own budget and its own minister at the Cabinet table.

One key component of this new emphasis on health promotion and disease prevention, which is entirely consonant with the GPI population health focus, is an effort to improve nutrition among young Nova Scotians. To that end, and in order to counter high and increasing obesity rates among children and youth, and to provide affordable, accessible, healthy, and safe food, in 2006 the Nova Scotia Departments of Education and Health Promotion and Protection released the *Policy Directives and Guidelines for the Food and Nutrition Policy for Nova Scotia Schools.*[72]

The changes include: setting standards for foods and beverages sold and served in school cafeterias; promoting nutrition education in the curriculum; providing tools for parents to help their children eat a balanced diet; establishing appropriate pricing to ensure healthy food and beverages are accessible; involving students in planning menus; and introducing healthy choices in vending machines and at fund raising activities. In addition, the directives point to the benefits of eating locally grown produce:

> Nova Scotia produces an abundance of produce and products. Buying food that is grown and produced within the province supports Nova Scotia agriculture and business and means that more money remains in the community. Locally grown, fresh food is often more nutritious if it is used shortly after harvest.[73]

The policy also attempted to deal with promotion and advertising in schools, and it clearly acknowledged the problematic nature of allowing corporate interests into the schoolhouse: "The business world is keenly aware of the potential to build preferences and cultivate brand loyalty by targeting schools that house a captive and impressionable audience of future consumers." The directives and guidelines recommend that partnerships must be designed to meet identified educational needs and not to serve "commercial motives."[74]
One of the elements in the policy that deals with the issue of corporate advertising is that corporations are not allowed to put logos on scoreboards or pop machines that advertise products not meeting the nutritional standards set out in the policy.

Credits for selection harvesting

While GDP counts the timber cut and sent to market but gives no value to the forest left behind or to the ecosystem services provided by a standing forest, the GPI attempts to assess the health and value of our natural capital, including our forests, as fully as possible. To that end, an extensive two-volume GPI study, conducted over three years, determined that excessive clearcutting has severely degraded Nova Scotia's forests and resulted in a substantial depreciation in our forested natural capital. The GPI findings have clear and direct policy relevance and implications. Indeed, the second volume of the GPI study examined sustainable and economically viable harvest practices, including those currently being practiced in some Nova Scotia operations, as models for a potential restructuring of the Nova Scotia forestry industry that could—over time—gradually restore the value of the province's forests. The GPI forest results were widely referenced during the recent Voluntary Planning agency hearings on Nova Scotia's natural resources, and are cited in the agency's report (http://gov.ns.ca/govt/vp/NaturalResourcesReport.pdf).

Today, 94% of timber harvesting in Nova Scotia is still by clearcutting. Although there are many possible types of silviculture suited to different forest management and harvest systems, these were not traditionally equally favoured by conventional structures and tax regimes that for many years perversely favoured clearcutting over more sustainable selection harvest practices.

However, in the last few years we have seen the beginnings of some genuine progress in silviculture credit regimes in the province in creating financial incentives, for the first time, for sustainable forest management. These modest first steps have perhaps begun to remove previous disincentives to sustainable forest management. The challenge is to take these modest steps much further so that they can become real and practical tools to restore value to Nova Scotia's natural forest wealth. Since penalties and incentives are two sides of the same coin, the positive movement towards more sustainable forest practices can also be furthered by imposing penalties for management practices that diminish forest values.

For 25 years, from the early 1970s to 1995, there were formal financial agreements between the federal and provincial governments to fund silviculture work on private forestland. The provincial Department of Natural Resources (NSDNR) looked after implementation, administration, budgeting, and inspections on behalf of woodlot owners. Silviculture treatments were carried out either by silviculture contractors or by landowners themselves. Interested landowners would contact their local NSDNR office to partake in the program, and the local NSDNR office would then arrange for management plans and roads, and take care of paperwork.

Silviculture treatments and harvesting techniques prescribed under the federal-provincial agreements were, almost without exception, even-aged management techniques that were, in practice, largely geared towards softwood production for the pulp and paper industry, and to replanting and converting forests to conifers. Funded silviculture programs included credits for cleaning (or removing) non-commercial species, planting, herbicide applications, remnant removal, merchantable thinning, weeding, site preparation, and conifer release, following strip cutting, clearcutting, and shelterwood cutting.

Landowners interested in uneven-aged management systems were frequently advised to carry out even-aged management, and had few people or resources to turn to within government structures for expert opinions that recommended otherwise. The structures, incentives, advice, and knowledge base offered by government strongly favoured one particular management, harvest, and silviculture system—and the one, perversely, that was probably least sustainable and least protective of forest health and values. The silviculture programs, as administered by the NSDNR, were not conducive to selection harvesting, and especially not to efforts to restore the forest to a semblance of its former structure, function, species assemblage, age diversity, or site capability.

The new Forest Sustainability Regulations that came into law in April, 2000, have shifted the responsibility of silviculture work from the NSDNR to the pulp mills and sawmills. Forest product companies now carry most of the responsibilities for planning, funding, locating, and implementing the bulk of silviculture work on private forest lands. Registered Buyers are required to finance silviculture programs, with some help from the Province through forest sustainability agreements. Essentially, under the new Regulations, a Registered Buyer has the option to pay $3.00 per cubic metre for softwood or $0.60 per cubic metre for hardwood into a Sustainable Forestry Fund (SFF) or conduct their own silviculture.[75]

In other words, under these new regulations, companies are required to carry out a silviculture program themselves, or they can hire a private silviculture contractor to do the work for them. If they opt to do neither, they have to pay into the SFF, which is administered by an independent body to see that the work gets done. In this new system, the registered buyer has to acquire silviculture 'credits' in lieu of paying into the sustainable forestry fund. The number of credits acquired is proportional to the volume of wood taken off private land.

A schedule of silviculture treatments and the credits earned is published in the Forest Sustainability Regulations. While most of the treatments that earn credits under this system remain even-aged management scenarios (thus providing no direct disincentive for clearcutting), 2001 was the first year in Nova Scotia history that opportunities for the funding of selection and crop tree management techniques were also introduced. In 2009, there was an increase in the number of credits awarded for an initial claim for selection management from 250 to 450 credits per hectare—thus increasing the incentive for uneven-aged management.

Table 4. Schedule of silviculture treatments and credits, 2009

Category	Description	Silviculture Credits/ha
1	Natural Regeneration Establishment fill plant 0-<300 trees/ha fill plant 300 and + trees/ha	 70 300
2	Established Plantation (site preparation, stock acquisition, planting) Intensive plantation	650 150
3	Early Competition Control: Plantation & Natural (chemical/manual weeding)	300
4	Plantation: Density Control & Release (pre-commercial thinning in plantation)	350
5	Natural: Density Control & Release (pre-commercial thinning in natural stand)	750
6	Commercially thinned	450
7	Quality Improvement: a. Crop Trees Released b. Crop Trees Pruned c. Selection Managed	 3/tree* 300 450**

Source: NSDNR. Silviculture Credit Limits for Wood Acquisition Plans – 2009. As per section 8(1) of the Forest Sustainability Regulations.

Notes: All silviculture categories can only be claimed once during the life of the forest stand, except for 7a and 7c where reclaim periods apply.
* Minimum 100 trees per claim required, maximum 125 trees per hectare allowed.
** Initial claim only, subsequent claim on same area is 300 credits/ha.

In short, the new system has the *potential* to encourage a shift to selection harvesting systems, uneven-aged management, and restoration forestry practices if credits for those regimes were substantially increased. Conversely, it could discourage excessive clearcutting and the loss of old forests if credits for plantations were reduced proportionally—even as the system as a whole remained revenue-neutral.

In 2001, the GPI Forest Accounts reported that roughly 98% of harvesting in Nova Scotia in the late 1990s was by clearcutting (including shelterwood).[76] By 2005, this proportion was closer to 94%—the lowest percentage on record in the 30 years for which data are available. Between 2000 and 2005, therefore, there appears to have been some improvement in this area, with an increased use of selection harvesting—in which single trees or groups of trees are selectively removed from a stand in such a way as to maintain the integrity, diversity, health, and value of the stand as a whole.

Thus, in 2005, 838 ha of forest in Nova Scotia were harvested through selection cutting, up from 509 ha five years earlier—a quite dramatic relative increase of 65%, while the amount of forest clearcut fell by 4% during the same time period. In absolute terms, however, the selection harvest total remains very small. Thus, the few hundred hectares selectively

harvested is still in sharp contrast to the 52,874 ha clearcut in 2000 and the 50,864 ha clearcut in 2005. In other words, of the total forest area harvested in 2005, only 1.5% was cut using selection harvesting.[77]

The change in silviculture policy—whereby selection harvesting and uneven-aged management were actually recognized, acknowledged, and eligible for credits similar to those available for conventional methods—may have contributed to this very modest shift to more selection cutting in recent years.

The actual size of credits for different treatments can change over time and thus in the last 8 years, as noted, there has been an increase in credits for "selection managed" forests from 250 credits/ha to 450 credits/ha for an initial claim. The five-year review system therefore has excellent potential to turn the new credit system into a set of strong incentives for sustainable forest management and restoration, and a set of disincentives for those methods that have degraded the province's forests in the past. While very modest steps in that direction have been taken, the full potential of the silviculture credit system has yet to be realized in consonance with the GPI accounting system that assesses forest health and values as comprehensively as possible.

5 Implementing full-cost accounting

- Cost of illness
- The economic value of civic and voluntary work
- Transportation Accounts: What are the true costs of driving?
- Solid Waste Resource Accounts
- Forest Accounts
- Paid Work Hours: Costs of work stress and unemployment

In this chapter, we have provided several examples—from both the resource and environmental realm and from the social realm—of full-cost accounting results and of the methodologies used to reach those results. Because the valuation of non-market variables is complex, time and space limitations did not permit a comprehensive description of all the underlying assumptions and detailed methodologies used for each GPI costing exercise. However, the following case studies have been carefully chosen to reflect different key points of interest in implementing full-cost accounting methods.

A note on precision

Two major caveats must be emphasized again at the outset. First, as noted earlier, money is acknowledged as a poor tool to value non-market variables, and no claim to precision in the GPI valuations is therefore made. However, neither that lack of precision, nor the assumptions and complexities involved in full-cost accounting methods, constitute reasons to dismiss the methods or not to apply them. Non-market transactions like volunteer work do have value and provide real services to society and the economy, and so-called 'externalities' like climate change and resource depletion carry very real costs to society and the economy. Assigning an arbitrary value of zero to such benefits and costs—as in conventional GDP-based accounting systems that value only market transactions—produces far greater inaccuracies and distortions than using the best available evidence and methods to assign at least approximate values to non-market factors.

Because of the uncertainties involved in non-market valuations, the GPI makes the assumptions underlying each valuation transparent, frequently provides a range of estimates based on different assumptions, and always cites a highly conservative estimate in its public releases. For example, simply varying the discount rate in net present valuations of

anticipated future costs like climate change will greatly affect results, as will the use of different climate change models. To illustrate the challenges, complexities, and assumptions involved in pricing non-market factors—and also to illustrate how the GPI results err on the conservative side—one concrete example is provided here.

GPI Atlantic's study of road passenger transportation costs in Halifax Regional Municipality (HRM) included congestion as one of 19 costs examined, and found that congestion in HRM costs about $7 million a year. Although congestion carries real costs to businesses, commuters, and the natural environment, these costs, along with many other so-called "externalities," are ignored in conventional transportation accounting mechanisms. The GPI congestion cost estimate—extrapolated from a 2006 Transport Canada study— was based on only three cost elements that were relatively amenable to valuation—excess time spent in traffic jams and heavy traffic, excess gas consumed at those times, and excess greenhouse gas emissions attributable to that additional gas consumption.

This example illustrates that exclusion of key variables and of costs that are more difficult to quantify is a key factor rendering many GPI cost estimates conservative. In this case, the GPI estimate considered only recurrent congestion occurring during the morning and afternoon rush hours, and not congestion occurring at any other time of day or due to snow storms, road works, or any other special circumstance. As well, the GPI estimate considered only congestion occurring on major arteries leading into and out of Halifax, and not on any side street. In addition, the definition of congestion in this case excluded any slowing of traffic to more than half the posted speed (e.g. to 27 km an hour in a 50 km an hour zone). Perhaps most significantly, the three cost components considered—excess time, gas, and GHG emissions—excluded other congestion-related business losses, excess air pollutant emission costs, health and stress impacts, and other costs that were difficulty to quantify.

In sum, this one small example—of just one of 19 separate costs in just one of the 20 GPI components—illustrates several key issues in full-cost accounting work: First, valuing non-market variables is complex and based on a range of assumptions that define and limit the scope of investigation. Second, despite the complexities and assumptions involved in accounting for social and environmental benefits and costs, such valuations are nonetheless essential in order to understand the true impacts of economic activity. Third, GPI estimates are generally highly conservative, largely due to the exclusion of key variables and cost components, and to citing low-end estimates in public releases whenever a range of estimates is considered. Fourth, despite the inherent lack of precision in valuing non-market factors, the resulting GPI estimates are far more accurate, and a far more precise and comprehensive guide to policy and budget formation, than arbitrarily assigning these so-called externalities a value of zero, as in conventional GDP-based measures.

Due to continued refinement of data sources, ongoing efforts to improve measurement methodologies, and inclusion of additional factors excluded in earlier cost estimates, the Genuine Progress Index should always be seen as under continuous development, and it should always be open to improvements in data, methods, and comprehensiveness. Already, some GPI components are far more advanced in terms of data availability and methodology than others. For example, recent years have seen vast improvements nationwide and globally in measures of population health and in cost of illness studies, while there is not yet even

basic agreement on suitable indicators of an educated populace, let alone on quantifying the economic benefits of such knowledge.

Here we can only repeat that this frank acknowledgment of current limitations is no excuse for not embarking without delay on the absolutely necessary step of beginning to value natural, social, human, and cultural capital—for the simple reason that Nova Scotia, and the world at large, can no longer afford to see this capital depleted. "Out of sight" is simply no longer "out of mind," as the world belatedly begins to come to terms with the potentially catastrophic consequences of failing to account for real costs of economic activity like climate change, resource depletion, species extinction, stress, and cultural loss. To the extent that we make such costs visible in our accounting mechanisms and begin to measure progress holistically and comprehensively, we still have a small potential window of opportunity to reverse past losses, restore our innate heritage and wealth, and enhance the wellbeing of both this and future generations of Nova Scotians and others.

A note on complexity

While the first caveat discussed above has to do with the imprecision inherent in valuing non-market variables, the second major caveat concerns the complexity of that process. Indeed, policy makers may shy away from use of the GPI precisely because the integration of social, economic, health, and environmental measures will inevitably be more complex than use of a single narrow set of economic growth statistics conveniently rolled into one composite GDP number. Indeed, over more than 12 years, GPI Atlantic has produced more than 100 reports on a wide range of measures of progress and wellbeing—many of them large, detailed, heavily footnoted, and comprising literally thousands of pages of spreadsheets, tables, charts, and explanatory text.

There are three key issues here:

First, at a fundamental level, we cannot and indeed should never apologize for the complexity of the GPI. Reality is complex and consists of a wide range of interconnected social, economic, and environmental dimensions. Would we feel more comfortable flying in a plane that had only one gauge—say altitude (or GDP) alone—or one with a more wide-ranging and complex dashboard of gauges that give the pilot all the information he or she needs to take off, fly, and land the plane safely? Piloting the ship of state is no less complex an undertaking than flying a plane, and if we are to reach our societal destination and goals safely and successfully, we require our lawmakers and officials to have all the information and understanding they need to navigate often challenging and turbulent waters effectively. In an era of climate change, resource depletion, health care challenges, and globalization, we simply cannot trust lawmakers to make good policy based on a GDP gauge alone.

Second, this manual—written and intended for policy makers—is only one facet of what is needed to adopt and use the GPI properly. We also urgently need to build technical capacity in full-cost accounting methods by offering new courses and training programs, and by restructuring university economics courses to include these methods and to adopt a more holistic approach that recognizes the social functions of the economy and its dependence and impact on the natural world. In other words, once we have designed our safe and

effective aeroplane with its multiple gauges, we need to train pilots to fly it. That is precisely our present situation in Nova Scotia: The Nova Scotia GPI is ready to use, apply, and 'fly', but we have insufficient trained pilots, and therefore continue to rely on old-fashioned and outdated vehicles that cannot measure our progress correctly or help us reach our collective destination.

In this regard, the Gund Institute for Ecological Economics at the University of Vermont (http://www.uvm.edu/giee/), with its mandate to "develop, test, and implement innovative methods and models that reflect the need to integrate the social, built, natural, and human capital components of our world" provides an excellent model of what is now needed in Nova Scotia. Dalhousie University's newly formed College of Sustainability is a step in that direction, and discussions have already begun on a potential GPI course for senior students in that new program. We should go a step further and have Nova Scotia become Canada's premier hub of learning in the new accounting methods. Just as the Gund Institute has become an international destination for students, and the 'jewel in the crown' of the University of Vermont, as one observer recently remarked, so a full-fledged holistic economics and full-cost accounting training program in Nova Scotia could bring renown and economic benefit to this province

Third, while building this technical capacity is essential in the longer term, present constraints are again no reason to hesitate in using and applying the GPI immediately. The reason is simply that what matters most in implementation is an understanding of the fundamental principles and approach of the GPI. That is what this manual is designed to provide, and it contains many examples of GPI-related policy applications that are possible and that can be implemented without delay. Once it is understood that the social and environmental benefits and costs of economic activity must be incorporated into policy making at all levels in order to ensure long-term prosperity, then the GPI can be considered to be already in use. Some First Nations groups have a long tradition that, in all major policy deliberations, one elder represents the interests of the seventh generation hence. That method and understanding are sufficient to ensure, for example, the sustainable use of resources.

In sum, while greater precision, improved methodologies and data sources, training, and enhancing technical capacity are top priorities for effective implementation of the GPI, current complexities and valuation imprecision constitute no reason for delay in adopting and using the GPI. The overly simplistic present reliance on GDP and economic growth based measures, and the gross inaccuracy of assigning an arbitrary value of zero to real social and environmental costs and benefits, have proven far too dangerous and misleading to delay implementing a viable, comprehensive, and much more accurate alternative that is ready for use. We already know too much to continue regarding the real costs of climate change, resource depletion and degradation, obesity, stress, poverty, crime, and social exclusion as so-called 'externalities'. Even beginning to account for those costs, however imprecisely, and beginning to value real assets like volunteer work, family time, safe communities, and vital ecosystem services that support life itself will vastly improve the quality of policy formulation and deliberations.

Because this particular chapter gives a taste of the kinds of complexities and technical issues involved in valuing non-market variables, readers may find it interrupts the flow of the manual as a whole, which focuses on policy relevance and policy applications. They are more than welcome to skip the rest of this chapter, which is more technical, and proceed to the concluding Chapter 6. The sections that follow are akin to a brief explanation of a few sample dashboard gauges to someone visiting an airplane cockpit for the first time. They are obviously no substitute for the detailed training required to enhance technical capacity effectively, to train a pilot to fly the plane, and to implement the GPI fully, properly, and in all its dimensions. That will require the kind of Gund Institute approach noted above, which in turn fully embraces the complexity of the GPI and aims to make its valuations ever more precise over time.

One final introductory note to this chapter is necessary. One of the fundamental pillars of the Genuine Progress Index is the now internationally accepted "precautionary principle" which holds that lack of scientific certainty should not delay action to avert potentially irreversible damage. This principle is explicitly written into both federal and provincial environmental legislation. Thus Part One, Section 2 (b) (ii) of the Nova Scotia Environment Act states:

> The precautionary principle will be used in decision-making so that where there are threats of serious or irreversible damage, the lack of full scientific certainty shall not be used as a reason for postponing measures to prevent environmental degradation.

The same logic applies directly to use and application of the Genuine Progress Index itself. While efforts must continue unabated, and indeed with renewed energy and vigour, to improve evidence, methodologies, data sources, precision, training, study, and other aspects of rigorous scientific investigation, current imperfections and imprecision are no reason not to adopt and use the GPI at this time. It ***is*** ready to use, and indeed its full-cost accounting approach is an essential component of informed and intelligent policy making. We literally ignore its insights at our peril and do a disservice not only to ourselves but to future generations of Nova Scotians if we continue to use current discredited and misleading measures to assess our wellbeing and progress. Perhaps most importantly, the complexity of the GPI in integrating social, economic, and environmental realities must be embraced rather than denied if we are not to stumble forward blindly into the new millennium and if we wish to leave our children a legacy of which we can be proud.

While the following examples of full-cost accounting methods are necessarily highly condensed and offered for illustrative purposes only, GPI Atlantic will gladly provide detailed step-by-step guidance on the methodologies used for each set of accounts upon request as needs arise or as they emerge naturally from the initial efforts to apply the GPI in practice. In addition, detailed explanations of cost calculations, transparent descriptions of all assumptions, and explanations of technical factors like use of discount rates, can be found in the full GPI Accounts themselves, which—in more than 100 volumes—are all available for free download under from the GPI Atlantic website.

5.1 Cost of illness

Cost of illness due to risk factors (obesity/physical inactivity/tobacco use)

GPI Atlantic has produced several cost of illness studies—exploring for example the overall costs of preventable chronic disease in Nova Scotia, the cost of risk factors like tobacco use, physical inactivity, and unhealthy weights, and the available data and methods for estimating the health impacts of unemployment, poverty, gambling, and other factors. Here we focus on behavioural factors, which have seen the greatest advances in costing methodologies in recent years, and where results are therefore relatively more reliable than for other health conditions where quantification and development of reliable relative risk ratios are more challenging. The obesity cost example also illustrates the importance of ongoing improvements in both costing methods and data sources.

Smoking, obesity, and physical inactivity are all preventable causes of sickness and premature death in Canada and Nova Scotia. Together these three risk factors are estimated to account for about 25% of direct taxpayer-funded health care costs. Thus, if all Nova Scotians did not smoke, had healthy weights, and exercised regularly, the province could potentially save half a billion dollars a year in excess health care costs. We begin with a very brief overview of key results in these three areas, followed by a basic outline of methods and steps taken in the GPI cost of illness studies, and concluding with an outline of data and methodological improvements that will enhance the accuracy of these estimates in the future.

For example, tobacco alone—including both direct smoking and exposure to Environmental Tobacco Smoke (ETS)—kills more than 1,700 Nova Scotians every year, accounting for more than one-fifth of all deaths in the province.
Worldwide, tobacco presently kills one in ten adults, and by 2030 the World Bank estimates that it will kill one in 6, or 10 million people a year—more than any other single cause of death.[78] In Canada, Health Canada reports that 21% of all deaths are attributable to smoking—amounting to 45,000 preventable deaths a year.[79]

Ninety per cent of lung cancers are attributable to smoking, and tobacco is also a significant risk factor for a wide range of other cancers, for coronary heart disease, for respiratory illnesses, and for a range of other ailments.[80] In fact, tobacco is the only product sold legally that causes sickness and death when used exactly as intended. These health impacts produce real economic costs, though paradoxically, many of those costs—like hospital, physician, and drug use—contribute to GDP and are therefore misleadingly counted as contributing to prosperity and progress in GDP-based measures of progress. By contrast, the GPI counts these as costs not gains to the economy, and registers lower rates of illness and risk behaviours as signs of progress and improved wellbeing.

GPI Atlantic estimates that the cost burden of tobacco use to the Nova Scotian economy is $171.3 million ($2007) annually in direct health care costs and more than $500 million more in indirect costs resulting from productivity losses due to long and short-term disability and

premature mortality.

In terms of the direct burden on the health care system, obesity is the second most preventable and costly cause of illness and premature death after smoking, and has been linked to a wide range of chronic diseases including type 2 diabetes, heart disease, hypertension, and gallbladder disease. Rates of overweight and obesity have more than doubled in Nova Scotia, in Canada, and globally in the last two decades. GPI Atlantic estimates that obesity costs Nova Scotia $148 million ($2007) a year in direct health care costs—or roughly 5% of the total health care budget, and an additional $173 million ($2007) a year in indirect productivity losses, for a total cost of more than $320 million.

GPI Atlantic has just completed a major study on obesity costs that was designed to improve the accuracy of obesity cost estimates substantially through use of new data sources and costing methodologies. This is discussed in greater detail below to illustrate the improvements in full-cost accounting methods and mechanisms that should always be ongoing.

Physical activity has proven benefits in preventing disease, improving health, and promoting independence and quality of life in old age.[81] The most substantial body of evidence for achieving healthy active aging relates to the beneficial effects of *regular* exercise.[82] Physical activity has been called "the most obvious of variables which might reduce overall lifetime morbidity" and the "cornerstone" of any strategy aimed at prolonging disability-free life expectancy.[83] The evidence indicates that regular physical activity also protects against obesity and assists weight control; fosters development of healthy muscles, bones and joints; increases strength and endurance; enhances mental health; improves behavioural development in children and adolescents; and helps maintain function and preserve independence in older adults.

Studies have found that physically active adults have lower rates of lifetime illness than those who are inactive, and are more likely to remain independent into old age. Because regular exercisers have much less overall lifetime morbidity than those who are sedentary, medical costs avoided due to physical activity are not simply deferred to older ages.[84] Abundant evidence shows that physical activity helps protect against heart disease, stroke, hypertension, type 2 diabetes, colon cancer, breast cancer, osteoporosis, obesity, depression, anxiety, and stress.[85] Conversely, abundant epidemiological evidence shows that physical inactivity is linked to a wide range of chronic illnesses, including diabetes 2, heart disease, hypertension, and colon cancer.

GPI Atlantic estimates that physical inactivity costs Nova Scotia $122 million ($2007) a year in direct health care costs. Of this, $14.2 million is estimated to consist of mental health care costs attributed to physical inactivity, based on epidemiological evidence linking physical inactivity to higher rates of depression, anxiety, and stress. Indirect productivity losses due to premature mortality and disability for the seven diseases reliably related to physical inactivity in the epidemiological literature are estimated to account for an additional $274 million ($2007) in economic costs annually.[86] In other words, the Nova Scotia economy would be worth $274 million more each year than it currently is if it had the benefit of the productive services of the hundreds of Nova Scotians disabled or killed prematurely by a sedentary

lifestyle.[87]

When direct medical costs and economic productivity losses are combined, the total economic burden of physical inactivity in Nova Scotia is estimated to exceed $395 million ($2007) annually.

How are these costs estimated? Here our illustrative example is from the GPI study on the costs of physical inactivity in Nova Scotia, though the same method was earlier used in 2000 to assess the cost of obesity in Nova Scotia. In both cases, GPI Atlantic followed the methodologies used in studies published in the *Canadian Medical Association Journal.* Thus, to estimate the economic costs of any risk factor, the following eight steps are necessary:

1. First, the epidemiological evidence is examined to ascertain the relationship between physical inactivity (or any other proven risk factor) and various diseases. This is expressed as the "relative risk" (RR) of developing a particular disease for a physically inactive person compared to an active person. For example, if sedentary people are twice as likely to develop heart disease, then the relative risk (RR) is 2.

   In the case of GPI Atlantic's physical inactivity study for Nova Scotia, GPI Atlantic did not directly examine the epidemiological evidence to calculate its own relative risk ratios, but rather used a peer-reviewed secondary source for this purpose. Thus, the relative risks for seven chronic diseases, and the methodology for assessing the economic cost of physical inactivity, were taken from an analysis by Katzmarzyk, Gledhill, and Shephard in the *Canadian Medical Association Journal (CMAJ),* 28 November, 2000.[88] To the best of our knowledge, this CMAJ article was the first Canadian study to use previously published meta-analyses and large prospective epidemiological studies to estimate the relative risks attributable to physical inactivity for various chronic diseases.

2. The second step is to ascertain the prevalence of a risk factor within a given population using existing surveys. For instance, the *CMAJ* article cited above uses the Canadian Fitness and Lifestyle Research Institute's (CFLRI) Physical Activity Monitoring Survey results. In recent years, however, and since the initial GPI report on physical inactivity costs in Nova Scotia was published, levels and rates of physical activity and inactivity are now assessed using Statistics Canada's Canadian Community Health Survey, and using the new Statistics Canada standards and definitions of activity and inactivity rather than the CFLRI ones used at the time.

3. To assess the public health burden of sedentary living, or of any other risk factor, the relative risk ratio (step 1) is combined with the prevalence of physical inactivity (or other risk factor) in the population. The resulting population attributable fraction (PAF) of a disease is an estimate of the effects of an individual risk factor on a given disease at the population level, and the extent to which each disease is attributable to the risk factor. The population attributable fraction (PAF) of a disease is, therefore, the proportion of each chronic disease that could theoretically be prevented by eliminating physical inactivity. GPI Atlantic's most recent Cost of Obesity study (2009) contains a detailed discussion on formulae commonly used to calculate PAFs.

4. The fourth step is to multiply the population attributable fraction (PAF) for each disease by the total cost of treating that particular disease, using Health Canada's *Economic Burden of Illness in Canada* (EBIC), which describes illness costs by diagnostic category. In other words, we estimate the direct health care costs of treating the particular diseases that are linked to physical inactivity by using the population attributable fraction (PAF) of each disease to estimate the fraction of those costs that are attributable to physical inactivity. The GPI analysis of physical inactivity costs for Nova Scotia was again based on the methodology used by Katzmarzyk et al. in assigning costs to particular diseases, but the costs were updated and adjusted for Nova Scotia using Nova Scotia specific data whenever possible. Katzmarzyk et al. used the 1993 EBIC results, inflated to 1999 values.[89] In GPI's cost of illness analyses, Nova Scotia specific results were derived from the 1998 EBIC. Future updates of the GPI cost of illness reports should use the 2000 EBIC results that have not yet been published but have kindly been made available to GPI Atlantic by the Public Health Agency of Canada (PHAC), and inflate these costs to the current year. PHAC has plans to update EBIC results in the future to be closer to current year costs.

5. Indirect productivity losses due to inactivity-related premature mortality and disability for each of these diseases were estimated by GPI Atlantic as follows. For coronary heart disease, stroke, and diabetes, the ratio of indirect to direct costs from the 1993 EBIC was applied to the direct cost estimates. Costs for those more specific diagnostic categories were given in the 1993 EBIC but were not available at the provincial level in the 1998 EBIC results to which GPI Atlantic had access at the time. For colon cancer and breast cancer, the ratio of indirect to direct costs for all cancers in Nova Scotia was used from the 1998 EBIC. Similarly, since productivity losses due to hypertension were not separately available, the ratio of indirect to direct costs for all cardiovascular disease in Nova Scotia was used from the 1998 EBIC to estimate indirect inactivity-related hypertension costs. Likewise, productivity losses due to inactivity-related osteoporosis were estimated by using the ratio between indirect and direct costs for all musculoskeletal disorders in Nova Scotia from the 1998 EBIC.

6. An important category of illness related to physical inactivity, in particular, was omitted in the Katzmarzyk et al. cost estimates—namely mental illness. According to Statistics Canada estimates based on National Population Health Survey data, sedentary Canadians are 60% more likely to suffer from depression than physically active Canadians. Physical activity also protects against stress, which has been assessed in meta-analyses of medical costs as the most expensive of all risk factors—exceeding even tobacco and obesity costs, and accounting for about 8% of total health care costs.[90] For this reason, a rough estimate was added in the GPI physical inactivity study, based on the 1998 EBIC figures for Nova Scotia, of the possible costs of mental illness attributable to physical inactivity in the province. Although it was not possible to derive an accurate population attributable fraction (PAF) for mental illness in relation to physical inactivity, it was considered more accurate to attempt an estimate for this category, using the best available evidence, than to assign it an arbitrary value of zero.

7. The number of premature deaths attributable to physical inactivity (or any other risk factor) in Nova Scotia was estimated—in GPI Atlantic's original Cost of Physical Inactivity report—by multiplying the number of deaths attributable to each inactivity-related disease by the population attributable fraction (PAF) for that disease. Deaths from heart disease and stroke in Nova Scotia were taken from Health Canada's *Statistical Report on the Health of Canadians*. Deaths from colon cancer and breast cancer in Nova Scotia were from the National Cancer Institute of Canada's *Canadian Cancer Statistics 2001*. Deaths due to diabetes, hypertension, and osteoporosis were derived from Katzmarzyk et al., and assumed the same proportion of deaths due to these three conditions in Nova Scotia—as a percentage of total physical inactivity related deaths—as in Canada. A similar method was used in the GPI report to estimate potential years of life lost due to physical inactivity.

   However, GPI Atlantic has revised this method in its latest Cost of Obesity study (2009) in light of analyses by the U.S. Centers for Disease Control and Prevention (CDC) that have demonstrated different results when PAFs specific to mortality are used than when PAFs for disease are used to estimate premature deaths. CDC has therefore advised that PAFs comparing the number of deaths, by cause of death, among the physically inactive or obese population with the number of deaths from the same cause in the physically active or healthy weight population should be used to determine premature deaths attributable to the risk factor. This method is used in GPI Atlantic's 2009 obesity study.

8. Finally, the savings that could potentially be realized from a 10% reduction in physical inactivity were derived from the estimates of Katzmarzyk et al. who recalculated the population attributable fractions (PAF) of each disease and corresponding costs by assuming a 56% prevalence of inactivity instead of a 62% prevalence. Katzmarzyk and his colleagues then estimated savings according to the difference between the two sets of costs. The 56% prevalence (rounded) is 62% minus 6.2% (representing a 10% reduction in physical inactivity). As the Nova Scotia physical inactivity rate (62%) was identical to that used by Katzmarzyk et al. for Canada in 1997, the Nova Scotia savings were assumed to be proportional to the results derived by Katzmarzyk et al.

This describes the method used in the GPI cost of physical inactivity report for Nova Scotia, but is similar to that used in GPI cost of obesity and tobacco studies. The outline above does not go into many details, like the challenges in matching the diagnostic categories in the epidemiological literature with those in the *Economic Burden of Illness in Canada* database. These and other details are described in the actual reports available on the GPI Atlantic website. Here we move on to describe some of the advances in both methodology and data availability since the original GPI cost of illness studies. GPI Atlantic's most recent cost of obesity study (2009) describes and reflects these advances, and also identifies further areas for improvement. The following summary therefore reflects the dynamic nature of this ongoing work.

Update on cost of illness methodology, definitions, and data sources

Since GPI Atlantic's initial work on the cost of chronic disease, tobacco, obesity, and physical inactivity in Nova Scotia, a number of new developments have occurred to improve and standardize definitions, costing methods, and data sources. These advances—illustrated here for obesity cost analysis—indicate the dynamic nature of the field and the intensive work now under way to account more accurately and comprehensively for benefits and costs that remain invisible in conventional GDP-based accounts. Improvements in illness cost and risk factor evidence have been matched in the policy arena by a new emphasis on health promotion and disease prevention to complement the traditional focus on health care and illness treatment.

In the area of obesity cost analysis, for example, recent developments include new definitions for obesity and physical inactivity, expanded risk factor /disease associations, new directly measured obesity data from the Canadian Community Health Survey (CCHS), new Environmental Burden of Illness in Canada (EBIC) costing data, and new directly measured data for overweight and obesity in children and youth. As well, significant policy shifts since GPI Atlantic's original cost of tobacco, obesity, and physical inactivity reports include the creation of a new provincial Department of Health Promotion and Protection under its own Minister, which has developed healthy nutrition guidelines for schools, and the development of a new comprehensive tobacco control strategy that includes sharply increased tobacco taxes and smoke-free places legislation. The latter has already helped sharply reduce smoking rates—most dramatically among teenagers—and the success of these health promotion programs in turn will significantly impact future costing projections. In other words, just as present chronic illness costs reflect past rates of smoking, obesity, and physical inactivity, so any present improvements will reduce future costs.

It must be acknowledged that updating past GPI chronic disease and risk factor cost estimates to account for new developments in the field would be a fairly significant undertaking, since some of the methodological advances in the field are quite complex, while some of the best new data sources that rectify past biases do not yet have sufficiently large sample sizes to cross-tabulate results by age, gender, and other factors. As well, such updates should account for the impacts, trends, and cost implications of new policy developments in the health promotion field. A few specific examples of these new developments are provided here for illustrative purposes, particularly to indicate the dynamic and evolving nature of data sources and methods. These examples are largely drawn from GPI Atlantic's most recent cost of obesity research (released in 2009):

New epidemiological literature

The knowledge base in the areas of obesity and physical inactivity has expanded tremendously since GPI Atlantic's original 2000-02 reports on both risk factors. Indeed, the vast majority of obesity and physical inactivity research in general—and costing work in particular—has all happened in the last few years since those original GPI reports on the subjects were released. Unlike tobacco research, which has a much longer history, these two risk factors were not studied nearly as extensively over such a long period (several decades), and the scientific understanding of their importance as health risk factors and of their actual costs is much more recent.

Since 2000, obesity awareness has increased both among researchers and among policy makers and the general public. For example, there has been a substantial increase in new obesity-related literature—particularly in the field of epidemiology—investigating the association between obesity and various illnesses, and accounting for potential confounding factors. A search for obesity-related evidence in only one database, Medline, showed that during the 1970s, 10,197 obesity-related articles were indexed in Medline, and during the 1980s, 11,800 were indexed. During the 1990s, the number rose to 17,754, and between 2000 and 2008 alone—just since the publication of GPI Atlantic's original Cost of Obesity study for Nova Scotia—42,913 articles were published, reflecting a remarkable increase of more than 260% from two decades earlier. Other databases and literature searches reveal similar increases, all pointing to a massive, and very recent, expansion of the knowledge base in this important area.

Proper costing updates for obesity and physical inactivity will require careful study of the new epidemiological literature, which provides new information on the relation between these two risk factors and particular health and illness outcomes. That in turn, will require adjustments in the relative risk factors associated with particular diseases based on the most reliable evidence now available in meta-analyses of the epidemiological literature. It will also require the addition of new illness categories now reliably associated with obesity and physical inactivity on which insufficient epidemiological evidence was available a decade ago to include in GPI Atlantic's original cost estimates. To give just one example, GPI Atlantic's original 2000 cost of obesity study included evidence and costs for three types of cancer—colon, endometrial, and post-menopausal breast cancers. The most recent 2009 cost of obesity work included 14 different cancers.

In addition, the new cost updates will need to take into account new definitions, new data sources, and new methodologies, plus the new understanding that now exists of some of the problematic issues involved in using earlier, less refined costing methodologies. In short, cost of illness studies constitute a relatively new field, in which most significant advances have been made in recent years—again since the time of GPI Atlantic's original studies. This well illustrates the dynamic and fast-changing nature of full-cost accounting work and its emergence as a major field of study in which Nova Scotia is well placed to play a leading role. A few specific examples follow.

New definitions

The definition of a non-market variable affects its scope, what is measured and excluded, and thus the resultant trends and cost estimates. For example, new definitions of physical inactivity and obesity now produce very different prevalence rates that are not comparable to those used in GPI Atlantic's original costing studies in these areas. At the time of GPI Atlantic's original cost of physical inactivity study, the Canadian Fitness and Lifestyle Research Institute (CFLRI) rates for physical inactivity—which had consistent annual trend data available—were used to define physical activity and inactivity. Those CFLRI rates and definitions were also used by Katzmarzyck et al. in the first systematic cost of physical inactivity study undertaken for Canada, published in 2000 in the *Canadian Medical Association Journal (CMAJ),* which served as the model for GPI Atlantic's study of physical inactivity costs for Nova Scotia.[91]

However, the CFLRI definition of "physically active" was different from the definition—now more universally accepted—adopted in Statistics Canada's subsequent Canadian Community Health Surveys (CCHS), which were first administered in 2000-01. The CCHS now has results available biennially to 2007 and for 2008 when the survey changed to annual collection periods, with data comparable to earlier National Population Health Survey (NPHS) results, thus allowing for consistent 1994/95–2008 time series on physical activity and inactivity for Canada and the provinces.

Specifically, in the definition now used by Statistics Canada, Canadians are considered physically inactive or "sedentary" if they report a usual daily leisure-time energy expenditure amounting to less than 1.5 kilocalories per kilogram of body weight per day (kcal/kg/day). Individuals are defined as moderately active if they expend 1.5-2.9 kcal/kg/day, and as "active" if they expend 3.0 or more kcal/kg/day. Calculations are made based on individuals' reporting of the frequency and duration of different types of physical activity using independently established values for the energy demands of each activity. In that analysis, "regular" physical activity (at the levels indicated) is defined as at least 15 minutes of leisure time physical activity 12 or more times per month. The CCHS/NPHS results apply to Canadians 12 and older.

By contrast, the CFLRI definitions of physical activity and inactivity used in the original *CMAJ* and GPI Atlantic cost of physical inactivity studies were more rigorous, and thus produced higher rates of physical inactivity and lower rates of physical activity. As well, the CFLRI Physical Activity Monitor surveys, on which the *CMAJ* and GPI trends and cost estimates were based, were administered to Canadians 18 and older, thus again producing different results than in CCHS surveys administered to Canadians aged 12 and older. Specifically, the CFLRI rated Canadians according to whether their physical activity levels were sufficient for "optimal health benefits." Physical inactivity, according to this measure, was defined as less than 12.6 kilojoules (kJ)/kg of body weight per day of physical activity—the minimum judged necessary to obtain health benefits from physical activity.[92] A key advantage of using the CFLRI data at the time was the availability of a consistent national time series dating back to the first Canada Fitness Survey conducted in 1981.

Aside from these two sets of definitions, there was also a wide range of other definitions of physical activity and inactivity that were current at the time of GPI Atlantic's original Cost of Physical Inactivity study. For example, Health Canada's 1998 publication, *Canada's Physical Activity Guide to Healthy Active Living,* called for an hour of low-intensity activity every day for adults aged 25-55, or 30-60 minutes of moderate-intensity activity, or 20-30 minutes of vigorous-intensity activity 4-7 days a week.[93] Thus, estimates of physical activity rates were produced based on these criteria, indicating that only 34% of Canadians aged 25-55 at the time met Health Canada recommendations for adequate physical activity.[94]

In addition, other Statistics Canada survey evidence, reported in Statistics Canada's CANSIM database with trendlines available from 1985 to 1996, assessed physical activity levels according to whether respondents reported exercising three or more times weekly, once or twice weekly, less than once weekly, or never.[95]

Because there were so many different definitions of physical activity and inactivity at the time—compromising comparability both over time and among jurisdictions—an "international consensus group" was formed in 1998 to develop an internationally agreed upon set of measures of physical activity participation. At the time that GPI Atlantic produced its original Cost of Physical Inactivity study for Nova Scotia, this international consensus group had developed and pilot-tested a set of International Physical Activity Questionnaires (IPAQ), with Canada one of 12 countries participating in the validation and reliability phase of the project.[96]

The significant differences between the different definitions of physical activity and inactivity, and between the CCHS/NPHS and CFLRI definitions in particular, will clearly produce markedly different prevalence rates, which in turn will subsequently affect cost estimates for 'physical inactivity,' depending on how it is defined. Using comparable years, for example, the 1996-97 CFLRI Physical Activity Monitor found that 66% of Canadians were not sufficiently active to reap the health benefits of physical activity, while the NPHS data for those years reported a physical inactivity rate of 57% for Canadians.[97]

Definitional differences will produce significant differences in cost estimates of physical inactivity in two important ways. First, they will affect use of epidemiological evidence to assess relative risk ratios associating physical inactivity with particular diseases, since relative risk estimates will differ according to amounts of physical activity expended by study subjects. Second, as noted above, the definitional differences will affect estimates of physical inactivity prevalence rates. Reliable and consistent relative risk ratios and prevalence rates for physical inactivity, in turn, are both necessary bases for any cost estimates.

In short, a new cost of physical inactivity study for Nova Scotia would now use the CCHS/NPHS definition and data on prevalence rates that have now become universally accepted, rather than the CFLRI definition and prevalence data used at the time both by the *CMAJ* and by GPI Atlantic. In order for the new estimates for Nova Scotia to be comparable to earlier ones—i.e. to assess the degree to which costs have increased or declined in response to changes in physical inactivity rates—the earlier estimates would have to be refigured according to the CCHS/NPHS definitions, relative risk evidence, and prevalence rates.

Similar definitional changes have occurred with regard to the obesity cost estimates. GPI Atlantic's previous cost of obesity studies, undertaken for eight provinces—as well as a seminal 1999 *CMAJ* study on the cost of obesity for Canada,[98] which again served as the template for the 1999-2001 GPI provincial studies—used a different definition of obesity than that subsequently adopted by Health Canada and Statistics Canada. The new guidelines, which describe a body weight classification system that can be used to identify health risks associated with body weight in individuals and populations, are in accord with the World Health Organization (WHO) recommendations that were released in 2000 and have now been widely adopted internationally.[99]

Between 1988 and 2003, for adults aged 20 to 64, Health Canada considered a body mass index (BMI) of 20–24.9 as "acceptable weight," 25–26.9 as "some excess weight," and 27 or higher as "overweight."[100] There was no "obesity" classification in these official Canadian

standards, which were also used as the basis for Statistics Canada reporting, though the original 1999 *CMAJ* national cost of obesity study classified Canadians with a BMI of 27 or more as being obese. As the basis for the *CMAJ* and subsequent GPI Atlantic cost estimates, epidemiological evidence on relative risks for particular disease categories were therefore assessed for those with a BMI of 27+.

In 2003, based on the new WHO guidelines and on new research on the relationship between BMI and risks of morbidity and mortality, Health Canada updated and changed its guidelines for body weight classifications for (non-pregnant or lactating) adults. In the process, it also changed the age classification for overweight and obesity estimates to '18 years and over' from the earlier 20-64 age group categorization previously used for overweight and obesity prevalence estimates.[101]

The new Health Canada guidelines—now also used by Statistics Canada for reporting purposes—identify "underweight" as having a BMI of under 18.5, "normal weight" as having a BMI of 18.5 to 24.9, "overweight" as having a BMI of 25.0 to 29.9, and "obese" as having a BMI of 30 or greater. The new guidelines further divide "obese" into three levels: BMI 30.0 to 34.9 (obese-Class I); 35.0 to 39.9 (obese-Class II); 40 or greater (obese-Class III).[102] Relative risk ratios have been found to differ substantially according to these different categories, thus also allowing for much finer cost estimates than were previously possible, and for breakdowns of aggregate obesity cost estimates according to the proportion of total obesity costs attributable to different categories of obesity.

In addition—as part of the new guidelines—a level of abdominal fat measurement, which is rarely used in surveys or studies, was changed from a waist to hip ratio to a waist circumference measure. Altogether, the new classifications substantially affect both the relative risk ratios and the prevalence rates that are both essential bases for any cost estimates.

New and more precise data

Prevalence rates and cost estimates for non-market variables can also become considerably more accurate with improvements in data sources. For example, new directly-measured obesity data that did not exist at the time of GPI Atlantic's original March 2000 Cost of Obesity in Nova Scotia study have now become available through the Canadian Community Health Survey (CCHS). Thus, between 1995 and 2003, there were no health surveys conducted in Canada that directly measured height and weight—the basis for calculating BMI. Instead, all available population health survey obesity data in those years were based on self reports of height and weight. In 2004, the CCHS, Cycle 2.2, which focused on nutrition, became the next survey to directly measure the height and weight of respondents, and in 2005 the CCHS directly measured a small sub-sample of the 2004 survey for comparison purposes.[103]

Evidence has shown that directly measured BMI data are considerably more accurate than self-reported data, which tend to be biased.[104] This bias is not always gender-specific, but it has been found that men generally tend to overestimate their height, while women more often tend to underestimate their weight—perhaps, as S. Connor Gorber et al. of Statistics Canada note, because of social desirability and the stigma that can be associated with

obesity.[105] As well, it was found that overweight and obese individuals tend to misrepresent their height and weight more often than do those with normal weight.

In general, therefore, self-reported data on height and weight tend to underestimate BMI, which in turn results in fewer people being classified as obese than is actually the case, and in correspondingly lower and overly conservative obesity cost estimates. In addition, the association found between obesity and morbidity tends to differ depending on the data collection method.[106]

For example, in a recent study, Margot Shields et al. of Statistics Canada found that the prevalence of obesity in Canada in 2005 was 22.6% when based on measured data, and 15.2% when based on self-reported data from the same individuals—a very substantial difference of 7.4 percentage points that indicates nearly 50% more Canadians being classified as obese according to directly measured data than according to self-reported data.[107] For males the directly measured obesity rate was 8.8 percentage points higher than the self-reported rate (24.2% vs. 15.4%), and for females it was 6 percentage points higher (21.0% vs. 15.0%). The directly measured data showed significantly higher obesity rates for all age groups, with the 65 and older age group showing the greatest disparity—with the difference 15 points higher for men aged ≥65 (31% vs. 16%), and 13 points higher for women aged ≥65 (28% vs. 15%).

These substantial differences are much more important in costing studies that depend upon accurate estimates on the relative risks of disease associated with particular BMI levels and on obesity prevalence at a particular point in time, than in assessing relative trends over time that are more concerned to assess whether rates are increasing or declining. Such trend estimates, which are only really possible in Canada and the provinces using the consistent self-reported NPHS/CCHS data collected biennially from 1994/95 to 2008, may reasonably assume that the BMI under-reporting bias has remained relatively consistent over time and will therefore not substantially affect trend reporting. Even that assumption, however, must be qualified by the evidence on the magnitude of disparity by age group noted above, which indicates that BMI underestimates may become progressively greater as the population ages, since older people are more likely to overestimate their height based on the height they once had.

Certainly, Statistics Canada's new evidence on the magnitude of disparity between measured and self-reported BMI results indicates that the self-reported BMI results—used as the basis for the original *CMAJ* and GPI obesity cost estimates based on data availability at the time—were significant underestimates that in turn underestimated associated economic costs.

In addition, the original obesity cost studies used 1998 Economic Burden of Illness in Canada (EBIC) costing data from Health Canada. Although not yet published, PHAC now has EBIC costing data for 2000 that have kindly been made available to GPI Atlantic by PHAC in unpublished form. In sum, any future updates for the cost of obesity in Nova Scotia should use both the new EBIC data as well as measured rather than self-reported BMI prevalence rates.

That said, it must be acknowledged that the advantages of using directly measured data are balanced by the reality that Statistics Canada's sample sizes for directly measured data are very much smaller (12,400) than for self-reported data (135,000), which seriously compromises the statistical validity of the directly measured results when broken down by province and by diagnostic, socio-demographic, and obesity class categories. As described in GPI Atlantic's most recent 2009 Cost of Obesity study, Statistics Canada has now developed a method and formula enabling adjustment of the 2005 self-reported data to approximate the 2004 directly measured results. Therefore, in future studies, GPI Atlantic plans to use the self-reported data for the considerably greater statistical validity conferred by their larger sample sizes, adjusted to directly measured data using Statistics Canada's new methods.

In response to the need for more accurate data, Statistics Canada, Health Canada, and the Public Health Agency of Canada (PHAC), have developed a new survey—the Canadian Health Measures Survey—that directly measures physical health, including BMI, blood pressure, heart rate, lung functioning, and cardiovascular fitness, among other factors.[108] Data collection is currently taking place between 2007 and 2009, and will sample approximately 5,000 Canadians aged 6–79 years. When the results are released in 2010, they should provide important new data concerning the health of Canadians, which in turn will potentially allow far more accurate assessments of illness and risk factor costs than has hitherto been possible.

Again, however, this very small sample size will seriously compromise the statistical validity of results when broken down by province, disease, obesity class, and socio-demographic factors. Rather, the new results will need to be the basis for the development of adjustment methods and formulae allowing conversion of the much less accurate self-reported to the more accurate results revealed by the new Canadian Health Measures Survey. In sum, ongoing improvements in data sources are gradually allowing increasingly accurate and more precise cost estimates of non-market variables.

More advanced and precise methodologies

As a result largely of work by the Centers for Disease Control and Prevention in the U.S., and by Beverly Rockhill Levine and associates—who found that previous epidemiological and costing studies frequently had computation errors—new methodological understanding on how to conduct cost of illness studies has been developed in the last few years.[109, 110]

Specifically, Rockhill et al. found that one of the most common errors has been the use in the epidemiological and costing literature of adjusted relative risk ratios in association with the wrong formula to estimate population attributable fractions for the proportions of particular chronic diseases attributable to obesity, physical inactivity, tobacco, and other risks. That commonly used formula—also used in the *CMAJ* cost of obesity and physical inactivity studies referenced above and in the GPI Atlantic cost studies—is as follows: The population attributable fraction (PAF) for each disease is calculated as [P(RR – 1)] / [1 + P(RR – 1)], where P is the prevalence of the risk factor (obesity, smoking, physical inactivity, etc) in the population, and RR is the relative risk for the disease in an obese, smoking, or inactive person compared to a non-obese, non-smoking or physically active person.

Rockhill and her associates argued that either a formula other than the one commonly used

should be utilized in association with adjusted relative risk ratios, or that the relative risk ratios used with the common formula should *not* be adjusted for confounding factors since this adjustment removes part of the population from the estimate. Rockhill et al. note: "The magnitude of bias resulting form this error will depend on the degree of confounding."[111]

Since the vast majority of epidemiological studies do report adjusted and summarized (rather than unadjusted) relative risk (RR) ratios, it will be very challenging to obtain unadjusted RR results for use in the common PAF formula without consulting the study authors and going back to original unadjusted data sets that are rarely provided in the peer-reviewed epidemiological and medical journals in which the study results were published. Despite these challenges, this new methodological understanding requires that future updates of Nova Scotia costing studies for any risk factor, including obesity, tobacco, and physical inactivity, should, to the extent possible, use unadjusted RR ratios.

In order to move this costing work forward on all fronts, GPI Atlantic's recent (2008-09) research on the cost of obesity in Alberta, undertaken for the Alberta Cancer Board, does attempt to use the new definitions, data sources, methods, and knowledge—including use of the new EBIC data (kindly provided to GPI Atlantic by PHAC prior to publication), use of the 2004 measured BMI data where possible,[112] and calculation of new unadjusted RR ratios based directly on CCHS data. This major study, to be released in 2009, can potentially serve as a useful template for future Nova Scotia cost of chronic disease and risk factor studies.

The major advances and improvements in definitions, data sources, and methods referenced above have all occurred in the space of just six years. And the advances must continue. For example, as noted, the directly measured survey data are based on sample sizes that are presently insufficient to produce reliable age, gender, and obesity class prevalence and cost breakdowns by province, and insufficient even to produce reliable national data when results are broken down by diagnostic, obesity class, and socio-demographic categories. In the short term, use of Statistics Canada's adjustment methods to convert self-reported data to at least an approximation of directly measured data is recommended. In the longer term, larger CCHS sample sizes — or a Nova Scotia decision to buy additional sampling from Statistics Canada or to conduct its own health surveys as the province of Newfoundland and Labrador currently does — will hopefully eventually allow reliable obesity prevalence rates and cost estimates for these key confounding variables. Such additional information, in turn, will allow more careful and accurate targeting of policy interventions designed to promote healthy weights.

This discussion simply serves to illustrate the dynamic nature of the full-cost accounting field, which gradually allows substantial improvements in precision and accuracy in valuing non-market variables. Already results and cost estimates are possible that were not feasible 15 or 20 years ago, so there is no longer any reason to delay adoption and implementation of a full-cost accounting system. Actual adoption and use of such a system will in turn be the greatest possible spur to further improvements in data sources and methodologies, and in finer and more precise definitions and category breakdowns that will allow ever more accurate reporting and targeting of policy interventions.

5.2 The economic value of civic and voluntary work

The very term 'full-cost accounting' implies a focus on costs rather than benefits. But this is not the case. The GPI methods are as concerned to reveal the benefits flowing from conservation of and investment in human, social, and natural capital as to measure the costs resulting from their depletion and degradation (depreciation). In fact, costs are frequently simply the consequence of taking for granted (and therefore failing to preserve) the unpriced value of ecosystem, social support, and other services that are assumed to be 'free'. To emphasize the importance of these often hidden values that are invisible in the conventional economic accounts, we here provide one of many examples in the GPI of valuing the benefits of key non-market services.

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

In addition, research has found that social networks may play as important a role in protecting health, buffering against disease, and aiding recovery from illness as behavioural and lifestyle choices such as quitting smoking, losing weight, and exercising.[113] Indeed, volunteerism is often used as a proxy for determining the strength of social networks as a non-medical determinant of health.

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

Previous GPI Atlantic reports and updates on the Economic Value of Civic and Voluntary Work in Atlantic Canada reported voluntary work trends from Statistics Canada's General Social Surveys (that allow assessments of formal and informal voluntary work combined), and also analysed data from Statistics Canada's National Surveys of Giving, Volunteering and Participating (NSGVP) from 1997 and 2000 that focussed on formal voluntary work. That latter survey was subsequently reconfigured and renamed the Canada Survey of Giving, Volunteering and Participating (CSGVP). According to Statistics Canada, however, the results from the 2004 CSGVP are not comparable to the 1997 and 2000 NSGVP results on volunteerism rates, due to methodological differences and changes in the 2004 survey coverage, sample size, and questionnaire. Therefore, in GPI Atlantic's most recent (2008) update of trends in civic and voluntary work indicators, trends up to 2000 were reported using the earlier NSGVP, while the 2004 data were reported separately using the CSGVP.

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

In order to estimate the economic value of voluntary work in Nova Scotia (including both formal and informal voluntary work), GPI Atlantic used data from Statistics Canada's General Social Surveys (GSS 1992, 1998 and 2005), Statistics Canada's Households' Unpaid Work: Measurement and Valuation, and the Census of Population for 1991, 1996, and 2006.

GPI Atlantic estimates that Canadian volunteers contribute the equivalent of $64.9 billion ($2007) worth of services annually to the national economy either through voluntary organizations or by informal volunteer work—far more than a wide range of other industries. When both formal and informal voluntary work are combined, using the GSS data, Nova Scotian volunteers contributed an average of 144 hours per person 15 and older in 2005—the equivalent of $1.8 billion worth of services annually to the provincial economy. Nevertheless, this massive contribution still represents a loss of nearly $400 million in voluntary services compared to the combined value of formal and informal voluntary work in 1997—$2.2 billion ($2007)—as estimated in GPI Atlantic's original 1998 report on *The Economic Value of Civic and Voluntary Work in Nova Scotia.*

If Nova Scotia volunteers were providing services at the same rate in 2005 as they did in 1992, Nova Scotians would be receiving 18.3 million additional hours a year of voluntary services. To replace this lost work for pay in the market economy would cost nearly $300 million. In other words, a decline in voluntary work that is invisible in the conventional market-based economic statistics can be very costly if those 'free' services have to be replaced for pay. If they are simply not replaced, the lost volunteer hours can point to a significant decline in quality of life. Unfortunately, available data do not allow an assessment of which lost volunteer services were replaced for pay.

Methodology used to calculate value of voluntary work and dollar loss in voluntary services

1. Take the average time spent on civic and voluntary work (minutes per day) per person for the total population 15 years and older, as provided in the GSS.

2. Multiply by 365 to get total average hours per year per person.

3. Multiply the total average hours per year per person by the population aged 15 and over.

4. Multiply this product by the hourly replacement cost of $19.63 ($2007) for Canada and $16.28 ($2007) for Nova Scotia. In 1995, Statistics Canada estimated the *specialist replacement value* of voluntary work by looking at the market value of the work that volunteers actually do in the *formal* volunteer sector. After adjustment to 2007 dollars using the Consumer Price Index, this is the basis for the $19.63 and $16.28 ($2007) numbers used by GPI Atlantic in the 2008 update of the value of civic and voluntary

work.

However, voluntary work done *informally* is often of the domestic variety, e.g., cooking, cleaning, or shopping for a sick neighbour, doing yard work for someone who is disabled, etc. This informal voluntary work is often less skilled and requires less expertise than the formal volunteer work offered through organizations, so it should probably be valued at a lower rate of pay, since it would cost less to replace in the market economy than, say, the volunteer treasurer of a board of directors. In GPI Atlantic's 1998 Value of Civic and Voluntary Work study, informal voluntary work was valued at the *generalist replacement value* that Statistics Canada used to value unpaid household work (which is a lower hourly rate and more similar in type to a lot of informal voluntary work), rather than at the *specialist replacement value*. In GPI Atlantic's 1998 economic valuations, therefore, different hourly pay scales were applied to the formal and informal voluntary sectors.

Due to time and resource restraints, however, this step differentiating formal and informal voluntary sector replacement values was not taken in the 2008 update. As a result, the total economic value of voluntary work in the 2008 update may be somewhat overestimated because the specialist replacement value (which has a higher hourly rate than the generalist replacement value) was used for *all* voluntary work—formal and informal—rather than only for the formal sector. Nonetheless, this overestimate is likely balanced by another factor that yields an underestimate. In GPI Atlantic's 1998 report, the out-of-pocket expenses of volunteers—including for example the cost of gas to get to meetings and assignments, equipment, materials, supplies, sometimes even uniforms, etc.—were added to the total value of voluntary work. We did *not* add those out of pocket expenses in the 2008 update, which results in an underestimate of the total value of voluntary work. This will likely roughly balance the overestimate that results from using the specialist replacement method rather than the generalist replacement method for the value of informal voluntary work.

5. Divide the product of step 3 (total volunteer hours given by all volunteers within the population 15 years and older) by the total population to get voluntary services per capita—which represents the rate at which voluntary services are ***received*** by the population at large.

6. Extrapolate 1992 voluntary service hours per capita to 2005 by asking the question: Had voluntary service hours per capita in 2005 been offered at the same rate as in 1992, how many hours would have been offered? To do this, take the voluntary service hours per capita in 1992 and multiply that number by the total population in 2005. This gives the number of voluntary hours that would have been offered in 2005 had voluntary services been offered at the same rate in 2005 as in 1992.

7. Multiply result of step 6 by the hourly replacement cost of $19.63 ($2007) for Canada and $16.28 ($2007) for Nova Scotia.

8. Subtract the number of total voluntary hours *actually* offered in 2005 (Step 3) from the result of Step 6 above (which is the number of voluntary hours that would have been offered had voluntary services been offered at the same rate in 2005 as in 1992). The difference is the loss in voluntary services actually experienced by the Canadian and Nova Scotian populations.

9. To get the dollar value of that loss in voluntary services compared to the 1992 voluntary service rate, either a) multiply the result of Step 8 by $19.63 for Canada and $16.28 for NS, or b) subtract the result of Step 4 from the result of Step 7 above, or c) subtract the dollar figure in Row 3 from that in Row 5 in Table 4 below.

Table 5. Value of voluntary work and dollar loss in voluntary services, Canada and Nova Scotia, 1992, 1998, 2005

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

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

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

5.3 Transportation Accounts: what are the true costs of driving?

The following is a summary of the transportation full-cost accounting methodology used by GPI Atlantic. For details on the transportation literature review, data sources, and methodology please refer to: The GPI Transportation Accounts: Sustainable Transportation in Nova Scotia. 2006. Available at http://www.gpiatlantic.org/pdf/transportation/transportation.pdf.

There are many key costs of driving of which drivers are typically unaware. To illustrate the differences between different types of transportation costs, the GPI private passenger transportation costs are divided into three categories:

1 Internal variable costs
These are direct costs borne by the driver, which vary according to conditions, vehicle type, and how much a person drives. Examples are vehicle operating costs (like petrol and repairs) and travel time.

2 Internal fixed costs
These are direct costs borne by the driver, which do not really change when driving habits and conditions change. These generally include vehicle ownership costs (car payments), registration, insurance, and fixed parking fees associated with residence and work.

3 External costs
These are the uncompensated effects an activity poses on other individuals or on society at large. These include, for example, costs imposed by drivers on others, such as climate change and air pollution damages, congestion, noise, taxpayer-funded accident costs (such as medical and hospital costs), traffic policing expenditures, and parking subsidies to drivers, the cost of which is passed on to other citizens. Since individual drivers do not bear these costs directly as actual out-of-pocket expenses, they tend to undervalue these impacts when making a particular trip in a vehicle. For example, when parking facilities are subsidized, drivers will tend to rely less on alternative modes of transport than if parking costs were borne directly by users. Economic efficiency requires that externalities be internalized so that prices reflect the full marginal costs of producing that good or service, unless a subsidy is justified for societal reasons.

Alternatively, costs can be classified simply as either **direct** or **indirect**, based on either objective criteria or subjective experience. If, for example, an employer or business subsidizes parking for driving employees or customers, those additional employer-borne costs may be passed on to all employees or customers, which in turn indirectly favour drivers over non-drivers.

It should be noted that there are many non-market external costs associated with transportation for which money is a poor valuation tool. In addition, some monetization techniques are quite complex. As well, raw data and physical information on many of these transport-related costs are currently limited, for example, in the case of transport-related water pollution, and the transport-attributable portion of some costs like resource externalities may be challenging to determine with precision. However, the non-market

effects of economic activity, including transportation, are no less real than many of the costs that are conventionally counted. Quantifying these costs to the extent possible at least allows them to receive the attention they deserve in policy analysis.

GPI Atlantic used the Victoria Transport Policy Institute's (VTPI) work on full-cost accounting for transportation as a template for its own valuation work for this component of the Nova Scotia Genuine Progress Index, itemizing all but two of the VTPI costing categories in applying the method to transportation in Nova Scotia. The excluded categories are Equity and Option Value (also called Transportation Diversity Value, which refers to the value of having a variety of transportation options available) and Land Use Impacts (which include consideration of whether transportation decisions support strategic land use planning objectives). These categories were excluded because they are particularly difficult to quantify and monetize, and because Nova Scotia data in these areas are currently severely limited. It should be noted here that these omissions should not be taken to signify that these two categories are unimportant. It is hoped that improved data availability and methodological advances will allow their incorporation in future updates of the GPI transportation costs.

VTPI developed a set of "generic" cost values, all expressed as $ per vehicle-kilometre to allow for aggregation, based on an analysis of numerous studies undertaken throughout North America, and in some cases, in other parts of the world. VTPI recommends adjusting these values as appropriate to reflect specific regional and local circumstances more accurately. For example, vehicle operating cost values should be adjusted to reflect current fuel costs in the jurisdiction under study, and parking costs should be adjusted to reflect prevailing land and property values and construction costs in the area. Because of data limitations, the GPI study relied largely on VTPI cost values, except where more definitive local data were readily available. Again, any future updates of the GPI transportation costs should make further adjustments that account more precisely for specific Nova Scotian conditions, as further local data become available.

The VTPI costing framework primarily reflects passenger travel and does not include a complete set of freight transport cost values. While many of the default costs are transferable to freight transport, some adjustment is needed, and some of the key data needed for a proper analysis of freight transport in Nova Scotia are missing. For example, GPI Atlantic was unable to obtain records for tonne-kilometres of goods moved in Nova Scotia by rail, marine, or air transport. Without these data and specific freight transport cost values, it was not possible to calculate overall freight costs in the province. However, by using GPI Atlantic's previous work on the cost of greenhouse gas and air pollutant emissions attributable to freight transport in Nova Scotia, it was possible to include some cost estimates for road freight transport at least for this pair of cost categories.

In regard to cost accounting for accidents, GPI Atlantic used actual numbers of road transportation injuries and fatalities in Nova Scotia and then monetized these statistics by using the costing methodology adopted by Anielski Management Inc. for its study of traffic safety in Alberta.

Overall, therefore, GPI Atlantic generally followed the VTPI framework except in cases where this was not appropriate to Nova Scotia conditions, or was impossible due to a lack of data. Thus, VTPI provides cost estimates for 11 different transport modes, including walking, cycling, telecommuting, and various forms of automobile use and public transit. However, the GPI analysis does not, for example, include the VTPI "electric bus/trolley" category, since none of these are currently operating in Nova Scotia, nor do we include the "electric car" category, since there are very few such vehicles in the province, though both these transport modes are included in the VTPI analysis. Walking, cycling, and telecommuting are also not accounted for in the GPI analysis due to data limitations.

Based on a wide-ranging review of the literature on transportation costing studies, the VPTI derived cost estimates for each of 20 transportation impacts and for 11 different modes of passenger transportation. As noted, costs are expressed by VPTI on a per vehicle-kilometre basis (or on a per passenger-kilometre basis where appropriate) to allow aggregation using a common metric, and comparison between cost estimates for different impacts. GPI Atlantic examined 16 transportation impacts[114] for four different modes of motor vehicle transportation: automobiles, light trucks (including SUVs, minivans, and pick-up trucks), buses, and motorcycles. For most of the cost categories considered by GPI Atlantic, the generic VTPI per vehicle-kilometre estimates were multiplied by the number of kilometres travelled annually within Nova Scotia by each of the four passenger transportation modes, in order to derive the total cost estimates for each mode and each impact. Cost totals for each modal category were then summed to assess the total cost of each transport-related impact (congestion, traffic services, noise, etc.) attributable to motor vehicle passenger transportation in the province. The cost totals were then divided by the Nova Scotia population in order to assess per capita transportation costs by mode per year.

While GPI Atlantic was not able to conduct a full cost-benefit analysis of transportation in Nova Scotia, the focus on costs is not intended to ignore transportation benefits. A comprehensive monetization of benefits was simply not possible due to data and resource limitations. At the same time, cost analysis is often the basis for quantifying incremental benefits, and so the GPI transportation cost analysis may be seen as a necessary first step towards a full benefit-cost analysis. For example, improved mobility is often measured in terms of travel time cost savings, and improved safety can be measured based on reduced crash costs. Of course, transportation provides many benefits to users and society and in total these benefits are huge. However, the evidence also demonstrates that, beyond a certain optimal level, additional mobility provides declining and eventually negative marginal benefits. As a result, the greatest benefits to society may result from policies that increase transportation system efficiency and so reduce total vehicle travel.

Studies have also shown that non-automobile transportation services tend to provide special types of benefits, such as:

- ***Mobility and accessibility benefits***: benefits that result when improved transportation options allow people who are physically or economically disadvantaged to travel more and access more services and activities.

- ***Efficiency and cost reduction benefits***: benefits that result when improved transportation options allow people to shift travel to more efficient and affordable modes.
- ***Fitness and public health benefits***: benefits that result when more people are able to achieve the level of physical activity required for basic health (20-30 minutes a day of moderate physical activity, such as walking and cycling).

This categorization of benefits indicates the types of benefits that can be demonstrated by a costing analysis. In other words, a comparative assessment of costs and potential cost reductions by transport mode can point to the benefits attributable to particular types of transportation. Thus, a costing analysis does not exclude consideration of a wide range of transportation benefits.

The power and policy relevance of these cost estimates can be seen when looking closely at each cost, since each has the potential to point to financial incentives and penalties rewarding sustainable behaviour and penalizing unsustainable behaviour, and may be the basis of effective road pricing policies. For example, in 2006, GPI Atlantic estimated that traffic congestion costs Nova Scotia more than $12 million a year. In cities like London, England, congestion costs have been translated into policy whereby a significant congestion tax has kept cars out of central London and markedly improved both air quality and traffic flow—a perfect example of how pricing mechanisms can be used to change behaviour. In such a case, the cost of congestion can potentially be used to determine the dollar amount of a congestion tax.

Each cost has its own assumptions, with the accounts almost naturally producing highly conservative estimates, since they generally only count what can be quantified and therefore omit a wide range of less measurable costs. In the example described earlier, the congestion cost estimate cited above counted only lost time, excess gas burned, and excess greenhouse gases generated. GPI Atlantic was unable to assess the health costs of breathing in the fumes of idling cars stuck in traffic jams. Also, we counted only recurrent congestion occurring during the morning and late afternoon rush hours between 7am and 9am and between 4pm and 6pm—not at any other time of day or attributable to any other cause (snowstorms, accidents, road works, etc.). We only looked at passenger transportation costs, not costs to business attributable to freight delays, and we only counted congestion on major arterials, not on side streets. We defined congestion as conditions in which traffic moves at less than half the posted speed limit, so we excluded consideration of time lost if traffic slowed say to 27km/hour in a 50km/hour zone, and so on.

As noted earlier, this example of congestion cost estimates is given to illustrate the kind of assumptions and exclusions built into each cost calculation, and to indicate the GPI propensity to err on the side of conservatism—which is essential in introducing new accounting systems in order not to discredit them through possible exaggeration. Congestion constitutes a very small portion of total driving costs.

After each transport cost was separately assessed based on the kinds of considerations illustrated above, all costs were then summed to estimate total transportation costs. Per capita costs by mode of transport were also compared. Average road passenger

transportation costs (per vehicle-km) were then ranked by magnitude to indicate the aggregate distribution of costs for an average car. It was found that 39% of automobile costs were internal variable costs, 28% were internal fixed costs, and 33% were external costs.

As noted above, the transport cost categories used by GPI Atlantic are divided into three categories: *internal-variable* (costs borne directly by users according to how much they drive), *internal-fixed* (costs borne directly by users, but not significantly affected by how much a motorist drives), and *external* (costs imposed on others). In general, economists tend to consider costs that are fixed or external as *inefficient* (where efficiency requires that prices equal or at least amply reflect marginal costs), and costs that are external as *inequitable* (in that users should bear the full costs resulting from their consumption decisions unless a subsidy is explicitly justified for demonstrable societal benefit).

Overall, as seen in Table 5 below, the full cost of road passenger transportation in Nova Scotia in 2002 was between $7.2 billion and $14.8 billion ($2007), with the gap between the low and high cost estimates influenced largely by the use of different climate change models in assessing long-term greenhouse gas emission damage costs. It should be noted here that while the overall road transportation costs in Table 5 include diesel bus costs, buses account for roughly 2% of the total costs, thereby demonstrating that the overwhelming proportion of the cost estimates (98%) refer to private not public vehicle use.[115]

Table 6. Per capita road passenger transportation costs, Nova Scotia, 2002 ($2007)

Transportation impacts	Per Capita Costs			Total Costs (millions)	
	Internal-Variable	Internal-Fixed	External	Low	High
Vehicle ownership		$2,122		$1,983	$4,046
Travel time	$1,371			$1,281	$1,281
Vehicle operation	$1,167			$1,090	$1,233
Climate change			$776	$110	$5,181
Internal crash	$771			$721	$721
External parking			$562	$526	$526
Air pollution			$262	$62	$426
External crash			$385	$360	$360
Internal parking		$244		$228	$228
Resource externalities			$236	$221	$221
Land value			$139	$130	$130
Water pollution			$114	$106	$106
Road facilities			$109	$101	$101
Barrier effect			$80	$74	$74
Traffic services			$79	$74	$74
Noise			$74	$69	$69
Waste			$18	$17	$17
Operating subsidy			$18	$13	$13
Congestion			$14	$13	$13
Per Capita Costs	**$3,309**	**$2,366**	**$2,866**	**Totals:**	**$7,179** **$14,820**
Total Per Capita Costs		**$8,541**			

Notes:

- Congestion, Operating Subsidy, and the Barrier Effect costs are presented here for illustrative and comparative purposes only. They have been netted out of the aggregate numbers and are therefore not included in the totals presented above in order to avoid double-counting, since congestion and the barrier effect are actually sub-components of the travel time costs and operating subsidy costs are a part of vehicle ownership costs.
- The per capita cost estimates for climate change and air pollution are based on mid-range estimates of their costs, rather than on the low or high cost estimates. These costs also include both road freight costs and road passenger costs since data for those two cost categories are not available for passenger vehicles only. Per capita vehicle ownership and operating costs are based on the low-end estimates for those categories.
- Low and High estimates for climate change and air pollution are calculated by using different costing methods than the other cost categories. For details on these methods, please see The GPI Transportation Accounts: Sustainable Transportation in Nova Scotia. 2006. Available at http://www.gpiatlantic.org/pdf/transportation/transportation.pdf.
- These cost totals include all four modes of transportation (automobiles, vans/SUVs/light trucks; diesel buses, and motorcycles). Diesel bus costs account for roughly 2% of the total costs. For more details on these cost breakdowns by mode of transport please refer to Table 68 in the GPI Transportation Accounts.

Overall, these results indicate an inefficient, unsustainable transportation system where externalities conceal the full costs of private vehicle use to society.[116] The results provide the basis for potential road pricing policies that may eventually ensure that driving pays its true costs, which will in turn improve the efficiency of the transportation system as a whole.

At first glance, the GPI transportation cost results might seem discouraging, because they identify such a variety of problems and unsustainable trends. However, there is actually a very positive message that emerges from the evidence and particularly from the identification and compilation of full transportation costs. The GPI analysis does indicate that the current transportation system is distorted in various ways that result in economically excessive motor vehicle travel (that is, more motor vehicle travel than would occur in an efficient market), which in turn is harmful in a number of ways. But what this means is that that market reforms which correct existing distortions can provide a wide range of economic, social, and environmental benefits that will enhance wellbeing, produce cost-savings, improve environmental quality, and boost long-term prosperity.

For example, improved walking and cycling conditions, improved public transit services, and more efficient pricing can help reduce traffic congestion, road and parking facility costs, consumer costs, accident risk, energy consumption, and pollution emissions, while improving public fitness and health, increasing beneficial economic activity, supporting strategic land use objectives (such as reducing sprawl), and even supporting specific objectives such as urban redevelopment, tourism activities, and heritage preservation.

A wide range of tested and proven policy and planning reforms can help provide such benefits. The GPI report dubbed these reforms "Win-Win Transportation Solutions" because each intervention achieves multiple benefits across economic, social, and environmental dimensions. They are cost-effective and technically feasible market reforms that help solve transportation problems by increasing consumer options and removing market distortions that encourage inefficient travel behaviour. Although their individual impacts may appear modest, their combined benefits can be substantial.

If fully implemented to the degree that is economically justified, Win-Win Solutions can provide very significant total benefits. They are "no regrets" measures that are justified regardless of uncertainties about global warming or other environmental and social impacts. They therefore represent true sustainability strategies, as opposed to strategies that help address one or two planning objectives, but exacerbate other problems by increasing total motor vehicle travel and sprawl. Please see Table 6 in the GPI transportation study (http://www.gpiatlantic.org/pdf/transportation/transportation.pdf), which lists examples of these strategies and reforms in summary form. Each of these options has been described in detail in the literature, with examples of best practices.[117]

5.4 Solid Waste Resource Accounts

The GPI Solid Waste Resource Accounts provide further evidence that the internalization of externalities does not necessarily lead to gloomy scenarios, penalties, and additional user costs, as a superficial reading of the transport cost results might initially imply. On the contrary, a full-cost accounting system that includes social and environmental benefits and costs can point to strengths and advantages that are entirely unacknowledged in conventional accounting systems. This example also illustrates how different and even contrary messages can be communicated by the two different accounting systems, and that it

is the conventional accounting system that may misleadingly send overly pessimistic signals to policy makers and the general public.

In 1997, Nova Scotia implemented a leading-edge solid waste-resource strategy that included very high rates of composting and recycling. In less then five years, the province went from almost zero diversion of waste from landfills to 50% diversion—the highest rate of any state or province in North America.

From a conventional accounting perspective this new system looked costly, with operating and amortized capital costs increasing from $48.6 million ($53 per capita) in 1997 to $72.5 million ($77 per capita) in 2001—an increased cost of $24 million or $25 per capita for implementing changes that included kerbside pick up and sorting of recyclables and organics, and provision of compost bins for all households. After tabulating these costs, the conventional accounts stop there.

From a full-cost accounting perspective, however, when the new Nova Scotia solid waste-resource system was compared to the old pre-1997 system, it produced net savings of at least $31.2 million. This translates into net savings of $33 a year for each Nova Scotian, as opposed to the cost of $25 indicated in a conventional comparison of the operating and amortized capital costs of the two systems. Let's look at why:

In the GPI accounts, the total benefits of the 2001 system were found to range from $79 million (low end) to $221 million (high end), or between $84 and $236 per person, with the breadth of the range again determined mostly by the assumptions built into different climate change and air pollution damage cost estimates. It should be noted that the $31.2 million overall net benefit estimate is based on the low end estimates, and may therefore be considered highly conservative. The benefits considered in the GPI accounts included:[118]

- $3.3 – $84.3 million in avoided climate change damages due to greenhouse gas emission reductions
- $9.5 – $67.4 million in avoided health and environmental damages due to air pollution reductions
- $18.8 million in extended landfill life due to the high rates of diversion
- $28.6 million in energy savings from recycling compared to costs of production from virgin materials
- $6.5 – $8.9 million in employment benefits through new jobs created
- $1.2 – $1.9 million in avoided liability costs
- $1.1 – $1.7 million in export revenue of goods and services
- $187,000 in additional tourism revenues as delegations from around the world came to Nova Scotia to study the new solid waste-resource system

To break down just one of these categories—energy savings—by way of example, the evidence indicates a saving of 2.4 million Btu for every tonne of glass recycled compared to production of glass from virgin materials; a saving of 8.5 million Btu for every tonne of paper recycled; a saving of 20.1 million Btu for every tonne of plastic recycled; and a saving of 166.9 million Btu for every tonne of aluminium cans recycled.

Compared to these benefits, the total costs of the 2001 solid waste-resource system were $96.6 to $102.7 million:

- $72.4 million in operating and amortized capital costs
- $14.3 million for the beverage container recycling program
- $2.7 million for the used tire management program
- $1.6 million in Resource Recovery Fund Board operating and administrative costs (the non-profit agency created to run and oversee the new system)
- $5 – $9.5 million to increase citizen participation in composting and recycling through education and other programs
- $220,000 – $1.8 million in nuisance costs (including the extra time required by households to sort their garbage)

When the costs and benefits were carefully compared to the pre-strategy costs and any potential double-counting eliminated, the Nova Scotia Solid Waste-Resource Strategy was found to produce a considerable net savings, both in monetary and non-monetary terms. Despite increased operating and amortized capital costs, the new system provided a net savings of between $31.2 million and $167.7 million compared to the operating and amortized capital costs of the old system. In keeping with GPI Atlantic's propensity to err on the side of conservatism, we only cite the low-end estimate of $31.2 million in our communications and public reporting of results.

To illustrate the relationship between indicators and accounts, the GPI analysis also reached conclusions on the indicator front—namely that Nova Scotia had become a leader both internationally and nationally in solid waste diversion based on a wide range of international comparisons, and that the accessibility, comprehensiveness, and levels of waste being composted and recycled had all vastly improved since the introduction of the new Solid Waste-Resource Strategy. Following are examples of indicator results that were deemed to show "genuine progress" in this area:

- Diversion of waste from landfills increased from less than 5% before implementation of the Strategy to 50% within less than five years;
- Access to curbside recycling in Nova Scotia jumped from less than 5% in 1989 to 99% today;
- 76% of Nova Scotia residents now have access to curbside organics pickup.[119]

Sadly, Nova Scotia's waste diversion rate has been decreasing since 2000-01, dropping to 34% in 2005/2006 and then increasing slightly to 36% in 2006/2007. According to the Nova Scotia Department of Environment, this decline in waste diversion has been due primarily to an increase in the amount of waste being disposed, which according to GPI analysis was, in turn, due to rising GDP and consumption. If that analysis is correct, the current recession should trigger a further reduction in waste generation and disposal.

5.5 Forest Accounts

Our natural world provides and performs a wide range of ecological, social, and economic functions, providing people with both direct goods and services like wood, food, and recreational opportunities, and indirect goods and services that support life and enable human society and the economy to function. For example, an intact, optimally functioning forest ecosystem provides, at no cost, a long list of vital services including climate regulation, habitat and watershed protection, flood and natural pest control, prevention of soil erosion, formation of topsoil, nutrient recycling, and long-term storage of carbon. It also provides us with beauty and a place to relax and rest our minds.

Preservation of the capacity of nature to yield such a full range of economic, ecological, social, and cultural benefits is sometimes called "holistic" forest use because this approach seeks to optimize the full range of forest functions. It also recognizes that long-term timber productivity is itself dependent on the preservation of healthy forest soils, age and species diversity, and other vital non-timber functions. Thus, a holistic indicator system defines a healthy forest as one that has the capacity to perform its full range of functions optimally, including soil and watershed protection; sequestration of carbon; provision of timber, habitat for other species, and cultural services for First Nations, etc.

This approach and measurement system contrasts markedly with the current and historical "industrial" approach to forestry in Nova Scotia, in which the primary focus of forest management is to harvest enough wood fibre to meet all available and desired markets. "Sustainability," in an industrial model, is largely measured in terms of how much forest land is regenerated to commercial species. Wildlife, water resources, biodiversity, and ecosystem services receive only token consideration, if at all. When a forest is degraded, its ability to provide such vital "free" ecosystem, social, and cultural services is compromised. Such services may be lost irreplaceably or diminished in effectiveness, or efforts may be made to replace them through often expensive feats of human engineering.

An accurate accounting system would recognize and count such losses as depreciation of natural capital, just as a factory owner currently counts a depletion or degradation in plant and equipment as depreciation of produced capital. Conversely, a full cost accounting system explicitly values the full range of both market and non-market goods and services provided by forests.

In 1997, an international team of scientists headed by Robert Costanza of the Maryland Institute of Ecological Economics conservatively estimated the average annual value of many of the world's key ecosystem services to be $33 trillion—almost twice the total annual GDP of all the countries on earth. It should be noted, however, that putting a price tag on the value of forests is highly problematic, in large part because there are many forest values that simply cannot be quantified.

Despite the limitations of monetization, however, GPI Atlantic does use the technique to make the intrinsic values of natural forests more clearly visible, and to ensure that these values are duly and properly considered and taken into account in the policy arena. In other words, monetization can be seen as necessary as long as the true values of standing natural

forests are ignored by policy makers and so long as vital non-market forest values continue to be assigned a value of zero in conventional accounting mechanisms.

Unfortunately, a full-cost accounting valuation of Nova Scotia's forests is not yet possible. Therefore—unlike the previous sections of this chapter that demonstrate how actual monetary values and results are derived in the GPI full-cost accounting system—this section demonstrates the process of moving from physical indicators towards eventual economic valuations in an area where data and methodological limitations do not yet allow the latter.

A fundamental principle of GPI full-cost accounting methods is the recognition that non-market economic valuations are secondary or derivative processes, which require a firm foundation in physical evidence. Currently, the basic physical data for a full-fledged economic valuation of Nova Scotia's forest services are not available. Therefore, the forest component in the GPI has focussed on assembling baseline physical data that can provide a basis for a more complete economic valuation at a later stage. As examples of the kind of physical data needed, the following forest ecosystem functions have been identified by de Groot (1992, 1994) as the basis for such forest valuation.[120]

Table 7. Forest ecosystem functions for forest valuation

Regulation Functions	Indicators
Regulation of the local and global climate	- carbon sequestration, temperature,
Regulation of runoff and flood-prevention	- hydrological cycle
Water catchment and groundwater recharge	- biomass rainfall interception
Prevention of soil erosion and sediment control	- tree height structure and density, root systems, leaf area, soil porosity and organic matter, interception
	- soil interception, tree structure, sedimentation
	- organic cycling, litter decomposition
Formation of topsoil and maintenance of soil-fertility	- photosynthesis, plant biomass
Fixation of solar energy and biomass production	
Storage and recycling of organic matter	- ecologically balanced ecosystem populations
Storage and recycling of nutrients	
Regulation of biological control mechanisms	- habitat, streams, wetlands
Maintenance of migration and nursery habitats	- habitat, wildlife, plants, fungi, microorganisms
Maintenance of biological and genetic diversity	
Carrier Functions	**Indicators**
Wildlife habitat	- structural diversity, age diversity, food sources, nests and dens
Recreation and tourism	- attractiveness, uniqueness, natural diversity, 'naturalness' (nature study, sports, relaxation)
Nature protection	- reserves, parks
Production Functions	**Indicators**
Oxygen	- photosynthesis, respiration, decomposition
Water (drinking, irrigation, industry etc.)	- water quality, runoff
Food resources	- berries, mushrooms, nuts
Genetic resources	- ecosystem & species diversity, population viability
Medicinal resources	- medicinal plants and fungi, biochemical properties
Raw materials for building, construction, industry	- timber, pulpwood
Fuel and energy	- fuel wood
Information Functions	**Indicators**
Aesthetic information	- aesthetic quality, landscape, vegetation cover
Spiritual and religious information	
Cultural and artistic inspiration	- spiritual enrichment, continuity, religion
	- heritage values, archaeological sites, old-growth
Scientific and educational information	- understanding and knowledge of functions of natural systems, nature study, environmental education, applied scientific research, new medicine discoveries, natural process monitoring

Sources: de Groot, R. S. 1992, 1994 (see endnote #119 for reference details).

Once GPI researchers identified the key functions performed by a healthy forest ecosystem, as defined by the scientific literature, they assessed the health of Nova Scotia's forest ecosystem according to its capacity to perform these multiple functions optimally. Any loss in that capacity—through depletion, conversion (for development purposes, for example), or unsustainable harvest practices—is described as a depreciation of natural capital and a diminution of its asset value.

The next step is the selection of appropriate indicators—with particular emphasis on those key indicators that may signify capacity to perform multiple functions. In the case of forests, GPI Atlantic found that age structure and species composition constituted such key indicators of forest health, since they pointed to the capacity of forests to protect soil quality and watersheds, provide a wide range of vital ecosystem services, and produce clear, wide-diameter timber that fetches higher market prices. For this reason, GPI researchers examined historical forest inventories in order to assess the extent to which the age and species diversity of Nova Scotia's forests were being maintained, improved, or diminished over time. Again, it must be emphasized that these indicators were highlighted because each provided multiple benefits relating to several key forest functions.

Thus, the science indicated that older forests with diverse age, height, and species diversity were more effective than younger forests at storing carbon, providing resilience to insect and disease infestation, providing habitat for a wide-range of forest-dependent flora and fauna species, preventing soil erosion, and producing more valuable lumber.[121] There is also mounting evidence that, by enhancing soil quality, age and species diversity improve timber productivity.

Similarly, GPI researchers found that species diversity is also an indicator of multiple vital forest functions and enhanced forest resilience. During a major spruce budworm infestation in Nova Scotia in the 1970s, for example, mixed hardwood-softwood forests had far lower rates of spruce defoliation than single-species softwood plantations, largely because the hardwoods provided habitat for bird species that were natural predators of the budworm—indicating that we interfere with nature's intricate balance to our peril.

In addition to these two key indicators—age structure and species diversity—the Nova Scotia Genuine Progress Index (GPI) also generally adopted the criteria and indicators of the Canadian Council of Forest Ministers and the Montreal Process[122] in explicitly addressing the following forest ecosystem services:

- biological diversity and genetic resources;
- carbon storage and sequestration for mitigation of global climate change;
- soil erosion control and sediment retention;
- water supply and regulation;
- nutrient cycling, biological control, and other ecosystem services;
- provision of timber and employment;
- recreation and the protection of natural and cultural heritage, and other social, economic and cultural benefits.

Thus, the physical indicators highlighted in the GPI Forest Accounts were[123]:

Conservation of biological diversity

Ecosystem diversity

- Forest age class distribution
- Representation of forest types in protected areas
- Protected areas as a percentage of total provincial landmass
- Level of fragmentation of forest ecosystem components

Species diversity

- Number of known forest-dependent wildlife species
- Number of known forest-dependent species at risk
- Population levels and changes over time for selected tree species

Impact of disturbance and stress on forest ecosystem health and productivity

Incidence of disturbance and stress

- Annual removal of wood products compared to the volume determined sustainable
- Harvest methods
- Area and severity of insect attack, disease infestation, and fire damage
- Rates of pollution deposition

Ecosystem resilience

- Percentage of area successfully naturally regenerated and artificially regenerated
- Area and percent of forest land with diminished biological components indicative of changes in fundamental ecological processes

Conservation of soil and water resources

Soil quality

- Control of soil erosion and linkages with fisheries
- Area and percentage of harvested area having significant soil erosion
- Area and percentage of harvested area with significantly diminished soil organic matter and/or changes in other chemical properties
- Area and percentage of harvested area with significant compaction, displacement, puddling, or changes in soil physical properties resulting from human activities

Water quality

- Water quality as measured by water chemistry, turbidity
- Trends in timing of events in stream flows from forest catchments
- Percent of stream kilometers in forested catchments in which stream flow and timing have significantly deviated from the historic range of variation
- Changes in the distribution and abundance of aquatic fauna
- Percentage of water bodies in forest areas with significant variance of biological diversity from the historic range of variability

Percent of water bodies in forest areas with significant variation from the historic range of variability in pH, dissolved oxygen, levels of chemicals (electrical conductivity), sedimentation, or temperature change

Only after tracking trends in these physical indicators of forest function—with units of measurement in the physical terms appropriate to each indicator—is it possible to proceed properly to the economic valuation step. As noted, the economic valuations in the GPI accounts are always secondary—derived from and ultimately pointing towards the more primary physical indicators of function. In this way, the intent is to use the GPI economic valuations to draw the attention of policy makers to the fact that we presently (and misleadingly) count the depletion of our natural wealth as economic gain in the conventional economic accounts.

In the end, of course, it would be much more desirable if the physical indicators themselves were used for policy purposes, since they are far more direct measures than the secondary economic valuations, which are essentially layered over the physical indicators. But in a world still dominated by economic and material priorities, we are not yet at the stage where physical indicators alone will effectively influence policy. The language of economic valuation must therefore still be used for communication purposes, and it is GPI Atlantic's recommendation that the forest measurement work continue to move towards a more complete economic valuation of Nova Scotia's forests than is presently possible.

The close relationship between indicators and accounts—and the dependence of the latter on the former—can be illustrated in some of the results of the GPI forest accounts to date. For example, the data reveal a sharp decline in the age class and species composition (diversity) of Nova Scotia's forests over time. Over the last two centuries the Province's forests were heavily logged, so that by the time of Nova Scotia's first systematic forest inventory in 1958, the forests were by no means pristine. In fact, in 1958, the Department of Lands and Forests reported that decades of "high-grading" the larger trees to meet the demand for sawlogs had not only changed the forest structure but had "nearly exhausted" the supply of larger trees, making it "necessary to accept smaller and smaller stock."[124] In other words, nearly 50 years ago, government documents were already warning that forest conditions had deteriorated considerably.

However, even within the 50-year period for which systematic forest inventory data are available, there has been a sharp decline in valuable tree species such as white pine, eastern hemlock, yellow birch, and oak. Since 1958, forests have also gotten progressively younger, largely as a result of excessive clear-cutting, with only 1.5% of all provincial forests now more than 80 years old, compared to 25% in 1958. True old-growth forests have virtually disappeared from Nova Scotia, along with many old-growth forest-dependent species of flora and fauna.[125]

This evidence on the dramatically changing age structure of Nova Scotia's forests (an indicator) allows at least a partial economic valuation as a next step. Thus, one forest function that can now be monetized is carbon storage capacity, since prices have now been placed on carbon emissions in accord with climate change models forecasting long-term damages, and with carbon trading prices. The carbon storage indicators and corresponding

scientific evidence tell us that Nova Scotia's forests presently store an estimated 107 million tonnes of carbon—38% less than the province's older forests 50 years ago.

Applying climate change damage costs from the literature to this physical carbon storage evidence, GPI Atlantic's economic valuations tell us that, at just over $20/tonne (based on conservative climate change models), this 107 million tonne carbon storage capacity will avoid an estimated $2.2 billion in climate change damage costs. Scientific studies, however, indicate that the conversion from old-growth to young forests produces a net loss of carbon to the atmosphere, even when the carbon uptake of new forests is taken into account. Based on the 1958 Nova Scotia forest inventory (the first available in the province), it was estimated that the carbon stored in provincial forests 50 years ago would have been worth $3.5 billion. Thus, it can be seen that the increased cutting and loss of old growth and mature forests since 1958 has drastically reduced Nova Scotia's carbon storage capacity by 38%, costing an estimated $1.3 billion in lost value.

Carbon storage is a 'stock' value and shows a substantial net loss of capacity in Nova Scotia's forests. However, a 1990-2004 carbon balance flow analysis conducted by the Canadian Forest Service (CFS), comparing carbon emissions due primarily to harvesting and natural disturbances with carbon sequestration due primarily to new planting, found a positive mean annual change of 1.6 million tonnes of carbon being removed from the atmosphere and captured in Nova Scotia's forest environment. This indicates that, overall, between 1990 and 2004, the province's forests remained a net sink rather than source of carbon, though the most recent data showed a reversal of that trend. According to the CFS study, the slight negative trend in ecosystem carbon flows in the last year of the analysis was caused primarily by the current level of harvest and natural disturbances such as fire and the damage from Hurricane Juan.[126, 127, 128]

Needless to say, this flow analysis does not contradict the reality that Nova Scotia's forests have lost substantial carbon storage capacity in stock terms due to the loss of old forests, and have thus depreciated in value from a carbon storage perspective. Indeed, presented first in indicator terms and then from an accounting perspective, the two-volume GPI Forest Accounts found that excess clear-cutting and the loss of natural age class and species diversity in Nova Scotia have resulted in:

- The loss of valuable tree species;
- The loss of wide diameter and clear lumber that fetches premium market prices;
- A decline in resilience and resistance to disease and insect infestation;
- A diminution of wildlife habitat, accompanied by declines in forest-dependent flora and fauna species, including some fish species;
- A decline in forest recreation values, which in turn has lessened the potential for nature tourism;
- A decline in forested watershed protection, contributing to a 50% drop in shade-dependent brook trout;
- Soil degradation and leaching of nutrients that can affect future timber productivity;
- A substantial decline in carbon storage capacity and an increase in biomass carbon loss in the most recent time period for which data are available;

- An overall decline in essential forest ecosystem services.

In accounting language, GPI Atlantic concluded that these losses represent a substantial depreciation of a valuable natural capital asset. It is important to note that the depreciation of a capital asset can occur as a result of both depletion (as in the loss of equipment or machinery in a factory, or over-harvesting a forest) or degradation (as in a machine in disrepair, or loss of age and species diversity in a forest). While not all aspects of depreciation can be measured in monetary terms, the results above and in the GPI Forest Accounts indicate that value can also be described and assessed in non-monetary terms. Thus, while the GPI Forest Accounts do not present a full economic valuation of Nova Scotia's forests in monetary terms, they do move beyond indicators to an accounting and valuation approach that draws specific conclusions, based on strong scientific evidence, on changes in natural capital stock values.

A number of positive opportunities and policy options arise from an honest appraisal and analysis of these results. In other words, as soon as the spotlight is shone on any hidden information, viable policy options and solutions naturally present themselves.

To this end, the second volume of the GPI Forest Accounts highlighted working case studies of the most sustainable and viable forestry practices that GPI researchers could find both in Nova Scotia and elsewhere in North America—as models for successful woodlot management and forest industry development in the province. The analysis demonstrated that selection harvesting and uneven-aged forest management could increase a wide range of forest values, produce more and higher value timber, *and* provide more jobs than the dominant clear-cutting methods used in 94% of present forest harvesting in the province. The study also found that a shift to greater value-added production could create far more jobs per unit of biomass harvested and four times the value per cubic metre harvested than the current emphasis on pulp and paper production. The analysis found that restoration forestry practices constitute a sound investment in natural capital value, and it examined the potential of incentives such as restructured silviculture credits to encourage such sustainable practices, as well as changes to taxation policies that currently encourage the liquidation of forested lands.

In sum, the point of all the number-crunching is to provide relevant and useful evidence for informed decision making.

Value of ecosystem services

As previously noted, using replacement and contingent valuation methods, Costanza et al. (1997) estimated that the value of the world's ecosystem services in 1994 were worth at least US$33 trillion (1994$) per year. This amount represented almost twice the global gross national product (GNP) of approximately US$18 trillion (1994$) per year.

Costanza's team acknowledged, at the time, that there were many "conceptual and empirical problems inherent in producing such an estimate."[129] However, the authors stated that the exercise was "essential" in order to:

- Make the range of potential values of the services of ecosystems more apparent;
- Establish at least a first approximation of the relative magnitude of global ecosystem services;
- Set up a framework for their further analysis;
- Point out the areas most in need of additional research;
- Stimulate additional research and debate.[130]

Costanza and his team also pointed out that the estimates presented were "minimum values" and would likely increase with "additional effort in studying and valuing a broader range of ecosystem services; with the incorporation of more realistic representations of ecosystem dynamics and interdependence; and as ecosystem services become more stressed and 'scarce' in the future."[131]

As part of this massive ecosystem contribution to human society, temperate and boreal forest ecosystems are estimated to contribute a global flow of services worth at least US$894 billion per year (1994$).[132] This is equal to 2.7% of the total value of global ecosystem services estimated by Costanza and his associates, or 5% of the total value of the world's human economy. This estimate is based on the following forest functions: climate regulation, soil formation, waste treatment, biological control, food production, raw materials, recreation, and cultural goods and services.

The estimates by Costanza and his associates are highly conservative as they exclude 9 out of a total of 17 identified key ecosystem services attributable to forests, due to lack of data and information sources. Thus, values were not provided for gas regulation, disturbance regulation, water supply, water regulation, soil erosion control, nutrient cycling, pollination, habitat, and genetic resources. Some critics have argued that the estimates of Costanza et al. (1997) are actually a vast underestimate, understating ecological service values by several orders of magnitude.

Counting only the eight ecosystem services considered by Costanza and his associates (1997), temperate and boreal forests were found to contribute at least US$302/hectare/year (1994$) in ecosystem services.[133] When converted to Canadian funds and updated using the Consumer Price Index (CPI), this is equivalent to roughly $550/hectare/year (CAD$2008). Although these calculations were not explicitly designed to be extrapolated for environmental valuation purposes at the regional level, the benefits valued in these assessments are nevertheless indicative of the values and the vital information missing from conventional resource accounting systems.

Until there is adequate information on the wide range of non-market forest values at the provincial level, and until there are consistent data measured and monitored on a regular basis to value Nova Scotia's forest goods and services fully, the assessments and methods used by Costanza et. al. (1997) can provide at least a temporary valuation substitute.

In the GPI forest accounts, data limitations also did not permit an aggregation of the value of forest services to arrive at a composite estimate of the full value of Nova Scotia's forests.

When possible, the economic benefits of various forest functions are described, as in the carbon storage example provided above, but these various economic benefits have not been summed to any cumulative total. The estimate adapted from Costanza et al. (1997) (Table 7 below) is a partial aggregation of the value of seven forest ecosystem services that might be applicable to Nova Scotia forests. However, this is presented here as a stand-alone extrapolation for illustrative purposes, and has not been integrated with the other evidence presented in the GPI forest accounts.

The monetary value of forest ecosystem services assessed by Costanza et al. (1997) is applied to Nova Scotia's forests, using the benefits transfer method, simply by multiplying the per hectare economic benefits estimated by Costanza et al. by the total area of forestland in the province. For the reasons noted above, and because the values have not been modified to account for Nova Scotia specific conditions, the estimates in Table 7 below should not be taken as literal values for Nova Scotia forests, but are provided here and in the GPI forest accounts simply to demonstrate how vast, extensive, and valuable forest goods and services are to the province.

Table 8. Valuation of Nova Scotia's non-timber forest ecosystem goods and services, based on Costanza et al., 1997 (CAD$2008)

Ecosystem Service	Monetary Value ($2008/ha/yr)	Total Value for NS ($2008 millions/year total forest[134])
Climate regulation	$159.74	$675.9
Soil formation	$18.15	$76.8
Waste treatment	$157.93	$668.3
Biological control	$7.26	$30.7
Food production	$91.42	$386.9
Recreation	$65.35	$276.5
Cultural	$3.63	$15.4
Total (not including raw materials)	**$503.48**	**$2,130.5**

Notes: *Monetary value estimates are based on replacement values and contingent valuations. Conversion of USD to CAD is based on the inter-bank rate average for 1994 (1.36581). Source: Costanza et. al. 1997.

All values have been updated to 2008 constant dollars using Statistics Canada's Consumer Price Index (CPI).

Extrapolating from the global estimates of Costanza et al., the province's forests could therefore be assessed as contributing at least $2.1 billion per year (2008$CAD) in non-timber ecosystem goods and services to society.

As noted above, this estimate excludes 9 of the 17 ecosystem services that were not valued by Costanza et al. due to lack of data. Also, raw materials (timber) are not included in the above estimate, since these are separately accounted for both in GDP-based estimates and in the GPI forest accounts (both in aggregate and per unit of biomass harvested). If all 17 ecosystem services described by Costanza et al. were included in the estimate, the economic

value of forest ecosystem services in Nova Scotia could well be double the estimate given above, likely exceeding $4 billion annually.

A proper regional valuation would need to examine each of the assumptions in Costanza et al. carefully, and to make the appropriate adjustments for regional conditions. Resources did not allow such an analysis for the Nova Scotia GPI forest accounts. But it might be speculated, for example, that the food production value of Nova Scotia's forests would be less than that of some tropical forests that produce abundant edible fruits and nuts, requiring the Costanza values to be adjusted downward for that measurement. Other assessments might be adjusted upwards, depending on a careful analysis of forest structure, type, and conditions. Nevertheless, the omission of several vital ecosystem functions of particular importance to Nova Scotia (such as watershed protection) make it likely that the aggregate estimate in Table 7 above is still highly conservative.[135]

There are many other methodological issues raised by such valuations. While the Costanza estimates are averages, and thus take into account different productive capacities of different forest segments, a more careful analysis would consider the different marginal values of different forest areas. For example, one particular hectare may have a very high recreational value, while another may have a minimal recreational value.

Further, a careful provincial analysis would also consider the *comparative* ecosystem values of Nova Scotia forests over time. In other words, if the $2.1 billion estimate, derived from Costanza et al. in Table 7 above, represents the current value of forest ecosystem functions in the province, what would these services have been worth 40 years ago or 100 years ago when Nova Scotia's forests had a very different age and species structure. To answer this question, the assumptions of Costanza's scientific team would have to be closely analyzed to assess the quality, structure, and composition of the forests to which each estimate applies. Clearly a degraded forest provides fewer and different ecosystem services than a healthy forest, and a single age single species plantation does not provide the same ecosystem services as a diverse old growth forest. Again, this preliminary GPI analysis has simply used the final results of the Costanza team without adjusting the estimates for the quality of the forests at a particular point in Nova Scotia's history.

Again, it bears repetition that this frank acknowledgement of the considerable limitations of this very preliminary extrapolation from the Costanza et al. study should not lead to any temptation "to throw the baby out with the bathwater." Going beyond GDP and conventional market measures to value natural capital, along with the benefits of non-market goods and services hitherto regarded as 'free', is now widely accepted as the essential way of the future by mainstream institutions, including the United Nations, World Bank, OECD, and Statistics Canada (in, for example, its new Canadian System of Environmental and Resource Accounts). The Costanza et al. study is a very important contribution to such valuation efforts, which now requires further refinement, and its results should be used to spur new developmental work in this vital area.

5.6 Paid Work Hours: costs of work stress and unemployment

The more hours we work for pay, and the less free time we have, the more the economy—as currently measured—will grow, and the "better off" we are supposed to be. Free time and family time count for nothing in our conventional economic accounts. Stress, from overwork, or underwork, is also good for the economy, to the degree that the purchase of drugs used to manage stress further contributes to GDP growth. As well, the economy can grow even as the quality of work—which supposedly "drives" the economy—deteriorates, as job insecurity grows, as temporary and 'contingent' work replaces 'permanent' work, and as capital-intensive 'jobless' growth sheds jobs.

To overcome some of the shortcomings of conventional labour force indicators that conceal such trends, the Genuine Progress Index attempts to go beyond the employment rates conventionally used to assess progress by including additional measures that assess the quality, nature, and type of work and that account for satisfactory work-life balance as a key ingredient in quality of life. Thus, the Genuine Progress Index also examines paid work in its relation to unpaid work, free time, economic and financial security, time stress, and a wide range of societal benefits and costs. In her seminal studies on the Great Depression, for example, Marie Jahoda found that paid work performs a wide range of functions beyond income generation—including giving time structure to a day, enhancing self-esteem and sense of purpose, and providing social contacts and interaction.

From this wider perspective, GPI Atlantic selected a broad range of key employment indicators based on the existing research and literature, of which there was an abundance. To give just one example, one key indicator chosen was hours polarization, which has been demonstrated by Statistics Canada to contribute to income and social inequities, and thus to negatively effect wellbeing. Based on Statistics Canada data, the GPI Atlantic work hours study reported that the 1990s saw an increased polarization of work hours in Canada and the decline of the standard workweek. During that period, larger numbers of Canadians worked longer hours, while at the same time larger numbers were unable to get the hours they needed to make ends meet. This trend is invisible in conventional employment statistics that report only aggregates, averages, and overall employment and unemployment rates. In fact, in the economic growth-based statistics conventionally used to measure progress, long work hours are counted as a contribution to wellbeing because they usually translate into increased output, income, and consumption.

As evidenced in the research literature, however, there are serious economic, social, and environmental costs associated both with increased output and with long work hours. Longer work hours may exacerbate stress, produce adverse health outcomes, reduce time with family and friends, and diminish quality of life, while increased output may place excessive demands on our natural resources and on the earth's waste absorption capacity. At the same time, unemployment and underemployment—the opposite end of the spectrum—waste precious human resources and also produce substantial social, human, health, and economic costs. In sum, hours polarization may produce serious costs that remain invisible in the conventional economic accounts.

After employment-related indicators were selected according to their importance for wellbeing and their capacity to assess progress according to as wide a range of social, economic, health, and environmental variables as possible, the next step was to collect the data—from Statistics Canada sources to the extent possible—and to assess trends for each indicator to determine whether there had been improvement or not over time. While the GPI work hours study pointed to a number of existing data gaps, the employment component of the GPI nevertheless remains one key area where data are relatively plentiful, with long time series available through Statistics Canada's Labour Force Survey, which has collected fairly consistent and comparable data on paid work hours since 1976.

Following reporting on trends, the next GPI developmental step is economic valuation. For many of the work hours indicators, related economic valuations were not possible, simply because there was not enough quantitative information available for this purpose. For example, we know from the extensive literature on the subject that the financial cost of decreased productivity in the workplace due to work-related stress and overwork-induced fatigue is so enormous as to be virtually incalculable. Specific cost estimates associated with these losses due to work stress and fatigue were cited in the literature and in the GPI report on the subject, but these direct and indirect costs tended to be associated with work stress in general and were generally not specific to stress resulting from long or short work hours. As well, there is no agreement on an objective cut-off point in work hours and work demands after which stress-related costs are triggered, and there are no viable methods to quantify the more subjective elements of work stress.

Because of the complexity of these issues, the interaction of a number of factors, and the difficulty of confirming direct one-way causal relationships, it is very challenging to estimate accurately 1) the specific health costs resulting from stress that are directly attributable to long work hours and 2) the lost productivity associated with stress-related absenteeism that may also result specifically from working too many hours.

In other words, the costs cited in the literature do not represent the costs of long hours of work specifically, but of work stress in general. However, as noted earlier, excessively long hours have been demonstrated to be one significant contributing factor to work stress, but by no means the only one. Thus, long work hours have been shown particularly to exacerbate stress when combined with lack of control, repetitive routine, lack of support, and other negative work conditions, even though the proportion of stress-related costs specifically attributable to these long work hours has not been reliably determined.

Therefore, GPI Atlantic was only able to report cost estimates for work stress in general—often extrapolated to Nova Scotia from the research literature in the field—with results revealing that work stress is very costly indeed. As well, the GPI study cited evidence indicating that long hours and work overload contribute significantly to this work stress in order to illustrate that long work hours must be seen as carrying hidden potential costs, rather than being uncritically assessed as being 'good for the economy', as measures of progress based on conventional accounting mechanisms implicitly assume.

Despite the present difficulty of quantifying the costs of excess work hours, there are very important new advances being made in this field that should allow improved economic

valuations in the future. For example, as part of its General Social Survey time use surveys, Statistics Canada now administers 10-question time stress surveys, the results of which can be correlated with objective work hours data from both labour force and time use surveys. Thus, it is not surprising that full-time working mothers are the most time-stressed demographic segment, and that they also work longer hours than any other population group—75 hours a week on average when paid and unpaid work are combined.

As well, new costing studies are providing vital new information. In a wide-ranging review of the literature, for example, the *American Journal of Health Promotion* found stress to be the most costly of all modifiable health risk factors.[136] Further analysis will be required to assess the proportion of such stress costs attributable to work stress and to excessive work hours in particular. A landmark Statistics Canada study has already found that longer work hours increased the likelihood of negative health behaviours that carry significant risks for cancer, heart disease, hypertension, diabetes, and other chronic illnesses. Thus, women moving to longer work hours were four times as likely to smoke more, twice as likely to drink more, 40% more likely to decrease their physical activity, and more than twice as likely to suffer major depression, compared to women working standard hours. Women with high levels of job strain were also 1.8 times more likely to experience an unhealthy weight gain than those with low job strain.[137] Given significant advances in cost-of-illness studies, such evidence on the health impacts of long work hours is an important step towards quantifying at least some of the key economic costs associated with long work hours.

For many of the indicators that could not presently be reliably translated into economic valuations, the GPI study therefore presented a review of the literature and a qualitative analysis of the costs associated with each indicator. The one exception was unemployment. There was enough evidence in the literature along with previous costing studies to assign an estimated monetary value to the cost of unemployment in Nova Scotia.

Joblessness has been associated with stress, poverty, financial insecurity, poor health outcomes, and a wide range of social problems including family breakdown and crime. For example, an abundance of evidence indicates that the unemployed suffer higher rates of physical and mental illness than those with jobs, and have higher rates of disability and a higher incidence of premature death. In fact, *both* unemployment and overwork carry health problems and hidden costs, and one Japanese study found that the underemployed and overworked had equally elevated risks of heart attack.[138] Unemployment is also associated with crime. For example, a Canadian Centre for Justice Statistics survey of inmates in Nova Scotia prisons found that 67% were unemployed at the time of admission to the correctional facility.[139]

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

In 1997, Statistics Canada began providing "supplementary" rates of joblessness, along with the official unemployment figures, in order to provide a more realistic picture of unemployment. The official figures only include those who are actively looking for work,

and therefore these estimates can actually fall when the unemployed stop looking for work. These so-called "discouraged workers" are not included in official jobless rates. In addition, official unemployment rates exclude the underemployed—those working part-time only because they cannot find suitable full-time employment due to business conditions, but who would rather be working full-time. Thus, Statistics Canada's supplementary unemployment rates include discouraged workers and the difference between the current work hours of "involuntary" part-time workers and the full-time hours they week. These supplementary rates do not include those underemployed who are working beneath their skill level.

The difference between Statistics Canada's official and supplementary unemployment rates can be substantial. For example, in 2006, the supplementary rate of unemployment for Nova Scotia was 11.9%, while the official rate was 7.9%. The costs of unemployment for the province were calculated in the GPI work hours study using both the official and supplementary rates provided by Statistics Canada.

Using costing evidence and methodologies cited in the research literature on unemployment costs, GPI Atlantic then estimated the output losses, fiscal costs (including lost tax revenues and EI payments), as well as some social costs including health costs, family breakdown costs, and crime, which could be attributed to unemployment in Nova Scotia. Please see the GPI work hours report available at http://www.gpiatlantic.org/pdf/workhours/workhours.pdf for details on the methods, assumptions, data sources, and research underlying each of those cost estimates.

The findings of the GPI analysis include:[140]

- In 2006, lost provincial production attributable to the official number of unemployed in Nova Scotia was estimated at $2.8 billion ($2006), or 9% of GDP, amounting to $3,021 for every Nova Scotian.
- Fiscal costs—including EI payments, Social Assistance benefits, and lost income tax and sales taxes—attributable to the official unemployment rate in 2006 (7.9%) were estimated at $870 million ($2006).
- The potential unemployment-attributable economic burden of illness in Nova Scotia that may be associated with the 2006 official unemployment rate is estimated to be $162.2 million. When the supplementary rate is used the economic burden of illness is estimated at $241 million. Epidemiological studies assessing relative risk ratios attributable to unemployment, as described in the early part of this chapter, are the basis for these particular illness cost estimates.
- Based on existing research literature, the economic costs associated with divorce attributable to unemployment in Nova Scotia in 2006 were estimated at $6 million.
- On the assumption that a 50% reduction in unemployment would result in a 10% reduction in crime—as indicated in the research literature—, it was estimated that Nova Scotia could save $66.8 million/year in avoided crime costs by cutting the jobless rate from 7.9% to 4%. In other words, each additional percentage point of unemployment may be estimated to cost the Nova Scotia economy roughly $16.7 million ($2006) a year in crime costs.

Since many of these cost estimates are based on assumptions that require further testing and verification, and in the absence of precise data allowing for accurate relative risk ratios and the calculation of population attributable fractions, the GPI unemployment cost estimates should be used for illustrative purposes only. However, based on the evidence available, it is nevertheless clear that the social, health, and crime costs attributable to unemployment are likely to be very considerable, and that even crude attempts at estimation are likely to be considerably more accurate than the arbitrary assignment of a zero value, as implied by conventional accounts.

Delineation of these costs is particularly relevant at the present time, when the current economic downturn is producing new layoffs and spikes in unemployment. Unfortunately, and until the GPI is regularly used as a provincial accounting tool, the longer-term social costs of this present increase in unemployment are inadequately considered in the policy arena. If they were, there would be much greater incentive to avoid layoffs through shorter work time solutions, as proposed in the previous chapter.

These few examples cannot plumb the depths and complexities of full-cost accounting mechanisms, which are explained in detail in the individual GPI reports, and which require dedicated training in order to expand technical capacity in the field. But this chapter at least serves to illustrate—by way of a broad summary overview—some examples of the kinds of methods used in full-cost accounting analysis. GPI Atlantic stands ready both to assist in providing the training needed to expand capacity in the field, and—in the interim—to provide any required assistance to apply the methods in practice in Nova Scotia.

What is beyond debate is the absolute necessity of beginning to value our social, human, and natural capital, and the non-market services they provide, and of moving without delay beyond the narrow, outdated, and even dangerous conventional accounts that ignore these vital components of our wealth and thereby send highly misleading signals to both policy makers and the general public. The good news is that—with Nova Scotia's Genuine Progress Index now ready to use and apply—the means to take that step decisively in this province are finally available. The work-in-progress quality of the GPI is no reason not to begin that implementation work immediately, since even preliminary economic valuations constitute far more comprehensive and accurate assessments than the current practice of ignoring vital social, human, and environmental benefits and costs.

In sum, there is no question that use of the GPI full-cost accounting mechanisms will effectively inform policy, lead to far more accurate assessments of the province's assets and liabilities, produce real evidence-based decision-making, and thereby substantially improve the quality of policy and leadership to enable Nova Scotians to leave a better province and world for their children.

6 New policy directions

To see the world through a GPI lens is akin to viewing light through a prism: the prism doesn't create the colours, but merely separates the colours that are already there.

There is no longer any question that the current GDP-based accounting system is incapable of measuring progress in society, and that using it for this purpose has proven not only dangerous, but delusional. The serious shortcomings and limitations of GDP-based measures have now been widely acknowledged in conventional circles, as evidenced by major recent 'Beyond GDP' conferences hosted by the OECD and European Union.

When we actually start using appropriate indicators to measure what we value as a society—including a healthy and educated populace, decent living standards, strong and safe communities, and a clean and healthy environment —and when we start using full-cost accounting methods to count the hidden costs of economic activity as well as the benefits, the resulting trends and economic valuations naturally point and lead to policies aimed at creating genuine progress.

The Nova Scotia Government's official adoption, in its 2006 Opportunities for Sustainable Prosperity development strategy, of the five capital approach—undertaking to value natural, human, and social capital in addition to built and financial capital—is an enormously far-reaching and radical commitment that should eventually produce a new form of budget estimates and a new set of economic accounts. It is also noteworthy that the 2007 Environmental Goals and Sustainable Prosperity Act (EGSPA)—accompanied by specific targets designed "to make Nova Scotia one of the cleanest and most sustainable environments in the world by the year 2020"—received unanimous all-party support. In short, the stage has been set for the adoption of the Genuine Progress Index, which is literally 'made to measure' for such expanded capital valuations and to assess progress towards the EGSPA vision, goals, and targets.

Of course, the all-party consensus that now exists in the province on these goals and priorities, does not eliminate the need for debate. While consensus goals, shared vision, and non-partisan measurement can help unify a society and provide a strong basis for evidence-based decision making and informed dialogue, politics is about *how to* get there and how to realize the shared vision. Thus, the appropriate role of democratic politics is to debate the best way to achieve the desired goals, even while there is a consensus on what those goals

are and on the agreed ways of measuring progress towards those goals. For example, there can be complete consensus on the need to reduce poverty, sickness, pollution, and greenhouse gas emissions, and in some cases even agreement on specific targets, and at the same time vigorous debate on how best to achieve those goals and targets. In other words, there should be a consensus on goals—the realm of measurement—and debate on strategy—the realm of politics.

While the expanded capital model is increasingly recognized as essential to value a society's full wealth, to track any depreciation in its assets, and to signal the need for re-investment, much work needs to be done to dislodge the existing GDP-based accounting system from its overwhelmingly predominant status. That system, after all, has held sway for more than half a century—influencing policy makers, economists, financial analysts, and journalists worldwide, and literally determining what makes it and does not make it onto the policy agendas of governments.

Again, this argument should not be misinterpreted to mean that the GDP should be abolished or even modified. When used for its intended purpose—to measure the size of the market economy and its expansion and contraction—it is a useful tool in its present form. However, it is the misuse of GDP to assess progress, prosperity, and societal wellbeing that has given it a far more dominant policy role and position than a mere measure of market size warrants. And because GDP-based growth measures are almost always used in isolation from the social purposes that the economy is intended to serve, and from the health of the environment that supplies the resources required by the market economy to function and that absorbs the wastes generated by the economy, the current misuse of those measures has also become misleading and dangerous. Displaced from its predominant position, it will be sufficient to release GDP statistics quarterly or every 6 months rather than monthly as at present, and thus to free up the resources required for more comprehensive measures of progress.

This work of measuring progress more comprehensively and accurately, of fully adopting and implementing the expanded capital approach, and thereby of displacing the predominant role of GDP-based measures needs to happen very quickly if are to salvage the key components of our true wealth before it is too late. Indeed, if we continue to assign an arbitrary value of zero to our natural, human, and social wealth as at present; if we continue to ignore their depreciation; if we continue to treat the essential services that natural, human, and social capital provide as so-called 'externalities'; and if the true costs of economic activities remain hidden, then it will indeed be too late for human civilization as we currently know it.

It is scientifically demonstrable and undeniably true that our children will be growing up in a world where forests, oceans, soils, lakes, rivers, and energy sources have been seriously depleted and degraded by human activity. They are sharing a poorer natural world with fewer living species than our parents did, and they are faced with an increasingly uncertain and perilous future due to climate change. Piecemeal measures and tiny advances like a reduction in clearcutting from 98% to 94% of all harvesting and an increase in more sustainable selection harvest methods from 0.9% to 1.5% of all harvesting—while signs of progress from a relative perspective—are not keeping pace with the rate of natural capital

depreciation. The Genuine Progress Index provides the comprehensive accounting and measurement framework required to facilitate a much more concerted and committed policy effort towards maintaining and restoring wealth for the sakes of our children and for all the species that share this planet.

Policy makers at all levels of government in Nova Scotia are therefore now in the position to begin the paradigm shift away from what one commentator called "brain-dead accounting," towards valuing and counting what matters to Nova Scotians and to society at large. They now have at their disposal the actual tools and ability to put in place the indicator and accounting framework required to analyse current trends accurately, and to inform policies that lead to genuine progress. Previous generations of policy makers could reasonably plead ignorance for their inaction—as for example in the inability of GDP-based measures to signal the decline in Atlantic groundfish stocks or farm economic viability and in the unavailability of better measures to tell the truth and thereby to point to policy alternatives. With the availability of the GPI and the wealth of policy-relevant information it contains, the present generation of policy makers has no such excuse, and their burden of responsibility for timely and corrective action that can immeasurably enhance the wellbeing of Nova Scotians is correspondingly much greater.

This is because the GPI, unlike the GDP that has virtually no capacity to send warning signals of declines in real wealth, the GPI has demonstrated remarkable predictive power that can in fact provide policy makers with the tools they need to take appropriate action. Because it is a system of 'net' rather than 'gross' accounting, and because it demonstrates the linkages between social, economic, and environmental variables, GPI trend analysis and valuations inevitably send more accurate signals about the nature of reality to policy makers than is possible in a system narrowly based in market economy growth statistics. To cite just a few examples, GPI studies in the last 12 years predicted the contraction of the voluntary sector (which was invisible in GDP, market-based statistics that ignore unpaid work); the long-term decline in the economic viability of farming in Nova Scotia; and, perhaps most poignantly given the current economic conditions, the fragility of Canadian household finances in light of rates of debt growth that vastly exceeded rates of income growth, thus imperilling the capacity of households to service their debt loads.

The key issue here is quite simply that if the government of the day uses the GPI to track trends and make policy choices, such warning signals will be clearly visible and facilitate timely corrective action that can potentially avoid the kind of dire outcomes experienced with the collapse of the Atlantic groundfish stocks. There is no longer any barrier to Nova Scotia adopting and implementing the new indicator and accounting tools as guides to policy, and to use them as the province's core measures of progress and valuation. This is the first time that GPI Atlantic is making this statement because it was inappropriate to urge the adoption and use of the measures during the research and development phase, and while work was still under way to identify the best and most accurate measurement methodologies and the most reliable data sources. But over a period of more than 12 years of research and development, the reliability, accuracy, comprehensiveness, feasibility, utility, and policy relevance of the new measures has been demonstrated time and again. What *is* required now is simply the political will to adopt and use them.

In the interests of 'truth in advertising,' it is important to acknowledge that the proposed adoption and use of the GPI will require courage. That is because political will is required not only to adopt a new accounting system (which in turn means presenting annual budgets to account for the value of natural, human, and social capital in addition to produced capital) *but also* to allow the new statistics to challenge the messages being sent by the conventional GDP-based measures through the existing economic paradigm. Clearly, this is no business for the faint of heart. It will take commitment, resolve, and vision.

For example, once a new accounting system has been adopted by government, it will provide a basis for a system of financial incentives and penalties designed to encourage sustainable behaviours that contribute to wellbeing and genuine progress, and to discourage unsustainable behaviours that undermine wellbeing and detract from genuine progress. This can include very practical actions such as shifting taxes from low-income households to carbon and pollutant emissions; subsidizing renewable energy development, public transit, organic farming, and uneven-aged forest management while increasing taxes and fees on gas-guzzling vehicles, synthetic fertilizers, and clearcutting. Because the new accounting system records differential environmental impacts by income and assesses time, income, and wealth distribution, it will also naturally lead policy makers to focus more on redistributive policies and shorter work time options than on untrammelled growth and economic stimulus strategies.

In terms of long-term sustainability and enhancing natural capital values in particular, the expanded capital system provides the accounting basis required to transform the system of economic incentives so that protecting and conserving soils, forests, wetlands, the atmosphere, and the marine environment—and enhancing the value of these assets—are competitive with currently subsidized harmful or destructive practices. This can be accomplished on the basis of hard evidence, because the underlying GPI *accounts* provide an objective basis for determining the monetary value of such financial incentives and penalties, since the accounts assess—according to the best available data—the true and actual benefits and costs of economic activity to society.

These incentives and penalties in turn will naturally affect consumer prices, thereby changing behaviour. Indeed, it is widely accepted by economists and other analysts that price signals are by far the most effective tool to influence behaviour at a societal level. For example, based on regression analysis, epidemiologists have found substantial increases in tobacco taxes to be the single most effective method of reducing tobacco consumption. In Nova Scotia, teenage smoking rates dropped by half—from 30% in 1999 to 15% in 2006—in direct response to rising tobacco taxes. Similarly, it took skyrocketing fuel prices rather than concern for the environment to prompt ordinary citizens to switch from their SUVs to more fuel-efficient vehicles. And the current recession is far more effective in moving us rapidly towards our Kyoto targets than all the environmental lobbying of the last decade.

The good news for policy makers is that use of the new accounts will save money by providing a concrete tool to assess program efficiency and cost effectiveness. Which programs, for example, are effectively achieving their targets and which are not? And how can market mechanisms that properly account for social and environmental benefits and costs reduce the need for costly government intervention and regulation?

To take one concrete example, the Nova Scotia government invested considerable resources, undoubtedly with good intention, in a 'Buy Local' campaign launched with great fanfare and the following announcement on July 5, 2007: "Selecting Nova Scotia first is the theme of an exciting, new marketing campaign aimed at promoting locally grown and produced food…. The event featured a logo unveiling, website introduction, details of upcoming promotional activities and the announcement of a Minister's Advisory Committee on Buy Local.[141]

Unaccompanied by appropriate price signals based on full-cost accounting mechanisms, however, this program—with all its attendant costs and human and financial resources—was bound to have very limited success, if not to fail entirely in its objectives. On a societal scale, consumers will not switch en masse to locally grown food so long as imported food is cheaper. Indeed, there is no evidence of any substantial shift in retail chain ordering practices and consumer preferences to locally grown food in the two years that the government's buy local program has been in effect. Indeed, the available evidence indicates that only 8.4% of the food Nova Scotians consume is produced on Nova Scotia farms—down from close to 15% in the early 1990s.

And yet, from a GPI full-cost accounting perspective, it is absurd that organically grown local food is more expensive in retail stores than chemically grown food imported from 2,000 km away—a perversity made possible only by ignoring the true costs of soil degradation, transportation, greenhouse gas and pollutant emissions, and other actual costs of production and distribution, and by ignoring the true value of improved nutrition, freshness, health, resource conservation, and the multiplier job and financial effects of stimulating the local farm economy. Once goods are accurately and properly priced according to the true costs of production and distribution, not only will consumer behaviour change, but the market economy will become considerably more efficient.

The GPI full-cost accounting system is designed precisely to provide the objective evidence basis for the system of financial incentives and penalties that in turn will reduce the price of sustainably produced local food and raise the price of chemically produced imported food—precisely because the true and full benefits of the former and the actual costs of the latter will be properly and accurately reflected in food prices. In that context, a buy local campaign is far more likely to succeed than when price signals send a message contrary to the government's program and intention, and when—as a consequence—the two large retail chains that supply Nova Scotians with such a large proportion of their food virtually ignore the campaign.

Similarly, a full-cost accounting system that assesses the true costs of energy use will naturally produce a system of government penalties and incentives that penalize wasteful energy use and reward energy conservation, which in turn will be reflected in the price structures that determine behaviour. In short, an economy that reflects the actual benefits and costs of the production and distribution of goods and services is the most effective tool that can move society en masse towards genuine sustainability and societal progress. Nova Scotia now has available to it, the means and instruments to make this happen. That, in turn, will provide essential leadership for the country and the larger world and will benefit Nova Scotia economically as others come to study and learn from the province's actions. All that is

required is the courage and political will to adopt, use, and implement these new accounting and measurement tools.

Appendix A

Summary of key results for the 2008 Nova Scotia Genuine Progress Index by component

DOMAINS / COMPONENTS / INDICATORS	RESULTS
DOMAIN: TIME USE	
1. Civic and Voluntary Work	
Trends in formal volunteer hours per capita	Volunteer hours have declined nationwide. Fewer volunteers are now putting in longer hours in order to maintain services.
Hours per volunteer and volunteer burnout	In 2000, volunteers in Nova Scotia increased their volunteer hours by 32%. The sharp increases in annual volunteer hours—occurring at the same time as a significant decline in the number of volunteers—may provide a warning signal of potential future burnout among volunteers struggling to maintain the same level of services with fewer human resources.
Composition and distribution of voluntary work	Unpaid household work and childcare contributed $10.4 billion to the Nova Scotia economy in 2005.
Trends in formal plus informal voluntary work	Between 1992 and 2005, the most dramatic declines in civic and voluntary work contributions occurred in Newfoundland and Labrador (down 27%) and Nova Scotia (down 21%).
Economic value of civic and voluntary work	Canadian volunteers contribute the equivalent of $64.9 billion ($2007) worth of services annually to the national economy either through voluntary organizations or by informal volunteer work—far more than a wide range of other industries. In Nova Scotia, volunteers contributed the equivalent of $1.8 billion ($2007) worth of services in 2005. The decline in volunteerism in Nova Scotia between 1998 and 2005 cost the province $370 million in lost voluntary services in 2005.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
2. Unpaid Housework and Childcare	
Total workload (paid and unpaid)—men and women	Between 1992 and 2005, total work hours (paid and unpaid) per week for both men and women in dual-earner families have increased. Women continue to do the lion's share of unpaid work.
Total work hours of full-time, dual-earner parents and lone-parent mothers	The 2005 total work hours data for these two groups are not publicly available; therefore, it is not possible to ascertain a trend at this time. However, 1998 Statistics Canada data show that the total weekly paid and unpaid work hours of full-time, employed, dual-earner parents aged 25–44 amounted to 71.4 hours for men and 73.2 hours for women. Total paid and unpaid work hours for full-time working mothers amounted to 74 hours a week and for full-time, employed, single mothers, it added up to 75 hours a week. Trend data are available for women aged 25–54. Counting both full-time and part-time workers, the average time spent on paid and unpaid work by women aged 25–54 increased from 57.4 hours a week in 1986 to 61.6 hours a week in 2005.
Time stress	Between 1998 and 2005 there was an increase in severe time stress among Nova Scotians from 16.2% to 18.3% of the population. The proportion of Nova Scotian women suffering from severe time stress jumped from 17.4% in 1998 to 22.7% in 2005. Nova Scotian women are nearly 70% more likely to be severely time stressed than Nova Scotian men.
Value of unpaid housework and childcare	Unpaid household work and childcare contributed $10.4 billion to the Nova Scotia economy in 2005.
3. Leisure Time	
Trends in free time—men, women, and single mothers	Free time in Nova Scotia has declined by an average of half an hour a day, or 186 hours a year, since 1998 as Nova Scotians work longer hours. The biggest losers of free time are single working mothers, who saw their free time shrink by 2.7 hours a day—or nearly 19 hours a week.
Value of free time	Nova Scotians are losing $1.25 billion worth of free time each year compared to what they had ten years ago.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
Composition of free time	Watching television comprises 40% of free time use in Nova Scotia. Nova Scotians spend 31% less time reading for pleasure than in 1992 and 35% less time socializing outside their homes.
4. Paid Work Hours (falls into both Time Use and Living Standards domains)	
Unemployment rate	There have been decreases in both the official unemployment rate and the supplementary unemployment rate for Canada and Nova Scotia since 2001. Unemployment last year was at its lowest level in more than 30 years.
Economic costs	The output loss (productivity) costs and fiscal costs associated with the official unemployment rate in 2006 of 7.9% were $3.6 billion, or $3,941 per Nova Scotian, compared to $4.4 billion ($4,846 per capita) in 2001 when the unemployment rate was 1.8 percentage points higher. The potential economic burden of illness in Nova Scotia that may be associated with the 2006 official unemployment rate of 7.9% is estimated to be $162.2 million—down from $202 million in 2001 when the jobless rate was 1.8 percentage points higher.
Hours polarization	There has been a move away from hours polarization, with fewer people working at the extreme ends of the scale.
Overtime	Between 1997 and 2007, there was an increase in the incidence of overtime in Canada and Nova Scotia.
Temporary work rate	The incidence of temporary work in Nova Scotia remained fairly steady between 2001 and 2007, but remains above 1997 levels.
Involuntary part-time rate	Rates of involuntary part-time work have declined since 2002, though they remain considerably higher than 30 years ago.
Work effort	Forty percent of the increase in real earnings between 1980 and 2001 for dual-earner Nova Scotian couples with children was purchased with increased work hours. The proportion is higher for couples shifting from single-earner to dual-earner status. Due to the high cost of data purchase from Statistics Canada, it is not possible at this time to assess progress for this indicator since 2001.
Work stress	Due to data comparability issues, it is not possible to ascertain a trend at this time.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
DOMAIN: LIVING STANDARDS	
5. Income Distribution	
Income inequality (gap between rich and poor)	The gap between rich and poor Canadians has widened substantially since 1981, while it has narrowed somewhat in Nova Scotia. The regional income gap (between the richest and poorest provinces) continues to widen.
Prevalence of low income	There has been a decline in the prevalence of low income in both Canada and Nova Scotia. However, economic vulnerability remains highly concentrated among certain groups.
Gini coefficient	Since 1976, inequality as measured by the Gini coefficient has increased in all provinces, except Prince Edward Island.
Gender wage gap: hourly female to male wage ratio	In Canada, the gender wage gap narrowed between 2001 and 2008.
6. Financial Security and Debt	
Wealth distribution by quintile	Since 1999, Canada's wealth gap has widened, with the richest 20% of Canadians increasing their wealth by 43% and the poorest 20% going deeper into debt—so deep, in fact, that they could not get out of debt even if they sold off everything they owned. The evidence points to declining financial security for millions of Canadians.
Regional distribution of wealth	Atlantic Canadians have a declining share of Canada's growing wealth, owning only 4.9% of the country's total household wealth—down from 5.3% in 1999—even though they make up 7.4% of Canada's households.
Debt growth versus asset growth	The rate of household debt growth is far outpacing the rate of household asset growth, particularly in Atlantic Canada and Ontario. Between 1999 and 2005, household debt grew by 62% in Atlantic Canada, while assets grew by only 35%.
Debt growth versus income growth	In both Atlantic Canada and nationwide, debt growth is far outpacing income growth. Only the richest Canadians have seen income grow at a faster pace than debt.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
7. Economic Security	
Index of economic security	Economic security in Nova Scotia declined during the 1981–2007 period, as it did nationwide. In 2007, the overall index of economic security in Nova Scotia was 0.581, a decline of 12.9% from its level of 0.667 in 1981. Nationwide, the economic security index declined from 0.666 to 0.555, a drop of 16.7%. The declines were driven by increased economic risks due to illness, and the higher share of household budgets spent on private health care.
Minimum wage	There has been virtually no change in the real (inflation-adjusted) minimum wage in Nova Scotia over a 26-year period. In 2006, employable persons on minimum wage in Nova Scotia had to work more hours per week than they did in 1981 in order to reach the low income cut-off (LICO).
Social assistance benefits	Welfare benefits decreased nationwide in real terms over the period 1986–2006, but Nova Scotia saw a substantially sharper decline in welfare benefits than the Canadian average.
Child benefits	Total child benefit investments more than doubled in Nova Scotia from $11.1 million in 1998/1999 to $27 million in 2006/2007—an increase of 144%. This was somewhat below the national increase of 162%.
DOMAIN: HUMAN AND SOCIAL CAPITAL	
8. Population Health	
Self-rated health	Between 1994/1995 and 2007, the percentage of men and women rating their health as excellent or very good declined in both Canada and Nova Scotia.
Mortality due to selected causes	Mortality rates for selected diseases declined in both Canada and Nova Scotia between 1979–2004, except for the rate of mortality due to lung cancer, which increased in that time period.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
Health conditions / diseases	**Asthma:** There has been no improvement in asthma rates among Nova Scotians or Canadians between 1994/1995 and 2007. In 2007, Nova Scotia had the highest prevalence of asthma in the country. **Diabetes:** In both Canada and Nova Scotia, the prevalence of diabetes increased between 1994/1995 and 2007 from 3.6% to 6.8% in Nova Scotia and from 3% to 5.8% in Canada. In 2005, the prevalence of diabetes in Nova Scotia peaked at 9.3%. **High blood pressure:** The prevalence of high blood pressure increased in both Canada and Nova Scotia between 1994/1995 and 2007. The incidence in Nova Scotia has consistently been higher than the Canadian average, but the gap appears to be narrowing in recent years. **Cancer:** Between 1976 and 2006, cancer rates in Nova Scotia increased significantly—by 39% for men and by 24% for women. Cancer rates in Nova Scotia are higher than the Canadian average.
Mental health	**Life stress:** Fewer Canadians and Nova Scotians reported high levels of life stress in 2007 than seven years earlier. **Perceived mental health:** There was little change in the self-rated mental health of Nova Scotians between 2003 and 2007**.** **Self-esteem:** There was a significant improvement in the levels of self-esteem among Nova Scotian men and women between 1994/1995 and 2003.

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

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

DOMAINS / COMPONENTS / INDICATORS	RESULTS
10. Educated Populace	
Government student debt and tuition fees	Postsecondary students in Nova Scotia today are graduating with unprecedented debt loads. Nova Scotia has the second highest level of university student debt in the country. Nova Scotia has the highest average undergraduate tuition fees in Canada. Over the last 30 years, tuition has accounted for an increasing share of university operating revenue.
Public expenditures per full-time student (K–12)	Nova Scotia spent the second lowest amount of money per public school student in the country in 2004/2005.
Public versus private share of sponsored research at universities	The ratio of private to public funding of research has increased markedly since the early 1970s, posing a potential threat to the academic integrity and independence of Canadian university research.
Trends in prose and document literacy	Despite higher rates of postsecondary graduation, there was no real improvement in the literacy profiles of Canadians between 1989 and 2003.
Trends in general political knowledge by age cohort	The political knowledge of Canadians is in general decline. This decline is particularly marked among younger people, who tend to have considerably less political knowledge today than younger people did a generation ago.
Ecological Footprint by educational attainment	Those with the highest levels of educational attainment have the greatest impact on the environment.
DOMAIN: NATURAL CAPITAL	
11. Soils and Agriculture	
Net farm income	Net farm income has dropped an average of 91% in Nova Scotia since 1971, and in 2007 reached the lowest levels ever recorded in the province. Nova Scotia farms have recorded negative net farm income in four of the last six years.
Expense to income ratio	The expense to income ratio increased from an average of 82% in the 1970s to an average of 97% in the last decade—far exceeding the 80% threshold estimated as needed for a healthy farm sector. In 2006, the expense to income ratio reached 100% for Nova Scotia farms.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
Debt to net farm income ratio	Total farm debt increased by 146% in Nova Scotia between 1971 and 2006 and the debt to income ratio grew steadily. For recent years, it is not mathematically possible to calculate a ratio of debt to net income for Nova Scotia when the latter is zero or less.
Solvency ratio	The solvency ratio increased by 106% in Nova Scotia between 1971 and 2006, indicating that Nova Scotia farms are becoming much less sustainable with the rate of farm debt increase rapidly outstripping any appreciation in the capital value of farms.
Percentage of Nova Scotia consumer dollar going back to Nova Scotia farmers	In Nova Scotia, it appears that only about 7% of the consumer food dollar is returned to farmers—down from 10% in the 1990s.
Soil cover days	According to the most recent data for 2001, the average number of soil cover days in Nova Scotia has remained fairly steady since 1991 but has increased slightly since 1981. The average number of soil cover days in Nova Scotia has remained consistently higher than the Canadian average.
Ratio of productive value of agricultural land to market land value	The net productive capacity of Nova Scotia's farm land has declined significantly relative to market land values, with the most dramatic decline occurring between 1996 and 2006 when farm income plunged dramatically.
Intensity of synthetic input use	The intensity of synthetic input use has decreased in Nova Scotia since 2000.
Proportion of farm land occupied by forest and wetland	In 2006, 49% of Nova Scotia farm land, 34% of Kings County farm land, and 8% of Canadian farm land was occupied by forest and wetlands. Due to changes made in the 2006 Census of Agriculture, it is not possible to assess a trend at this time.
12. Forests	
Forest age class distribution	There has been a sharp and significant loss of old forests in Nova Scotia since the province's first major forest inventory in 1958, with no significant improvements in age class distribution in recent times and a continuing shift to ever younger forests.
Number of known forest-dependent species at risk	There has been an increase in the number of known forest-dependent species at risk in Nova Scotia since 2001.
Protected areas as percentage of total provincial landmass	There has been an increase in the percentage of Nova Scotia's total landmass under protection from 8.1% in 2001 to 8.5% in 2007.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
Harvest methods	There has been a marginal increase in the use of selection harvesting in the province. However, clearcutting remains by far the predominant harvest method in use.
Value added per cubic metre of wood harvested	Between 1998 and 2004, the rate of value-added forest product per cubic metre of wood harvested declined in Nova Scotia—giving it the second lowest ranking among the provinces in 2004.
Jobs per unit of biomass	Jobs per unit of biomass in the forest industry in Nova Scotia have not increased since 2001.
13. Fisheries and Marine Resources	
Quantity and value of fish stocks	**Groundfish:** Using groundfish in the Eastern Scotian Shelf region as an indicator of fish abundance, this measure has decreased substantially since the 1980s. The cod biomass shows no sign of recovery, while the haddock and pollock stocks show limited recovery. The value of the groundfish stocks in the Eastern Scotian Shelf region has decreased since the late 1980s, signifying a depreciation of natural capital. Despite modest increases in the value of the haddock and pollock stocks, the value of all groundfish stocks in the region remains low compared to the historically high levels of the mid- to late 1980s.
Quantity and value of fish stocks (continued)	**Lobster:** Landings have increased nearly five fold since the 1970s, leading to a perception that lobster stocks are healthy, but increased levels of fishing effort on lobster may have contributed considerably to the increased catches since 2001. In Nova Scotia, 2007 lobster landings suddenly dropped to 70% of the 2006 record level, returning to the lower levels of the 1990s. It is too early to determine the cause of this sharp decrease—in particular, what it says about the sustainability of the high catch levels of the previous few years. There is concern that lobster stocks could be in potentially serious trouble—possibly for the first time in recorded history.
Fish size: a measure of health and quality of individual fish	The "size at age" of some finfish stocks around Nova Scotia have remained relatively stable over time, while other stocks show either increasing or decreasing trends over the past 10–15 years.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
Mean trophic level of harvested species	There has been a steady decline in the mean trophic level of the species landed in Nova Scotia's fisheries since the mid-1980s. Species at the top of the marine food web have been depleted, and lower trophic level species are now the primary target and source of revenue in Nova Scotia's fisheries.
Marine species at risk	The two species groups examined here—marine mammals, and sharks and rays—have experienced substantial population declines in Atlantic Canada. While the mortality rate and birth rate of the North Atlantic right whale population have both increased since the 2002 *Nova Scotia GPI Fisheries and Marine Environment Accounts*, the increased birth rate is insufficient to counter the rate of population decline and the population is now in even greater jeopardy.
Shellfish closures	The number of shellfish closures in Nova Scotia has increased steadily since 1940, and has more than doubled since 1985.
Employment	The number of fishers employed in Nova Scotia decreased greatly from the highs experienced in the late 1980s and early 1990s, to much lower levels later in the 1990s following the collapse of the groundfish fishery. After 2001, the number of fishers rose somewhat, then fell again, and certainly has not returned to the high, likely unsustainable, pre-collapse levels.
Fishery GDP: a conventional economic measure	Nova Scotia's fishery GDP was steady at high levels for several years up to the time of the groundfish collapse. Between 1992 and 1995, that fishery GDP decreased by almost half. After 1995, the fishery GDP increased again, and by 2006, it had grown to nearly 80% of the 1992 level.
Age structure of fishers	The proportion of older fishers has increased since 1931, while the proportion of younger fishers has decreased. The proportion of middle-aged fishers has remained relatively stable.
Institutional expenditures to effectively manage fisheries and the marine environment	Expenditures by the federal Department of Fisheries and Oceans in Nova Scotia declined in the second half of the 1990s, jumped substantially in 2000, and then decreased steadily from 2000–2003. Provincial Department of Fisheries and Aquaculture expenditures show an overall increasing trend since 1996. However, both federal and provincial government expenditures as a proportion of the landed value of Nova Scotia fisheries have decreased over time.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
14. Air Quality	
Criteria Air Contaminant emissions	**CO:** Nova Scotia's carbon monoxide emissions have declined steadily since 1990 and are projected to reach about half of 1990 levels by 2015, but they remain higher on a per capita basis than other OECD countries. **TPM:** Total particulate matter emissions declined by 42% from 1990–2005 but are projected to increase by about 50% from 2005 levels in the coming decade. **PM_{10}:** Emissions of particulate matter less than 10 microns declined by nearly 40% from 1990–2005 but are projected to increase by about 30% over the coming decade. **$PM_{2.5}$:** Emissions of particulate matter less than 2.5 microns declined by one-third from 1990–1995, but have seen no further improvement since then and are projected to remain stable at 1995–2005 levels over the coming decade. **SO_X:** Sulphur oxide emissions declined by 22% from 1990–2005 and are projected to decrease by another third by 2010. Due, however, to its heavy reliance on coal for electricity generation, per capita SO_X emissions in Nova Scotia are more than double the Canadian average and higher than in all other provinces and all of 30 reporting OECD countries—more than three times the level in the United States and more than 20 times that in Germany. **NO_X:** Nitrogen oxide emissions increased by more than 20% between 2000 and 2005 to reach their highest level since the 1980s but are forecast to decline by more than 40% from peak 2005 levels in the coming decade. Per capita NO_X emissions in Nova Scotia were about 10% above the Canadian average and higher than in all but one of 30 reporting OECD countries—65% above US levels and 5.5 times German levels.

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

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

DOMAINS / COMPONENTS / INDICATORS	RESULTS
Quality of rivers, lakes, and wetlands (continued)	**Loss of wetlands:** A comprehensive inventory of Nova Scotia's wetlands, which provide many important ecological services, has been completed. As of 2007, there are estimated to be approximately 377,000 hectares of wetlands in Nova Scotia, an estimated loss of 17% of freshwater wetlands and 62% of saltwater wetlands from the original area of wetlands in Nova Scotia. **Recreational fishing:** Catches of Atlantic Salmon and Brook Trout that are impacted by acid rain have continued to decline steadily.
Economic costs	An estimated total of $3.45 billion per year ($2006) in damage, restoration, and health costs is associated with wetland loss and water pollution in Nova Scotia. By far the largest cost component is the value of services once provided by wetlands that have been lost.
16. Energy (falls into both the Natural Capital and the Human Impact domains)	
Total energy demand, by sector and fuel type	Nova Scotia's total energy demand grew by 25% from 1991–2005 and then fell by 11% between 2005 and 2006. Transportation accounts for the highest share of energy demand—34%, up from 26% in 1978.
Per capita energy demand, Canada and provinces	Nova Scotia's per capita energy demand increased by 22% from 1991 to 2005 and then fell by 11% between 2005 and 2006. Among the provinces, Nova Scotia had the second lowest per capita energy demand in the country—21% below the national average.
Total primary energy production	Primary energy production in Nova Scotia increased sharply from 1999–2001, due to Sable Island natural gas production, but has declined by 29% since then. The province is again a net importer of energy—with the vast majority of its energy needs dependent on foreign oil and coal.
Per capita primary energy production, Canada and provinces	Per capita primary energy production in Nova Scotia increased sharply from 1999–200,1 due to Sable Island natural gas production, but has declined by 28% since then. In 2006, Nova Scotia ranked fifth among the provinces in primary energy production—62% below the national average.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
Proportion of electricity generated from renewable sources	In 2006, 80.4% of Nova Scotia's electricity was from coal—the highest share since 1993. Renewables accounted for just 8.8%—relatively unchanged since 1993 and mostly from older, small-scale hydro projects. In 2006, wind energy production had not yet significantly changed the mix.
Primary sources of coal for electricity generation	Coal—accounting for over 80% of Nova Scotia's electricity fuel mix—is almost entirely imported from foreign countries, where coal production has produced some serious social and environmental problems.
Economic costs	Damage costs attributable to air pollutant and GHG emissions from Nova Scotia's stationary energy sources (power plants and refineries) in 2005 are estimated at more than $380 million, or $400 per Nova Scotian.
DOMAIN: HUMAN IMPACT ON THE ENVIRONMENT	
17. Solid Waste	
Solid waste disposed per capita	Since 2001, Nova Scotians have been producing and disposing more garbage per capita. Since 2006, there has been a slight reversal of this upward trend.
Diversion rate	In 2006/2007, the Nova Scotia waste diversion rate (36%) was well below the 50% peak achieved in 1999/2000 but remained highest among the provinces.
Residential recycling and composting rates	Residential recycling and composting rates in Nova Scotia have increased since 2001, and Nova Scotia continues to boast the highest rates among those provinces reporting.
Hazardous and toxic wastes	Due to lack of a tracking system, and therefore the absence of any raw data, it is not possible to evaluate progress on the disposal of household hazardous waste.
Stewardship agreements with producers	There has been one new stewardship agreement (for electronic waste) put in place since the 2004 *GPI Solid Waste Resource Accounts*. Progress continues to be made in this area.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
18. Ecological Footprint	
Ecological Footprint for Canada	According to the 2008 Edition of the Canadian National Footprint Accounts, Canada's 2005 Ecological Footprint was 7.07 gha—8% smaller than the 7.6 gha for 2003, but 2.6 times larger the world average per capita Footprint of 2.69 gha. In 2005, according to the Canadian National Footprint Accounts, the total global supply of productive area or biocapacity was 2.06 global hectares per capita. This means that, if everyone in the world lived and consumed like Canadians do, we would need 3.43 planets to support that lifestyle. **Note:** Nova Scotia data are presently unavailable, but Chapter 20 notes that reliance on coal for electricity likely expands the provincial Footprint.
19. Greenhouse Gas Emissions	
Total greenhouse gas emissions, 1990–2006	Nova Scotia's GHG emissions decreased by nearly 10% from 2005–2006. However, this decrease is largely the result of indirect changes in energy supply and demand, suggesting that radical changes are still needed in order to meet GHG reduction targets.
Per capita greenhouse gas emissions, 1990–2006	Nova Scotia's per capita GHG emissions decreased by nearly 10% from 2005–2006. The province's rate of 21 tonnes of CO_2 equivalent GHGs per capita was the fourth highest in Canada in 2006 and, according to the UNFCC, puts Nova Scotians among the largest emitters of GHGs in the world.
Total greenhouse gas emissions by sector, 2006	Electricity production accounts for over 31% of Nova Scotia's total GHG emissions, highlighting the need to shift away from coal-fired power plants. Transportation accounts for 29% of total GHG emissions, with light trucks (SUVs and minivans) accounting for over 31% of GHG emissions from road transport.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
Nova Scotia performance relative to various greenhouse gas emissions reduction targets, 1990–2006	Nova Scotia would have to reduce its 2006 GHG emissions by 9% in two to four years to achieve the Kyoto reduction targets; by 13% by 2020 to meet the provincial Environmental Goals and Sustainable Prosperity Act reduction targets; and by 27% by 2020 and 81% by 2050 to meet the Suzuki Foundation targets.
Economic costs	Nova Scotia's 2006 GHG emissions could cost the global economy more than $725 million in predicted climate change damage costs, according to the lowest (most conservative) estimates available. Therefore, it is clear that Nova Scotia's GHG emissions, while only a tiny fraction of the world's emissions, will have a significant adverse impact on the world. The 2006 GHG emissions released from Nova Scotia's electricity generation stations alone are predicted to cause a minimum of $227 million in climate change damages to the global economy. Per capita GHG emissions in Nova Scotia were 21 tonnes in 2006, which translates into global damage costs of at least $777 for each Nova Scotian. A comparison of control costs and damage costs indicates that investments in greenhouse gas reduction are highly cost-effective, and that attainment of the province's legislated Environmental Goals and Sustainable Prosperity Act reduction targets will save more than $800 million net when control costs are subtracted from predicted damage costs.
20. Transportation	
Total road passenger movement	Total road passenger movement in Nova Scotia has increased by 19% since 1990. The use of light trucks (including SUVs and minivans) increased by 65% between 1990 and 2006, while passenger movement by bus decreased by nearly 10% in that same time period.
Road passenger movement per capita, in Nova Scotia and Canada	Per capita road passenger movement in Nova Scotia has increased by 16% since 1990. Nova Scotia's per capita rate was third highest in Canada in 2006. Per capita road travel using light trucks (including SUVs and minivans) increased by 61% between 1990 and 2006, while per capita passenger movement by bus decreased by nearly 12% in that same time period.

DOMAINS / COMPONENTS / INDICATORS	RESULTS
Total transportation energy use	Total transportation energy use in Nova Scotia declined by nearly 9% between 2005 and 2006. Energy use by off-road vehicles has increased by 170% since 1990.
Per capita transportation energy use	Per capita transportation energy use declined by just over 8% between 2005 and 2006. Nova Scotia's per capita transportation energy use of 82.8 GJ was sixth highest in the country and nearly 9% above the national average.
Total greenhouse gas emissions from transportation	Greenhouse gas emissions from Nova Scotia's transport sector declined by nearly 10% between 2005 and 2006 but were still 14% higher than 1990 levels. Road transportation accounted for 68% of transport-related GHG emissions in the province in 2006. The share of transport-related GHG emissions from light trucks (including SUVs and minivans) increased by nine percentage points between 1990 and 2006.
Per capita greenhouse gas emissions from transportation, Nova Scotia and Canada	Per capita GHG emissions from transportation were down 9% in 2006 but were still nearly 11% higher than in 1990. In 2006, Nova Scotia had the third lowest per capita GHG emissions from transportation in the country.
Number of fatalities and injuries from road accidents	The total number of injuries and fatalities from road transportation declined by 11% and 52%, respectively, between 1990 and 2005. In 2005, traffic injuries per 100,000 residents in Nova Scotia were 20% below the national average, and traffic fatalities per 100,000 residents were 15% below the national average.
Commute modal split	In Nova Scotia, 84% of commuters use a car to get to work—73% as drivers and another 11% as passengers. Another 6% use public transit, and 9% walk or bicycle to work.
Commuting distance	Just over half (55%) of all commutes in Nova Scotia are under ten km, 23% are 10–20 km, and 22% are more than 20 km.
Government spending on public transit as a percentage of total spending on road transportation	In Nova Scotia, 8% of total government spending on road transportation is on public transit—up from 4.5% since 1990 but still about 50% below the national average.
Economic costs	The full cost of private automobile use in Nova Scotia is estimated at more than $7.2 billion a year ($2007) when a full range of economic, social, and environmental costs is considered. About one-third of these costs are "external"—borne by society rather than by car users.

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Appendix B

List of key Genuine Progress Index reports by component

In October, 2008, GPI released its first integrated Genuine Progress Index for Nova Scotia in a comprehensive report that presented and updated a representative selection of key indicators and accounts for each of the 20 components. This report titled: *The 2008 Nova Scotia GPI Accounts: Indicators of Genuine Progress* is available at http://www.gpiatlantic.org/pdf/integrated/gpi2008.pdf

1. Time use

Civic and voluntary work
Economic Value of Civic and Voluntary Work (1998)
http://gpiatlantic.org/pdf/volunteer/volunteer.pdf
2003 Update http://gpiatlantic.org/pdf/volunteer/volunteerupdate03.pdf
2000 Update http://gpiatlantic.org/pdf/volunteer/volunteerupdate00.pdf
1999 Update http://gpiatlantic.org/pdf/volunteer/volunteerupdate99.pdf

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

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

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

2. Living standards

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

Financial security and debt
Financial Security and Debt in Atlantic Canada (2008)
http://gpiatlantic.org/pdf/livstand/finsec-extended.pdf

Economic security
Economic Security in Nova Scotia (2008)
http://gpiatlantic.org/pdf/livstand/econsec.pdf

3. Human and social capital

Population health
Health Disparities Indicators: Background Report for Developing Health Disparities Indicators in Canada (2008) http://www.gpiatlantic.org/pdf/health/hdi08.pdf.

Health Disparities Indicators Appendices
http://www.gpiatlantic.org/pdf/health/hdiapp.pdf

The Health Costs of Poverty in Canada: A Literature Review of the Evidence and Methodologies Needed to Produce a Full Report (2008)
http://www.gpiatlantic.org/pdf/health/povcost.pdf.

Kings County and Glace Bay GPI Community Profiles (2008)
http://gpiatlantic.org/pdf/community/glace.pdf
http://gpiatlantic.org/pdf/community/kings.pdf
http://gpiatlantic.org/pdf/community/taletwo.pdf

Atlantic Health Database, Parts A–D (2003)
Part A: Determinants of Health http://gpiatlantic.org/pdf/healthdb/PartA.pdf
Appendix A http://gpiatlantic.org/pdf/healthdb/AppendixA.pdf
Part B: Health Outcomes http://gpiatlantic.org/pdf/healthdb/PartB.pdf
Appendix B http://gpiatlantic.org/pdf/healthdb/AppendixB.pdf
Part C: Death & Disease http://gpiatlantic.org/pdf/healthdb/PartC.pdf
Appendix C http://gpiatlantic.org/pdf/healthdb/AppendixC.pdf
Part D: Health Service Utilization http://gpiatlantic.org/pdf/healthdb/PartD.pdf
Appendix D http://gpiatlantic.org/pdf/healthdb/AppendixD.pdf

A Profile of Women's Health Indicators in Canada (2003)
http://gpiatlantic.org/pdf/health/womens/whbreport.pdf

Women's Health in Atlantic Canada Volume 1 (2003)
http://www.gpiatlantic.org/pdf/health/womens/womensvol1.pdf

Women's Health in Atlantic Canada Volume 2 (2003)
http://www.gpiatlantic.org/pdf/health/womens/womensvol2.pdf

Cost of Chronic Disease in Canada (2004)
http://www.gpiatlantic.org/pdf/health/chroniccanada.pdf

Inequity and Chronic Disease in Atlantic Canada (2003)
http://gpiatlantic.org/pdf/health/inequity.pdf
Annotated Bibliography http://gpiatlantic.org/pdf/health/inequitybibliography.pdf

Cost of Chronic Disease in Nova Scotia (2002)
http://www.gpiatlantic.org/pdf/health/chronic.pdf

The Cost of Physical Inactivity in Halifax Regional Municipality (2004)
http://www.gpiatlantic.org/pdf/health/inactivity-hrm.pdf

Cost of Physical Inactivity in Nova Scotia (2002)
http://www.gpiatlantic.org/pdf/health/inactivity.pdf

Physical Exercise Trends in Atlantic Canada (2000)
http://www.gpiatlantic.org/pdf/health/exercise.pdf

Cost of Physical Inactivity in British Columbia (2003)
http://www.gpiatlantic.org/pdf/health/inactivity-bc.pdf

Cost of Tobacco in Nova Scotia (2007 & 2000)
http://www.gpiatlantic.org/pdf/health/tobacco/costoftobacco-ns-2007.pdf
http://www.gpiatlantic.org/pdf/health/tobacco/costoftobacco-ns.pdf

The Cost of Smoking in British Columbia and the Economics of Tobacco Control (2004) http://www.gpiatlantic.org/pdf/health/tobacco/costoftobacco-bc.pdf

The Cost of Smoking in New Brunswick and the Economics of Tobacco Control (2003)
http://www.gpiatlantic.org/pdf/health/tobacco/costoftobacco-nb.pdf

The Cost of Smoking in Newfoundland and Labrador and the Economics of Tobacco Control (2003) http://www.gpiatlantic.org/pdf/health/tobacco/costoftobacco-nf.pdf

The Economic Impact of Smoke-Free Workplaces: An Assessment for Newfoundland and Labrador (2003) http://www.gpiatlantic.org/pdf/health/tobacco/smoke-free-nf.pdf

The Socio-Economic Gradient in Health in Atlantic Canada: Evidence from Newfoundland and Nova Scotia 1985-2001 (2005)
http://www.gpiatlantic.org/pdf/health/hiec121605.pdf

Costs and Benefits of Gaming—A Literature Review with Emphasis on Nova Scotia (2004) http://gpiatlantic.org/pdf/gambling/gambling.pdf

Income, Health and Disease in Canada: Current State of Knowledge, Information Gaps, and Areas of Needed Inquiry (2003) http://www.gpiatlantic.org/pdf/health/cihr.pdf

Cost of HIV/AIDS in Canada (2001) http://www.gpiatlantic.org/pdf/health/costofaids.pdf

Cost of Obesity in Nova Scotia (2000) http://www.gpiatlantic.org/pdf/health/obesity/ns-obesity.pdf

Safety and security
The Cost of Crime in Nova Scotia (1999)
http://gpiatlantic.org/pdf/crime/crime.pdf

Educated populace
Education Indicators for the Nova Scotia Genuine Progress Index (2008)
http://gpiatlantic.org/pdf/education/nseducation.pdf

4. Natural capital

Soils and agriculture
Towards a Healthy Farm and Food Sector: Indicators of Genuine Progress (2008)
http://gpiatlantic.org/pdf/agriculture/thffs.pdf

Farm Economic Viability in Nova Scotia and Prince Edward Island (2008)
http://gpiatlantic.org/pdf/agriculture/farmviability08.pdf

Land Capacity in Nova Scotia (2008)
http://gpiatlantic.org/pdf/agriculture/landcapacity.pdf

The Nova Scotia GPI Soils & Agriculture Accounts Part 1: Farm Viability and Economic Capacity in Nova Scotia (2001)
http://gpiatlantic.org/pdf/agriculture/farmviability.pdf

The Nova Scotia GPI Agriculture Accounts Part 2: Resource Capacity and Use: The Value of Agricultural Biodiversity (2002)
http://gpiatlantic.org/pdf/agriculture/biodiversity.pdf

The Nova Scotia GPI Agriculture Accounts Part 2: Resource Capacity and Use: Soil Quality and Productivity (2002)
http://gpiatlantic.org/pdf/agriculture/soilqp.pdf

Forests
The GPI Forest Headline Indicators for Nova Scotia (2008)
http://gpiatlantic.org/pdf/forest/forestupdate.pdf

The Nova Scotia GPI Forest Accounts Volume 1:
Indicators of Ecological, Economic & Social Values of Forests in Nova Scotia (2001)
http://gpiatlantic.org/pdf/forest/forest1.pdf

The Nova Scotia GPI Forest Accounts Volume 2:
A Way Forward: Case Studies in Sustainable Forestry (2001)
http://gpiatlantic.org/pdf/forest/forest2.pdf

Fisheries and marine environment
The Nova Scotia GPI Fisheries and Marine Environment Accounts (2002)
http://gpiatlantic.org/pdf/fisheries/fisheries.pdf

Energy
The Energy Accounts for the Nova Scotia Genuine Progress Index (2005)
http://gpiatlantic.org/pdf/energy/energy.pdf

Air quality
The Ambient Air Quality Accounts for the Nova Scotia Genuine Progress Index (2004)
http://gpiatlantic.org/pdf/airquality/airquality.pdf

Water quality
The GPI Water Quality Accounts: Nova Scotia's Water Resource Values and the Damage Costs of Declining Water Resources and Water Quality (July, 2000)
http://gpiatlantic.org/pdf/water/waterquality.pdf

The Costs and Benefits of Sewage Treatment and Source Control for Halifax Harbour (2000) http://gpiatlantic.org/pdf/water/halharbour.pdf

5. Human impact on the environment

Solid waste
The Nova Scotia GPI Solid Waste Resource Accounts (2004)
http://gpiatlantic.org/pdf/solidwaste/solidwaste.pdf

Ecological footprint
The Nova Scotia Ecological Footprint (2001)
http://gpiatlantic.org/pdf/ecofoot/ns-ecofoot.pdf

The Prince Edward Island Ecological Footprint (2003)
http://gpiatlantic.org/pdf/ecofoot/pei-ecofoot.pdf

Greenhouse gas emissions
The Nova Scotia Greenhouse Gas Accounts for the Genuine Progress Index (2001)
http://gpiatlantic.org/pdf/greenhouse/ghg.pdf

Introduction to the GPI Greenhouse Gas Accounts (1999)
http://gpiatlantic.org/pdf/greenhouse/greenhouse.pdf

Application of the Genuine Progress Index Approach to Analyzing Reduction of Greenhouse Gas Emissions in the Nova Scotia Freight Transport Sector (1999)
http://gpiatlantic.org/pdf/freight/freight.pdf

Transportation

The GPI Transportation Accounts: Sustainable Transportation in Halifax Regional Municipality (2008)
http://gpiatlantic.org/pdf/transportation/hrmtransportation.pdf

The GPI Transportation Accounts: Sustainable Transportation in Nova Scotia (2006)
http://www.gpiatlantic.org/pdf/transportation/transportation.pdf

Application of the Genuine Progress Index Approach to Analysing Reduction of Greenhouse Gas Emissions in the Nova Scotia Freight Transport Sector (1999)
http://www.gpiatlantic.org/pdf/freight/freight.pdf.

Endnotes

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[13] According to Statistics Canada: "Gross domestic product, probably the most quoted economic statistic, can be computed in three ways using the I-O [Input-Output] accounts, by summing (1) the incomes generated by production; (2) the final expenditures; and (3) the value added by industry….Estimates of GDP are central to [the income and expenditure] account and are, in fact, identical (for estimates of Gross Domestic Product expressed at current prices) to those found in the

I-O accounts." See http://www.statcan.gc.ca/nea-cen/about-apropos/index-eng.htm and http://www.statcan.gc.ca/nea-cen/about-apropos/index-eng.htm#note1

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[29] Statistics Canada, *Households' Unpaid Work: Measurement and Valuation,* System of National Accounts, Catalogue no. 13-603E, no. 3, 1995, p. 3. Cited in Colman (2003), p. 72. It is noteworthy that Simon Kuznets, Nobel Prize-winning economist, and one of the chief architects of national income accounting, argued half a century ago that unpaid household work should be included in GDP estimates, since it reflects actual production and since its valuation is essential in order not to mistake production shifts from the unpaid household sector to the paid market sector as 'growth' (as happens today). Kuznets felt so strongly about this that he actually broke with the U.S. Commerce Department largely over the department's failure to value unpaid household work.

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[50] Statistics Canada, Canadian Centre for Justice Statistics, *Criminal Justice Trends in Canada from 1962: Corrections Program,* p. 21. Cited in Dodds and Colman (1999), p. 100.
[51] Statistics Canada, Canadian Centre for Justice Statistics, *A One-Day Snapshot of Inmates in Canada's Adult Correctional Facilities,* Catalogue no. 85-601, p. 120. Cited in Dodds and Colman (1999), p. 100.
[52] In the 1958 forest inventory, no 0 to 20 age class data were provided. The earliest data for this age class were reported in the 1965-1971forest inventory. These 1965-71 data were therefore reported here.
[53] In 2006, 80.4% of Nova Scotia's electricity came from coal—the highest share since 1993. Coal was almost entirely imported from foreign countries. Renewables accounted for just 8.8%, relatively unchanged since 1993 and mostly from older, small-scale hydro projects. In 2006, wind energy production had not yet significantly changed the mix.
[54] In 1989, the Canadian Council of Ministers of the Environment (CCME), comprising all of Canada's provincial, territorial, and federal environment ministers, set a target to halve the amount of solid waste being sent to landfills and incinerators by the year 2000. That same year (1989), Nova Scotia sent 641,375 tonnes of waste—or 726 kg per person—to landfills and incinerators. CCME criteria require that diversion rates be based on the diversion of solid waste from landfills compared to the amount of waste sent to landfills in 1989.
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[64] The factors that contributed to the economic turnaround in the Netherlands are numerous. Shorter work time arrangements contributed to the success in the Netherlands in reducing its unemployment rate but are by no means the only reason for the country's success. According to Anders Hayden, other factors include "low inflation, sound public finances, competitive firms, low inequality, and preservation of social protections." Hayden, Anders. 1999. Sharing the Work, Sparing the Planet. Work Time, Consumption and Ecology. Between the Lines. Toronto, p. 149.

[65] CBC News. Work-sharing agreement saves jobs at N.S. Michelin plant. March 27, 2009. Available at http://www.cbc.ca/canada/nova-scotia/story/2009/03/27/ns-michelin-work.html. Accessed March 27, 2009.

[66] CBC News. Underwear company to shrink work week to save jobs. March 19, 2009. Available at http://www.cbc.ca/canada/nova-scotia/story/2009/03/19/ns-stanfields-jobs.html. Accessed March 27, 2009.

[67] The design of Canada's 1982 Work Share Program was based on the German model, which has been using unemployment insurance benefits to pay workers on reduced schedules since l927.

[68] Service Canada. Worksharing 2009. Available at http://www.servicecanada.gc.ca/eng/work_sharing/index.shtml. Accessed April 16, 2009.

[69] Singh, Surendar. l991. "A Note on the Work Sharing Program." *Perspectives*. Statistics Canada. Minister of Industry. Ottawa. p. 56.

[70]Advisory Group on Working Time and Distribution of Work. l994. *Report of the Advisory Group on Working Time and the Distribution of Work*. Human Resources Development Canada. Hull. pp. 52-53.

[71] For more information on work-time reduction strategies and options please refer to Pannozzo, Linda and Ronald Colman. 2004. Working Time and the Future of Work in Canada. A Nova Scotia GPI Case Study. Available from http://www.gpiatlantic.org/pdf/workhours/workhours.pdf. Accessed April 16, 2009.

[72] NS Department of Education and Department of Health Promotion and Protection. 2006. Policy Directives and Guidelines. Food and Nutrition Policy for Nova Scotia Public Schools. Available from http://www.ednet.ns.ca/healthy_eating/pdf/22454_ver1_lo_res.pdf. Accessed April 16, 2009.

[73] Ibid. p. 8.

[74] Ibid. p. 2.

[75] As an example, a Registered Buyer with an annual wood acquisition of 100,000 cubic metres solid of softwood/yr must complete an annual silviculture program valued at $300,000. They have the option to carry out the silviculture themselves, or pay that amount into the Sustainable Forestry Fund, which is to ensure the work is carried out. Taken from Nova Scotia's Forest Sustainability Regulations. Synopsis. Available at http://www.gov.ns.ca/natr/forestry/strategy/sustainabilityregs.htm Accessed May, 2009.
[76] Shelterwood cutting is defined as the removal of mature trees from a stand in two or more stages instead of all at once, as with a clearcut. In essence, however, shelterwood is a form of clearcutting, since it also generally results in the entire removal of a forest stand.
[77] Selection harvest methods mimic the non-catastrophic natural disturbance regimes of this region. Group selection, or patch cutting, for instance, mimics the natural process of an occasional large tree falling and taking out several others with it, thus opening up a larger gap in the canopy and opening up areas for light penetration. This encourages the regeneration of less shade-tolerant species such as white pine. In 2001, the GPI Forest Accounts (volume 2) reported on Windhorse Farm's use of selection cutting. In that case study, it was reported that the tallest trees in the canopy were never removed from a stand, even if dead. These trees increase canopy height and the structural diversity of a stand. Group selection can also be used to restore the diversity of a simplified woodlot in which a particular species is under-represented. For example, four or five trees may be removed from around a tree that is unable to regenerate in the shade of the existing canopy.
[78] The World Bank. 1999. Curbing the Epidemic: Governments and the Economics of Tobacco Control. The World Bank, Washington, D.C., p. 1.
[79] Health Canada. 1999. "Deaths in Canada due to Smoking," *Information Sheet,* Ottawa; Health Canada, *Toward a Healthy Future: Second Report on the Health of Canadians,* Ottawa, 1999.
[80] Health Canada, *Toward a Healthy Future,* p. 25; Health Canada, *Statistical Report on the Health of Canadians,* Ottawa, 1999, p. 308; National Cancer Institute of Canada. 2000. *Canadian Cancer Statistics 2000,* Toronto.
[81] Canadian Fitness and Lifestyle Research Institute, *The Research File,* 2000, Reference No. 00-01. Cited in Colman, Ronald. 2003. A Profile of Women's Health Indicators in Canada. Prepared for Health Canada by GPI Atlantic. Halifax, p. 150.
[82] Andrews, Gary, "Promoting Health and Function in an Ageing Population," British Medical Journal 322 (7288), 24 March, 2001, pp. 728-729. Cited in Colman, (2003), p. 151.
[83] Fries, James, "Physical Activity, the Compression of Morbidity, and the Health of the Elderly," *Journal of the Royal Society of Medicine* 89, 1996, pp. 64 and 67. Cited in Colman, (2003), p. 151.
[84] Walker, Sally and Ronald Colman. 2004. The Cost of Physical Inactivity in Halifax Regional Municipality. GPI Atlantic. Prepared for the Heart and Stroke Foundation of Nova Scotia. Available from http://www.gpiatlantic.org/publications/summaries/inactivity-hrmsumm.pdf. Accessed May 26, 2009.
[85] Colman, Ronald. 2002. The Cost of Physical Inactivity in Nova Scotia. GPI Atlantic. Halifax. Available from http://www.gpiatlantic.org/pdf/health/inactivity.pdf. Accessed May 26, 2009. p. 3.
[86] The seven chronic diseases reliably linked to physical inactivity in the epidemiological literature available at the time of GPI Atlantic's original Cost of Physical Inactivity in Nova Scotia study, are heart disease, stroke, hypertension, colon cancer, breast cancer, Type 2 diabetes, and osteoporosis.
[87] For a detailed description of the methodology used to calculate direct and indirect costs attributable to physical inactivity please refer to Colman, Ronald. 2002. The Cost of Physical Inactivity in Nova Scotia. GPI Atlantic. Halifax. pp. 14-25, Available from http://www.gpiatlantic.org/pdf/health/inactivity.pdf. Direct costs include direct health expenditures on hospital, doctor, drug, and research associated with seven chronic diseases linked to physical inactivity plus estimated direct mental health costs attributable to physical inactivity. Indirect costs are productivity losses due to premature mortality and disability for each of the seven diseases related to physical inactivity.

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[89] Ibid.
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[95] Statistics Canada, *CANSIM database,* Matrix #M1011.
[96] Canadian Fitness and Lifestyle Research Institute, *International Consensus Project on Physical Activity Measurement,* Ottawa, available at: http://www.cflri.ca/cflri/research/ipaq.html.
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[112] Note that in this new GPI cost of obesity study, the directly measured data could only be used for hypertension, diabetes, and heart disease, since the 2004 Canadian Community Health Survey that reported directly measured data only provided information on those three illnesses. Also, as noted earlier, the small sample size of the directly measured data seriously compromised the statistical validity of results when reported by province, age, gender, diagnostic category, and obesity class. For other illnesses, the new GPI obesity cost study used adjusted self-reported data, based on Statistics Canada's new method and formula for adjusting the 2005 CCHS self-reported results to approximate the 2004 CCHS directly measured results.
[113] See, for example: Mustard, J.F., and Frank, J. (1991). *The Determinants of Health*, (CIAR Publication No. 5) Canadian Institute for Advanced Research, Toronto. Cited in Colman, Ronald. *The Economic Value of Civic and Voluntary Work in Atlantic Canada*. 2003 Update. GPI Atlantic. Halifax. Available from http://www.gpiatlantic.org/pdf/volunteer/volunteerupdate03.pdf
[114] Transportation impacts costed by GPI Atlantic include: vehicle ownership and operation, travel time, climate change, internal and external crash, internal and external parking, air pollution, water pollution, energy and resource consumption, roadway land value, road facilities, barrier effect, traffic services, noise, waste disposal, operating subsidy, and congestion.
[115] For further detail on how the road transportation costs break down by mode of transport, please refer to Table 68 in the original GPI Transportation Accounts:
http://www.gpiatlantic.org/pdf/transportation/transportation.pdf
[116] As stated, diesel bus costs represent roughly 2% of the total road transportation costs, indicating that the overwhelming proportion of costs refer to private not public vehicle use.
[117] Litman, Todd. *Win-Win Transportation Solutions: Cooperation for Economic, Social and Environmental Benefits*. (Victoria Transport Policy Institute, 2005f). www.vtpi.org
[118] Only a partial list of benefits was included and therefore these figures do not add up the total benefits cited.
[119] The percentage of residents with access to curbside composting is not the same as the percentage who participate in curbside composting. According to recent Statistics Canada data on this, the percentage of residents who participate in curbside composting increased from 19% in 1994 (when onlybackyard leaf litter was generally collected) to 69% in 2006 (the full organics pickup program). These figures do not include those residents who compost in their own backyards—for which participation rates and quantities processed are unknown. However, all Nova Scotia municipalities also promote backyard composting, particularly for leaf and yard waste. Indeed, from a GPI full-cost account perspective, backyard composting is preferable to curbside collection of compost, due both to direct savings in avoided curbside collection costs and indirect benefits including decreased transportation and energy costs, reduced transport-related GHG emissions and road maintenance costs, and the substitution of nutrient-rich compost for fossil fuel-based garden fertilizers that are a cause of water pollution. Composting rate data from Statistics Canada. 2007. Envirostats. Volume 1, no. 1. Catalogue no. 16002-XIE. Available from
http://www.statcan.ca/english/freepub/16-002-XIE/2007001/article/10174-en.htm. Accessed March 25, 2009. According to this source, PEI ranked highest in the country in terms of participation in curbside composting at 91% in 2006.
[120] de Groot, R. S. 1992. Functions of Nature: Evaluation of nature in environmental planning, management and decision making. Wolters-Noordhoff. Netherlands; de Groot, R.S. 1994. Environmental functions and the economic value of natural ecosystems. In Jansson, A. Hammer, M. Folke, C. and Costanza R. (eds.) *Investing in Natural Capital: The ecological economics approach to sustainability*. Island Press, Washington, D.C.

[121] Wide diameter, clear lumber, found predominantly in older forests, fetches higher prices in the market place than does small-diameter knotty lumber produced by younger forests.
[122] The Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests ("Montreal Process") was formed in Geneva in June 1994 to advance the development of internationally agreed criteria and indicators for the conservation and sustainable management of temperate and boreal forests at the national level. Participants in the Working Group included Australia, Canada, Chile, China, Japan, the Republic of Korea, Mexico, New Zealand, the Russian Federation, and the United States of America, which together represent 90 percent of the world's temperate and boreal forests. Several international organizations, non-governmental organizations, and other countries also participated in meetings of the Working Group. In February 1995 in Santiago, Chile, the above countries endorsed a comprehensive set of criteria and indicators for forest conservation and sustainable management, for use by their respective governments.
[123] For a complete listing of the indicators used in the GPI Forest Accounts (Volume 1 and 2) as well as the key indicators chosen for the Forest Accounts Update please refer to The Forest Accounts (2001) Volume 1 available at http://www.gpiatlantic.org/pdf/forest/forest1.pdf and Volume 2 available at http://www.gpiatlantic.org/pdf/forest/forest2.pdf. The key indicators can be found in the 2008 Nova Scotia GPI Accounts: Indicators of Genuine Progress, available from http://www.gpiatlantic.org/pdf/integrated/gpi2008.pdf.
[124] Nova Scotia Department of Lands and Forests. 1958. The Forest Resources of Nova Scotia. Prepared by L.S. Hawboldt and R.M. Bulmer, p. 62.
[125] For an extensive list of the forest-dependent flora and fauna currently at risk in Nova Scotia, please refer to Chapter 13 (Forests) of The 2008 Nova Scotia GPI Accounts: Indicators of Genuine Progress, available from http://www.gpiatlantic.org/pdf/integrated/gpi2008.pdf. Accessed February 25, 2009.
[126] Nova Scotia Department of Natural Resources. 2008. State of the Forest Report. Available from http://www.gov.ns.ca/natr/forestry/reports/State-Of-Forest-Report--April-2008.pdf. Accessed April 7, 2009. p. 39.
[127] The economic value of all the other ecosystem services (including carbon storage capacity) has recently been recognized in an unprecedented business deal between the new London-based firm, Canopy Capital, and Guyana, a small South American country. Essentially, the deal will help preserve a 371,000 hectare intact rainforest in the country. In exchange for funding a large portion of the Iwokrama preserve's research and conservation program on an ongoing basis, Canopy Capital has a license to develop value for the environmental services provided by the reserve. The company is currently in the process of determining the value of Iwokrama's ecosystem services, and says it will reveal how that value is determined so that the valuation methods can be used by others. *The Economist*. "Growing on Trees". May 18, 2009. Available from http://www.economist.com/world/international/displayStory.cfm?story_id=13684132. Accessed May 20, 2009.
[128] Ibid. Also according to the above article from *The Economist*, Pavan Sukhdev, an economist at Deutsche Bank, last year reported that the world was losing natural capital worth between $2 trillion and $5 trillion every year as a result of deforestation alone.
[129] Costanza et al. 1997. p. 253.
[130] Ibid.
[131] Ibid.
[132] Ibid. Table 2, p. 256.
[133] Ibid.
[134] Total provincial forest is 4,231,570 ha. Provincial forest area data are from the February 1999 DNR GIS Forest Inventory.

[135] For example, Peter Bein, Environment Canada (pers. comm. 2000), indicates that Costanza's assumptions are highly conservative, and that a more accurate valuation would assess ecosystem services very much higher.
[136] Goetzel, Ron (ed), "The Financial Impact of Health Promotion," *American Journal of Health Promotion* 15 (5), May/June 2001.
[137] Shields, Margot, "Long Working Hours and Health," Statistics Canada, *Health Reports,* volume 11, no. 2, Autumn, 1999, pages 33-48.
[138] Sokejima, S. and S. Kagamimori. 1998. "Working hours as a risk factor for acute myocardial infarction in Japan: Case Control Study," *British Medical Journal.* No 317. pp. 775-780.
[139] Statistics Canada, Canadian Centre for Justice Statistics, *A One-Day Snapshot of Inmates in Canada's Adult Correctional Facilities*. Catalogue no. 85-601. p. 120. For Canada, the "Snapshot" shows 55% of provincial prisoners and 43% of federal prisoners unemployed at the time of admission.
[140] In the GPI Paid Work Hours report, cost calculations have been made in relation to both a hypothetical 0% unemployment rate (full employment) and a 3.5% base rate. However, the calculations cited here are for the more conservative 3.5% base rate only. For more information and a step-by-step summary of the methodology used in the calculations please refer to the original GPI report: http://www.gpiatlantic.org/pdf/workhours/workhours.pdf.
[141] Government of Nova Scotia, media release, "Official launch of Select Nova Scotia," 5 July, 2007. Available at http://www.gov.ns.ca/news/details.asp?id=20070705004. Accessed 6 June, 2009.