UNIVERSITY OF PRINCE EDWARD ISLAND

A Small Island Perspective to Natural Capital:

Focus on Prince Edward Island

by

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Abstract

This thesis follows the development of natural capital economics and the impact that the valuation of ecosystem services might have on the value of limited natural resources in the Prince Edward Island economy. Natural capital economic systems are organized to accept laws of ecological science as determinates of outcomes. The application of ecological economic theory to island economic development imposes limits on the island economy; these limits are supported by physical island boundaries in geography. Financial values in natural capital economic theory represent a multidimensional concept which reflects various scientific disciplines and social groups when defining nature by built, natural, social and human capital.

A case study of PEI environmental indicators illustrates a declining stock of natural capital assets. Traditional economic indicators on Prince Edward Island reveal a lagging economy unable to reverse the long term decline in natural capital. Research indicates that these trends could be reversed by integrating ecological economics into island development and governance plans. Ecological economic theory, notwithstanding its early stages of development, provides guidance for islands to invest in income tax reform, natural area land assembly, climate change adaptation, and import substitution.

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Acronyms and Abbreviations

CO_2	Carbon Dioxide
CFC	Chlorofluorocarbon
GDP	Gross Domestic Product
GHG	Greenhouse Gas
ICSP	Integrated Community Sustainability Plan
IPCC	Intergovernmental Panel on Climate Change
IMF	International Monetary Fund
MA	Millennium Ecosystem Assessment
MDG	Millennium Development Goals
NO_X	Nitrous Oxide
NRTEE	National Round Table on the Environment and Economy
OECD	Organization for Economic Co-operation and Development
SO_2	Sulpher
UN	United Nations
UNEP	United Nations Environment Program
UNFCC	United Nations Framework Convention on Climate Change
USEPA	United States Environmental Protection Act
WCI	Western Climate Initiative
WMO	World Meteorological Organization
WTO	World Tourism Organization

Chapter One

Introduction

Urbanization of the modern world has lead, slowly but surely, most of the population to migrate into cities and surrounding urban areas, some have termed this phenomenon, the 'urban tsunami.' This global trend in population and cultural dynamic has affected Prince Edward Island as well as Canada over the last several decades. On Prince Edward Island, this change has been driven largely by a decline of economic activity in primary resource industries based in agricultural, fishing and forestry, and more recently, declines in the tourism industry. Urbanization has resulted from the loss of opportunities in rural areas, creating the need for people to move into urban situations to find employment and gain access to services.

Urbanization has created a culture that is removed from a deep daily attachment to the world of nature, where the economy and households are dependent on an individual level to the laws of nature. This loss of meaningful attachment to nature in our daily lives has allowed us to create a culture and an economy which appears to ignore nature order.

E. O. Wilson describes the human relationship with nature in his book, the *Biophilia Hypothesis,* as a relationship that stems from a biological need to focus on life and lifelike processes because we are dependent on biodiversity. Biodiversity, Wilson would suggest, is integral to our evolutionary development as individuals and as a species. The central element of Wilson's biophelia hypothesis is that nature and the natural environment are critical to the survival of mankind on an individual and societal scale. Biophilia postulates that humans must affiliate with nature because it is a biologically based need which is an integral part of our evolutionary heritage. Biophelia is also associated with the evolutionary survival of our species,

giving us a competitive advantage and genetic fitness, as well as improving the likelihood of increased personal fulfillment in the maintenance of our individual self-preservation interest.

Wilson asserts that mankind's affiliation with nature has given us an evolutionary advantage over many other species. The opposite of this assertion would state that should this bond with nature be eroded, the result will be a greater likelihood of a diminished existence in the future. The biophelia hypothesis supports an evolutionary imperative to maintain a close relationship with nature for reasons of individual survival. Man is dependent upon the continued success of this primary long term relationship with nature.

Wilson postulates we have created massive change in the environment already which is resulting in the largest extinction of species on the planet since the dinosaurs. Wilson suggests that the evolutionary trait of humans to bond closely with nature should be explored to establish the moral and ethical basis of change in society. The biophelia hypothesis would propose that the human species has an inborn need for nature which justifies the conservation of nature, both as a social and a biological imperative. We are human in good part because of the particular way we affiliate with other organisms (Wilson, 1993).

Critics of E. O. Wilson would suggest that his viewpoint is too alarmist and that our environment is not on the edge of collapse; therefore, no dramatic change to the status quo is necessary and change would, in fact, be counterproductive. In Canada, and in general, throughout the western world contrary commentary suggests that the health of financial markets serves as an indicator of sustainability for the industrialized economy. Wilson's critics would suggest that there has been little or no decline in the quality of our environment. The contrary view, although not unanimous in Canada, is held by many on the development side of the

political spectrum and provides the rational and basis for not making improvements in environmental conditions.

> *"Canada has been blessed with abundant natural resources and these have proved to be resilient. As the data provided here demonstrate—and contrary to the claims of alarmists — environmental conditions today are better than they have been in decades"* (Katz, 2009, p. 12).

The biophelia hypothesis provides the link to our evolutionary economic reality; nature is the primary economic engine of production, and must be the fundamental building block of an economy. Natural capital theory is based on the hypothesis that nature has financial value in the marketplace as the fundamental provider of goods and services. Continued economic development within the confines of this relationship is dependent upon nature preservation, conservation, and restoration.

Natural capital economic theory is founded on the assumption that natural processes define some effective methods of economic and financial profit production. Natural capital economic theory as developed by Paul Hawken, Amory Lovens and L. Hunter Lovins (Hawken, Lovins, & Lovins, 1999), has been used extensively in commercial enterprise. Other notable work on this field has been done by others such as Robert Costanza writing in America and Carl Folke from the Beijer Institute in Sweden, as well as the Resilience Network in Florida. This has developed the economic theory to the point of widespread academic credibility (Folke, 1994; Costanza, 1991; Hawken, Lovins, & Lovins, 1999; Steve Bernow, 1998). A fundamental premise of natural capital theory is the acceptance of limits to natural resources and growth the

founding definitions of which in global terms were brought forward in the publication of '*Limits to Growth*' by Roberta Meadows et al in 1972 (Meadows, 1972).

In natural capital economic theory, the incorporation of scientific laws into economic development models would require the acceptance of natural laws, such as the law of thermodynamics and the law of entropy. The law of thermodynamics is a founding principle of physics. The first law of thermodynamics dictates that the total energy in an isolated system is constant, despite internal changes. The second law of thermodynamics is the law of entropy which dictates that as energy dissipates or changes forms entropy increases, or as Kenneth Boulding refers to the concept , a lump of coal can only be burned once (Boulding, Kammen & Lipset, 1977). These two concepts of natural law, thermodynamics and entropy, can be seen in everyday actions and understood on a fundamental level by most people when represented by the input of fuel or food and the output of garbage or gas.

These two fundamental laws from the science of physics have been applied to economic theory; it is now easily recognized in economics that from every unit of economic production there are two outputs. Modern economic production models create products as a result of the use of thermodynamic energy, and waste or pollution, as a result of the law of entropy. The unit produced, and the garbage or negative output that accompanied production of the unit. Micro economic applications of natural capital economics are based on manufacturing situations which have shifted production models from simply the production of goods, to the production of services within a closed loop manufacturing system. Closed loop systems are designed to capture both thermodynamic and entropic energy.

Natural capital economic theory is driven in the manufacturing process by internal financial valuations and engineering measures aimed at improving energy consumption by a

factor of four (Hawken, Lovins, & Lovins, 1999). Energy conservation increases energy productivity (efficiency) in manufacturing and has the effect of decreasing the cost of production, this subsequently increases profit. The theory of designing production systems based in models of nature has been termed 'biomimicry' by Jean Benyus (Benyus, 1997). This field of biomimicry and engineering design has developed after recognition of superior design applications inspired by in nature found in architectural design, industrial engineering, aircraft design as well as innumerable other inventions.

My research has been motivated by several questions surrounding the application of natural capital concepts. Can biomimicry be adapted to small island economic theory? Are the laws of physics beneficial when applied to island economies, and is an island a closed loop production system?

Paul Hawken successfully used biomimicry in manufacturing models; this applied research yielded many new profit models and established benchmarks for industry awareness of social, cultural and environmental production impacts (Hawken, 1993). Hawken's applications were described as "*a rediscovery of Adam Smith's original version of free enterprise thinking (labor, capital, and resources) backed by new clarity on the critical conditions needed to keep them strong*" (Goerner, S. Lietaer & Ulanowicz, 2009, p. 76). The critical conditions described above are the new benchmarks in economic, ecological, social, and cultural sciences.

In the early years of the new millennium, the successful application of natural capital theory business models was exhibited by many international manufacturers including Interface Inc.[1] Modeling its products on nature, Interface captured the materials, energy and waste

1. Interface Inc. is the worldwide leader in design, production and sales of environmentally-responsible modular carpet for commercial, institutional, and residential markets; Interface is a

involved in each phase of a closed loop production life cycle. Within this framework, environmental impacts were quantified, opportunities identified, evaluated and incorporated.

The application of natural capital theories in small scale, closed loop micro-economic production systems yielded promising results, but on a macroeconomic scale success was not immediately apparent. In my view, a small island setting provides the opportunity to develop natural capital economic values directly linked to the close knit community which shares interdependent connections to the natural landscape. Nissology (see page 9 for definition) provides insights into common island experiences from around the world, and informs economic theory with a multidisciplinary perspective on community economic values which have developed as a result of known geographic limits (Baldacchino, 2004, 2008; Briguglio, 1995; MacKinnon, 1996; McCall, 1994; Baas, 1995; UNEP, 2006).

The finite nature of islands presents an opportunity for micro-economic analysis; bounded as islands are by sea and sky, the geographic entity provides quantifiable limits and certain knowledge of the total economic value of nature within those boundaries. The economic value of islands; therefore, should theoretically be increased by the addition and incorporation of natural capital values into the economy.

I argue that nature should be assigned a financial value in a small island economy in order to increase opportunities for economic improvements to be, based in science, and grounded in small island reality. The identification and preservation of common environmental assets increases the total economic viability of an island, as well as increasing income streams (wealth) from use and non-use values of the environment.

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leading designer and manufacturer of commercial broadloom. The sustainability team includes to this day Hunter Lovins, Amory Lovins, Paul Hawken and Janine Benyus www.interfaceglobal.com (Interface Inc., 2010).

Prince Edward Islanders are aware of the limits that nature imposes in personal as well as societal conditions. In a historical perspective of PEI agriculture written the late nineteen nineties, Wayne MacKinnon described local limits to growth which were achieved in a series of industrial agriculture initiatives over the last several decades on Prince Edward Island. MacKinnon found that "... *with the provinces limited resources base, it (PEI.) could only support so much agriculture. No matter how successful an industry might become there were absolute upper limits"* (MacKinnon, 1996, p.3).

Two recent examples of limits to growth in the Prince Edward Island context confirm this reality to islanders; limits to economic growth on the island can, and have, been reached within our lifetime. The disappearance of Atlantic salmon from island waterways is evidence on a local level that salmon have declined since 1970 in numerous communities across PEI. The 'anthropogenic' activity of islanders has caused this decline which is resulting from land erosion from farming and forestry management practices, as well as water born nutrient contamination from sewage treatment plants. These factors, combined with traditionally high catch rates of wild fish, have resulted in significant declines from peak population levels (Guignion, 2009).

Limits to growth in agricultural production were realized with the production of potatoes on PEI over the last three decades. Potato production of 46,000 acres in 1971 grew to a peak of 109,000 acres in the year 2000 (Spierenburg, 2007). Potato production acreage has been declining since, and in 2010 is estimated to be less than 85,000 acres (Statistics Canada, 2010a).

A variety of outside forces, beyond the control of islanders, have established a combination of economic and environmental limits to growth in potato production. These factors include commodity markets to which the majority of island export production is directed, which set prices beyond the control of producers. Other factors include outbreaks of naturally

occurring virus or bacteria cultures which can be detrimental to the industry as a whole, such as the outbreak of potato wart on the island in 2000 and 2002. Continental forces might also reduce the demand for frozen potatoes due to health related concerns or changes in international trade protocol and barriers.

Nissology assists in the identification of upper and lower limits in island economies, as well as defining the common factors which contribute to these limits, such as exposure to commodity market prices, smallness of size and distance from markets in general.

Research Methodology

This thesis is designed to isolate the elements of natural capital economic theory which would provide the most benefit for economic development on small islands. Research in this field of economics, natural capital economics, reveals that several scientific disciplines are establishing rational approaches to environmental values. The integration of findings in biology, anthropology, sociology, and ocean and atmospheric sciences, among others, provides additional insight to inform economic development plans. The introduction of holistic and participatory approaches to environmental preservation involves adding a human dimension, which in this study provides the context of a small island reality.

In writing this thesis I intended to explore the theory of natural capital economics, researching recent literature for insights into small island economies and community economic development which could be applied in the local context. Building on the island context, natural capital economic theory, and the concept of closed loop production systems, I studied economic values found in nature which are being factored into decision- making processes in governance

and in business (Boyd, 2003; Hawken, Lovins & Lovins, 1999; NRTEE, 2003; B. Fisher. Robert Costanza, Kenneth Mulder, Shuang Liu and Treg Christopher, 2006).

I was interested in finding applications of natural capital theory for small islands, as it appeared to me that the addition of non-consumptive nature values would provide a catalyst to reverse the long-term financial decline. Natural resource based industries and as well as ecosystems have declined on Prince Edward Island, and this is mirrored on other islands around the world; could the application of natural capital economic theory improve the profitability of production systems and therefore increase the value of limited island natural resources?

I have reviewed widely published sources of statistical information available from the United Nations, Statistics Canada, and the Statistics Division of the Provincial Treasury of Prince Edward Island. This type of baseline economic information is widely regarded as accurate, is respected in many jurisdictions, and has been developed through rigorous work and refinement over the years (Statistics Canada, 2010b). I accept that these classic economic measures of the wealth of islands, individuals or nations are universally understandable, are widely used as the basis for measurement in western society, and have validity in mainstream economic policy debate. These documents provide the basic data base for the discussion of natural capital values in the island context in this thesis. Although I argue at times that these classic measures of value are inadequate, and present perverse notions and outcomes of growth, their validity and acceptance in current economic analysis is not in question.

I have examined the development of global financial institutions which enable the continued increase in production of goods and services in global trade. I suggest that the protocol provided by the overarching financial institutions determine the development paths for

many islands, and that these institutions and market mechanisms fail to recognize limits to nature and the economy which are fundamental and endemic to islands.

I suggest that findings in natural capital sciences, supported by findings in the social and cultural sciences, provide the theoretical foundation for the integration of natural capital economic theory into island economies. The validity of using the four pillars of sustainable economic development analysis, (social, natural, cultural and financial) as presented in Agenda 21 (Agenda21, 1992), is supported in this thesis by the financial analysis provided by the World Bank, the U.K. Treasury, statistics from Canadian state agencies, and numerous widely published economic journal articles and books (Agenda 21, 1992; NRTEE, 2003, 2009; Statistics Canada, 2001; Stern, 2006; World Bank, 2004). The economic reports I have reviewed on the value of nature and ecosystem services were rigorous studies commissioned by national governments and international organizations which have taken years, in some cases decades, to compile (IPCC, 2007).

Nissology

Nissology provides insights into island economies and cultures from the study of a growing body of literature and data on small islands in multiple disciplines. The study of small island economies reveals that islands are typically prone to some unique, pervasive and long-standing challenges for economic development, unlike those faced by communities in continental or 'mainland' societies (Baldacchino, 2004; Briguglio, 2003; McCall, 1994). Emerging evidence in nissology from studies in biology, physics, economics, psychology, and sociology may provide answers as to why Prince Edward Island continues to decline. The decline of the Prince Edward Island economy is reflected in current traditional indicators of growth as measured by

Statistics Canada and by OECD analysis of economic trends (OECD, 2008; Statistics Canada, 2005b).

My research in this area has been multi-disciplinary, as numerous commentators and researchers have brought social capital, intergenerational equity, community capacity and governance forward as important factors of natural capital economics. The multi-disciplinary approach to island research is articulated more fully in 'Pulling Strings,' a book published to illustrate the economic, social, cultural and natural fabric of the island (Baldacchino, 2008).

Nissology is currently providing important and valuable insight into the economic effects of the physical boundaries of land and sea that may be endemic to islands. This research focus also provides a window into the ingenuity of 'islanders' and illustrations of their ability to reinvent their circumstances in the face of limits to growth (Mitchell, 2008), as well as revealing the administrative framework available to islands seeking to increase autonomy and economy in the new millennium (Connor, 2008).

As it is very challenging for islands to create new natural capital wealth, the bounded legacy of the island inheritance provides fixed limits in geography and domestic economy; environmental economics may provide methods to improve these capital values. Every island is unique, based first on its geography and ecosystem, and second through its history and cultural expression. *"The study of islands on their own terms is one other area that Prince Edward Island has acknowledged as a strategically appropriate niche for itself to pursue"* (Baldacchino, 2008, p. 26).

Prince Edward Island

A case study of Prince Edward Island presents traditional information contained in economic data and analytical studies currently available and published by the federal and provincial governments. These sources of officially published economic data provide a highly descriptive and comparable picture of the PEI economy and environment (Statistics Canada, 2003; PEI, 2008, 2009b; Wilkenson, 2003).

I also searched literature and scientific studies of natural resources on P.E.I that detail the abundance and quality of our natural environment (Guignion, 2009; PEI, 2003). I researched reviews of historical records and current baseline studies in ecology and reviews of ecosystem health for information on changes in the environment.resulting from human activity (Sobey, 2006). I argue that the evidence presented details a significant decline in both nature abundance and quality on PEI, and these documents reveal many similarities to data and findings from all over the world. Findings on the island provided a mirror of findings in analysis provided by the U.N. Millennium Ecosystem Assessment Report (MA, 2005a; PEI, 1999, 2003).

I have researched aspects of tourism by reviewing local industry association reports, provincial and federal statistical data and analysis, and statistics and analytical reports published by the United Nations. This database of economic profile information provides a robust basis from which to more closely examine and compare the tourism pillar of economic development in the island economy (Service Canada, 2004; Statistics Canada, 2001, , 2005a; UNEP, 2009). I argue that tourism development on Prince Edward Island today is found to be an inadequate instrument of economic development on many levels of social and economic analysis (Craigwell, 2007; Service Canada, 2004, 2006; UNEP, 2009). Economic data made available from these publications and reports reveal a long history of poor performance in tourism and a high level of

dependency on tourism on the island. This is consistent with island tourism development around the world (TAC, 2007; UNEP, 2009).

The information made available from research in these three areas, natural capital economics, nissology and the background provided from the PEI case study, is followed by a synthesis of the findings. The criteria used to evaluate the findings are structured in the four pillared sustainability framework adopted by the United Nations in Rio de Janerio and subsequently adapted into applications in the Canadian context by, among others, the Natural Step (Agenda 21, 1992; Step, 2010). This sustainability framework is based in multidisciplinary scientific review.

In this thesis I have used consensus agreement as a basis for the evaluation of opportunities for growth which are presented in the concluding chapter. Consensus agreement seems to be an important element of the adaptation process on islands; island economies exhibit close knit community connections through family and friends, and agreement amongst these parties is necessary although at times reaching an agreement can be a slow process which impedes change (Mitchell, 2008). This close knit quality does make islanders adept at avoiding unpleasant situations, they become expert at muting hostility, and avoiding dispute in the interest of stability and compromise (Baldacchino, 1997). Consensus agreement is at the forefront of the work done by the NRTEE and The Natural Step in helping communities define and agree to move forward on some issues, while at the same time, agreeing to disagree and put aside differences on other issues.

Chapter Two

Sustainable Development

The United Nations has provided enduring framework for the conceptual integration of sustainable development into economic planning for many individuals and nations around the world. For many, the UN sponsored Brundtland Commission marked the beginning of a new era, and the consensus statements made by Gro Brundtland in *Our Common Future* laid the foundation for the consideration of social and environmental factors in business and government decision making. Although there were many milestones achieved in advance of this report in order to prepare world leaders and the public for the concept of sustainable development, the Brundtland Commission remains a defining moment in western economic history.

The development of the Club of Rome is another such milestone on the road prior to the Brundtland Commission; the Club of Rome work was groundbreaking in the sense that it challenged the traditional notion of unlimited availability of natural resources, which were previously viewed as abundant commodities in economic theory. The foundations of the modern capitalist economy were created by Adam Smith's theory of labor, capital and natural resources being the basic building blocks of business. These economic development principles were created at a time when the providence of the natural world knew no limits. The Club of Rome's publication of Donella Meadow's *Limits to Growth* in 1972 began to challenge some fundamental assumptions of the post war economy (Meadows, 1972).

The combined forces of the United Nations Environment Program, the World Wildlife Fund and the International Union for the Conservation of Nature (ICUN) also provided another stepping stone on the path to the development of the Brundtland Commissions report. The publication of the World Conservation Strategy in 1980 succeeded in focusing the attention of

world leaders on some of the more damaging effects of unbridled economic development which failed to incorporate conservation of natural resources. The Club of Rome and the IUCN provided an important theoretical framework for the integration of conservation into global economic development. The fundamental basis of these reports was in science, and the rationale of preserving vital, life sustaining ecosystems was hard to deny.

The United Nations sponsored Brundtland Report created a global agenda for change that has been unfolding to this day through the ongoing international negotiations surrounding the Kyoto Protocol and Agenda 21. Brundtland recommended long-term environmental strategies for achieving sustainable development. The sustainable development definition that the Brundtland Commission has provided us with has had lasting meaning, this definition, " *development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (Brundtland, 1987) provides one of the most commonly accepted and widely used phrases in society today

The most notable achievement of the Brundtland definition was to alter economic theory to include more factors than just simple measures of labor, capital and natural resource use. Brundtland began a process of inclusion of the needs of the poor and the most vulnerable of society; women, children and indigenous persons. This also began a discussion of how to integrate environmental concerns into our economic protocols to make the changes called for in the report.

The Brundtland definition introduced what some would call a weak environmentalist approach to business investors and policy development scenarios for government. A weak approach to sustainability is not accompanied by action. The framing financial, environmental, and social equity issues as a three legged stool by the Brundtland definition started a movement

of compromise and consensus building that continues to this day. It could be, as some environmentalists would suggest, that too much latitude is allowed for industry in this sustainability approach (Wilson, 2002). In many instances, this approach has enabled tradeoffs for the economy to outweigh and maintain priority over environmental concerns. As a result of this approach to sustainability, Canadian business has continued to build the Alberta Tar Sands project in particular, and the western provinces energy industry in general, to become one of the world's largest sources of CO_2 emissions (Jeffrey Simpson, 2007). Most development based programs of sustainability are presented as alternatives to strict nature protection and the notion of 'sustainable development' has slowed efforts to increase the size and number of protected areas worldwide (Michael Soule, 1997).

The UN sponsored Agenda 21 premised that the actions taken by man in the twenty first century would be critical to the survival of mankind in the long term. Agenda 21 states that economic development in the twenty first century must include consideration of the inter-generational sharing of the benefits of growth with the less fortunate in the world; women, children and indigenous persons (Agenda 21, 1992).

Chapter 28 of Agenda 21 specifically targets community development and local initiatives. This chapter has provided the template and the international authorities for the development of local area plans (Agenda 21, 1992). The implementation of Agenda 21 of the U.N. Conference on Environment and Development in 1992, is one example of a process that is based on a shared vision of strong sustainability in society, formulated by the global community (Carl Folke, Robert Costanza, 1997). In the Canadian context, Integrated Community Sustainability Plans (ICSPs) have become the local template for articulating and measuring improvements in community economic development plans called for by Agenda 21. Federal

funding to municipalities now requires them to develop ICSPs, long-term plans reflecting community actions for improved sustainability outcomes.

The Millennium Ecosystem Assessment Report

The arrival of the new millennium has brought a new recognition of the need for international efforts to improve the lives of the large portion of humanity who have been excluded from the growing global prosperity of recent decades (MA, 2005a). The 2005 UN Millennium Ecosystem Assessment Report provided scientific facts gathered by more than 1,360 scientists from around the world with state of the art assessments, current science on the health of ecosystems, and the quality of ecosystem services. The MA categorized ecosystem services into four broad categories; (1) provisioning services such as the supply of food and water; (2) regulating services like flood control, coastal erosion mitigation and disease control; (3) cultural services such as spiritual benefits and recreational opportunities; and (4) supporting services which provide nutrients on a constant basis cycling through the system providing and sustaining life on the planet.

The main findings of the MA are that humans have changed ecosystems more rapidly and extensively in the last 50 years than in any other period of time in human history; this has resulted in a substantial and largely irreversible loss of life on Earth. The changes to the Earth's ecosystem have contributed to substantial gains in economic development, but at the same time have increased poverty for large groups of people. Changes in the Biosphere present a significant challenge to achieving goals of poverty reduction and social equity around the world.

The substance of the MA findings illustrate that 60% of the world's ecosystems are degraded or are being used unsustainably, including fresh water resources and wild capture

fisheries. This degradation often shifts the costs from one group of people to another group or to future generations, most notably from developed nations to undeveloped nations and from this generation to the next. "*Some changes are irreversible and have important consequences for human well-being including disease emergence, abrupt changes in water quality, the creation of dead zones in coastal waters and the collapse of oceanic fisheries*" (MA, 2005b, p. 13).

The MA illustrates tipping points and points out significant decline of the world's ecosystem with many examples, one of which is the record of wild caught fish landings during the collapse of the Atlantic Cod stocks off the coast of Newfoundland. The collapse of a 500 year old fishery provided the world with a dramatic display of just how quickly a tipping point, when reached, can affect our food supply chain.

> "*Once such trigger points are reached, it can be difficult or impossible for natural systems to return to their former state: more than a decade after the sudden collapse of cod stocks on the Grand Banks off Canada, for example, there are few signs of the fish returning even though the main fishery has been closed for 13 years*" (MA, 2005a, p. 8).

The chart below illustrates how long lasting the dramatic decline of the wild fisheries has been, as well as how long lasting the effects of over fishing have been since the collapse.

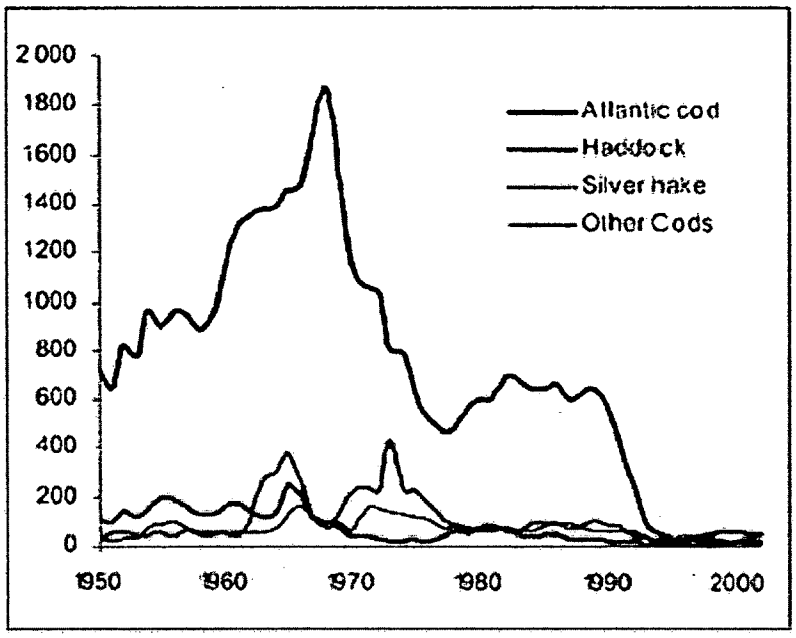

Figure 1 Collapse of the Wild Caught Cod Fishery off Newfoundland (MA, 2005a).

The example of the collapse of the fisheries off the coast of Newfoundland and Labrador is used extensively to illustrate the conflict between economic development and sustainable development, indeed, the Millennium Ecosystem Assessment uses this example in the executive summary to provide a concise example for world leaders to contemplate.

The counter intuitive nature of GDP based economic analysis is such that until the point of ecological collapse is reached, the destruction of natural capital is recorded as increased economic output in the free market accounting system. In 2001 the UN adopted the Millennium Development Goals (MDG) to provide guidance and targets for the reduction of poverty and the improvement of economic conditions for the world's poorest countries. Briefly described, the eight development goals include (1) poverty and hunger reduction, (2) universal primary education, (3) the promotion of gender equality, (4) the reduction of child mortality, (5) improvement of maternal health, (6) the reduction of HIV/AIDS and malaria, (7) the integration of sustainable development into the economy to reduce biodiversity loss and (8) the development

of global partnerships to improve governance and deal with the special needs of landlocked countries and small islands.

Canada is a signatory to the MDG and monitors key statistics to reflect progress that this country is making toward the achievement of relevant targets (MDG, 2009). Data reported in the Canadian context reflects national progress toward gender equality, child poverty reduction, youth unemployment, biodiversity restoration goals and GHG emissions.

International Financial Framework

The Bretton Woods Agreement of 1944 provided an economic framework of fixed value exchange rates based on the Unites States dollar having a fixed value against gold. This framework defined the postwar economy, and allowed for the development of a global economy. The Bretton Woods agreement provided exchange rate stability, the capitalist economy thrives on stability, and the agreement provided this stability. This, in stark contrast to the breakdown of international trade relations and increase in protectionist measures which typified the depression era of the 1930's (IMF, 2010).

The creation of the International Monetary Fund (IMF) and The World Bank provided strong new institutional capacity; the two fundamental institutions provide the necessary infrastructure for world trade and the expansion of free market economies in the post war era. The purpose of the IMF is to promote international monetary cooperation, promoting stability and ensuring members that safeguards are in place for the financial system. The IMF implements its goals and policies by facilitating international exchange of currency and contributing to high employment investment schemes worldwide (IMF, 2010).

The World Trade Organization (WTO) was established in 1995, and one of the bodies of law it administers is the General Agreement on Tariffs and Trade (GATT). The GATT is an important building block for the expansion of western business practices and increased global trade which has developed as a result.

The WTO uses the administration of GATT rules to ensure that trade flows operate in accordance with international protocol which generally do not favour the restriction of trade for environmental concerns. GATT rules do allow for some restrictions of trade due to plant animal or human health concerns and have provided some latitude for trade and economic protection in the world economy but this is the subject of debate and ongoing international trade negotiations (Etherington, 2003). However, "*any law or regulation passed by a WTO member country that affects trade flows – even if its purpose is primarily environmental protection – has to measure up to GATT rules*" (IISD, 2007, p. 1). This often places the WTO in the position of creating conflict between domestic and international environmental ethics and laws, because of the conflict between the ground rules of international trade and country specific policies.

Together, these three institutions (WTO, IMF, and the World Bank) have carried the Washington Consensus forward and enabled goals of global economic development and creating affluence in the developed world; however, this development has done little to relieve poverty or improve the environment (M.A., 2005).

What has been coined by John Williamson the 'Washington Consensus' was a term used to define the central economic powerhouse that is represented by the combined financial powers of the U.S. Congress, senior members of the U.S. administration, the Federal Reserve Board, along with the myriad of international institutions like the World Bank and the IMF within one sphere of influence (Williamson, 2004). The Washington Consensus defined the prevailing

world view in business and government to mean orderly and sustainable growth could be achieved by following a specific economic formula. This formula consisted of fiscal discipline in government spending, re-ordering government spending towards health, education and infrastructure, reducing income tax and increasing consumption taxes, international trade liberalization, privatization of government services, deregulation in industry and improved intellectual property rights around the world. Many of these formula elements remain in the forefront as suggested paths of development to this date.

The Washington Consensus set the world stage for development of government spending priorities for the economy for the last 20 years in a template developed by two contemporaries at the time, Ronald Reagan and Margaret Thatcher.[2] The use of this term, the Washington Consensus, has grown to symbolize the center of power in current global markets and the enormous influence that American financial institutions and economic gatekeepers have on the world today (Williamson, 2004).

Economic thinking has relied on scarcity and price to allocate natural resources and advise public policy on matters of world financial order since the end of the Second World War. This view holds that natural resources are considered free gifts from nature and are there for the taking. Natural resource scarcity and prices have heretofore been considered only as a function of economic availability and extraction costs. Admittedly, this theory of economic growth in free markets and improved world trade protocol in the western economy has yielded a long period of steady economic growth in the developed world.

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[2] Williamson points out that government spending cuts initiated at the time by Margaret Thatcher and Ronald Reagan were far in excess of what he considered the consensus statement to mean (Williamson, 2004).

The free market system of resource allocation depends on individuals and corporate entities making decisions on the costs and benefits of products and services which are based solely on individual welfare, 'Adam Smith's invisible hand.' Traditional approaches to economic growth look at the effects of changing the value of variables in the GDP equation (GDP = Consumption + Investment + Government + (Exports - Imports). The Keynesian approach to growth, so instrumental in bringing the world out of the Great Depression of the 1930's, was to stimulate government expenditure which resulted in increased individual and corporate consumption and investment.

The basic premise of the free market system argues for unregulated and unpriced environmental services to be factored into production models without full life cycle product costing mechanisms. The market system provides price signals based on supply and demand, but does not accept the fact that resources are limited by nature, and instead proposes that they are only limited by price (Boyd, 2003). This view is widely held in natural capital economic theory and reflected in criticism of international financial institutions. *"The price mechanism fails for resources that cannot be exclusively owned....and will consistently favor the production of market goods rather than the provision of non-marketed ecosystem services"* (Costanza & Farley, 2007, p. 251). This view is supported by research carried out by the World Bank, *"With few exceptions, there is little financial reward for conserving biodiversity, nor much penalty for destroying it"* (World Bank, 2004, p. v).

The usefulness of the traditional GDP equation in evaluating economic growth has presented limitations and concern about the consumption or even destruction of nature capital being reflected as GDP growth. Catastrophic events like the Exxon Valdez oil spill and the overfishing of Atlantic Cod are interpreted and presented as economic growth in GDP analysis

scenarios. It is somewhat counter intuitive to consider pollution or higher health care costs as contributing to GDP, but this is exactly how these costs are incorporated into traditional economic models.

The inability of the free market system to monetise environmental and social costs results in perverse outcomes which are represented as increased economic development in GDP (NRTEE, 2003). In the case of environmental goods and services provided from nature, the free market economy fails to provide consumers with correct signals of the opportunity costs of economic production. The result is that the benefits of manufactured goods and services are overstated and all associated costs are understated. Long term market failures continue to plague the global economy, clearly indicating the need for economic instruments which will deal effectively with these issues of economic valuation in world financial markets (Stern, 2006).

Economist Herman Daly is among many who suggest that economic development as measured by growth indicators in GDP measures alone fail in two ways

> "*The growth economy now fails in two ways: (1) positive growth becomes uneconomic in our full-world economy; (2) negative growth, resulting from the bursting of financial bubbles inflated beyond physical limits, though temporarily necessary, soon becomes self-destructive*" (Daly, 2009, p. 1).

Numerous authors have agreed with Daly's analysis, as we see in the writing of Robert Costanza.

> *"By emphasizing only one allocative mechanism and type of value (financial), the market economy fails to provide the proper balance of capitals,...if we are to protect our capital assets where they are most vulnerable, we must learn to view our economy as a complex interconnected system comprised of all four types of capital which contribute in multiple ways to human well-being"* (Costanza & Farley, 2007, p. 252).

The view that private markets cannot operate efficiently when allocating external costs is widespread, these inefficiencies provide the fundamental economic justification for the existence of governments and regulation.

Quality of life proponents would also suggest quantitative economic analysis and measurement do not include any sort of quality measures (Jennifer Scott, 2007). This viewpoint is echoed on Prince Edward Island, *"Mainstream economic development models fail to incorporate material flows, energy sources, physical structure and information about ecosystems. In fact, this is a major contributing factor for the looming environmental crisis"* (Nagarajan, 2006, p. 294).

The definition of Gross National Product (GDP) does not allow for line item integration of costs and benefits of social, cultural, or environmental factors of production. The income flows and tax rates from new fields of services, which are becoming evident through the environmental assessment process, are not yet institutionalised in GDP measures. Although the value of income streams from natural capital assets are just beginning to be identified, the value of these capital assets should be detailed and integrated into our income and taxation models (Costanza, 2007; Jeffrey Simpson, 2007; NRTEE, 2009).

The measure of economic success in natural capital theory results from improvements in the overall human condition. Economic development need also be accompanied by social development such as longer, healthier lives lived; cultural development exhibited in stronger social cohesion and environmental protection for the continued provision of life giving eco-system services.

Green House Gas Emissions

The growth of numerous UN sponsored international agreements and conventions such as those on Biological Diversity, Desertification, Wetlands and Migratory Species, eventually led to the planning of the Earth Summit in Rio de Janeiro, the outcome of which was Agenda 21.

The Kyoto Protocol (UNFCC, 1997) is a prodigy of the conference at Rio de Janerio; the United Nations Framework Convention on Climate Change (UNFCC) was agreed to in Rio de Janerio in1992 and Kyoto which was convened five years later as a result. Kyoto was directed to the compilation of international measures which would reduce emissions of gasses from human industrial activity.

International consensus developed around the effects of climate change impacting public goods and the growing need for mitigation to correct or halt this damage. The tendency of the free market and traditional economic analysis is present in this scenario is to over-represent the benefits of carbon heavy technologies and under-represent the full costs that are faced by consumers and business as they purchase these goods or services. The producers of carbon, energy and transportation industries in particular, impose costs on future generations which have not been factored into the price that is set in the marketplace for their products. "*This is the*

raison d'etre of a carbon price – to let consumers know, through a price signal, that carbon emissions are costing the Earth." (Nic Rivers, 2008, p. 8)

The Kyoto Protocol contained specific measures and actions aimed at GHG reductions which, technically speaking, 187 countries, including Canada, signed and ratified. The Kyoto Protocol essentially supports and depends on changing the lifestyles of millions of people in order to reduce carbon emissions. The protocol identified major greenhouse gas emissions (GHGs) as a serious environmental threat requiring action and targeted reductions, and 1992 was used as the base year of measurement.

The agreement specified targets for six greenhouse gasses (carbon dioxide, methane, nitrous oxide, sulpher hexafluoride, hydroflourocarbons, and perflourocarbons); these gasses are translated into their CO_2 equivalents in order to standardize measurements. Kyoto established a method of standardization reflects an effort to represent equivalency to the effects of carbon dioxide in our atmosphere and accounts for different long term effects that the six major gas emissions might have. This theory of equivalency was developed by the Intergovernmental Panel on Climate Change; it helps provide a standard accounting metric for greenhouse gas emissions from individuals, corporations and governments. This compensates for the difference between methane gas and carbon dioxide, where methane gas has a much larger effect on global warming than carbon dioxide (IPCC, 2006).

The development of the Kyoto Protocol has highlighted the wide variety of international responses, political viewpoints, and varying degrees of success in reducing emission which challenge the consensus approach to environmental change. The Canadian reaction to climate change agreements has been outwardly supportive, but measures to reduce greenhouse gas emissions are bogged down in regional differences in implementation schemes. Critics have

focused on the lack of action which has resulted because of a political stalemate between Alberta and Quebec. Alberta has the highest emissions per capita in Canada, and Quebec the lowest, the ability to come up with a compromise continues to challenge policy makers (Jeffrey Simpson, 2007). This lack of action and unwillingness to accept change in Canada appears to ignore scientific claims that climate changes, a direct result of GHG emissions, have a direct link to ecosystem health, future economic growth prospects and the distribution of wealth which results (IUCN, 2007; Stern, 2006; UNFCC, 1997).

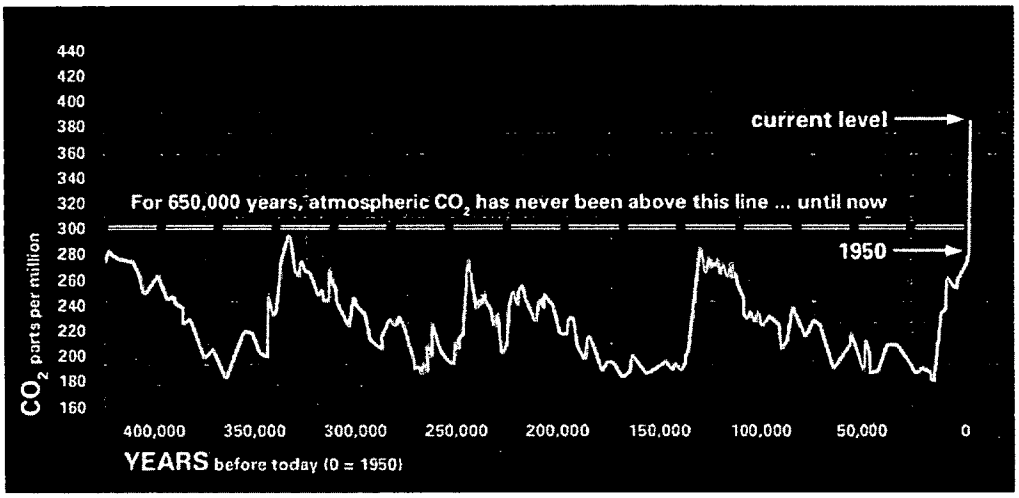

Figure 2 The CO_2 Record from ice core samples.[3]

[3] This graph, based on the comparison of atmospheric samples contained in ice cores and more recent direct measurements, provides evidence that atmospheric CO_2 has increased since the Industrial Revolution (Source: NOAA).

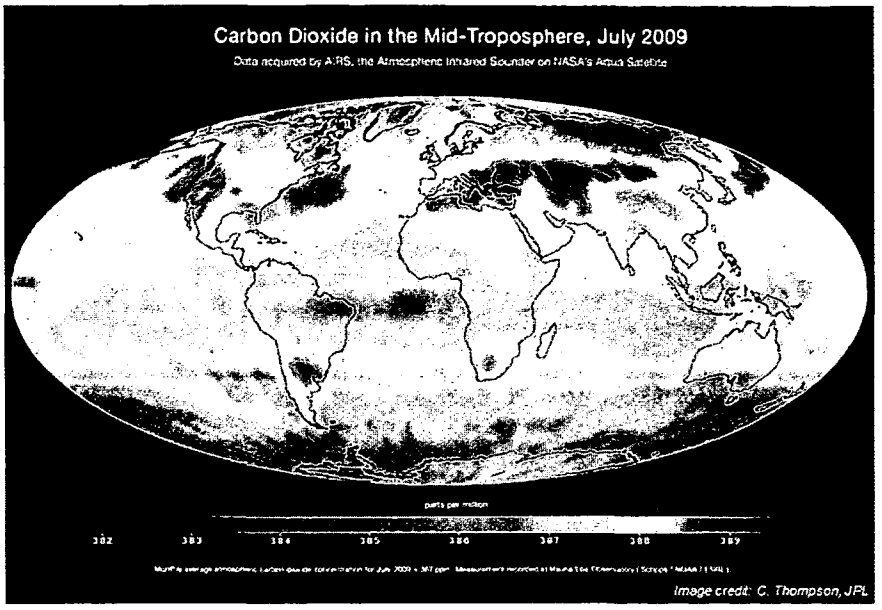

Figure 3 NASA Mapping of CO_2 in the Atmosphere 2009[4]

Current Canadian commitments represent an emission reduction target of 6% measured from 1990 levels; Canada was 32% away from achieving this target in 2005. The current Canadian target is contained in an April 2007 federal announcement which evidently moves the goal away from the Kyoto targets. Reductions of 20% from 2006 levels by 2020 are now targeted. This policy provides the basic template for current economic valuation of carbon emissions in Canada (E. Canada, 2007). The desire of the country to act on these international commitments is well intentioned, but the ability to incorporate the agreements has been plagued with poor performance of political leadership in Canada. *"Canada has moved steadily further from its Kyoto targets, compiling the worst climate change record of any major country that signed the Kyoto Protocol on global warming"* (Jeffrey Simpson, 2007, p. 34).

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4 AIRS map of carbon dioxide in Earth's middle troposphere for the month of July 2009. Image credit: NASA.

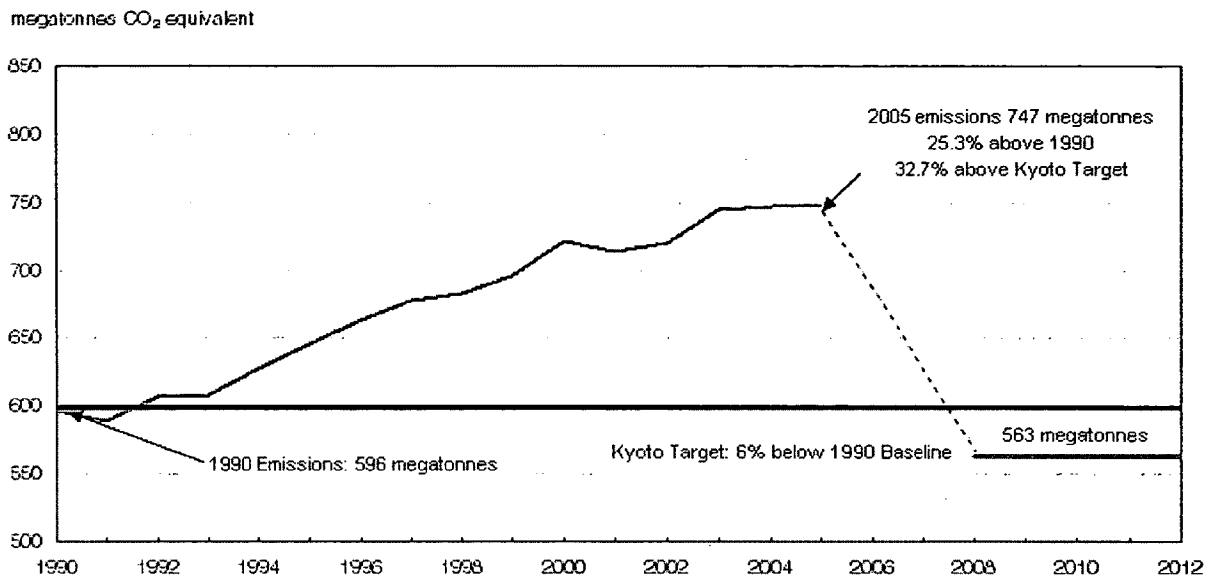

Figure 4 National Inventory Report (Environment Canada, 2007).

The Kyoto Protocol created a quantification framework for 'cap and trade' free market pricing systems which enabled carbon markets. Free market pricing signals provide guidance on the achievement of the overall goals of the protocol; the principal objectives of which are to increase the efficiency of oil and coal consumption, to encourage a switch to renewable forms of energy, and develop new low-carbon technology for industry. The emergence of 'cap and trade' systems for carbon emissions has resulted in the creation of active North American trading systems, the largest of which is facilitated by the Chicago Climate Exchange (Exchange, 2009).

The Chicago Climate Exchange provides the framework to market for all six greenhouse gasses, in a network of institutions that use cap and trade systems to achieve environmental goals. Expanding forests and halting the deforestation practices around the world is recommended as a high priority action because trees remove substantial amounts of CO_2 from the environment (Stern, 2006). Carbon management schemes have created markets for the

financial values created by carbon sequestered in forests and grasslands which, once certified, are traded on a regular basis in this market place.

The Intergovernmental Panel on Climate Change (IPCC) was created in 1988 by the UN to assess the science relevant to climate change, report on the impacts of climate change and to formulate realistic response strategies. The first report of the IPCC was published in 1990. The language and science in the first report was tentative compared to statements contained in the fourth IPCC report, AR4 issued in 2007, almost 20 years later. The 2007 report used the strongest language to date to describe climate change; "*warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level*" (IPCC, AR4, 2007, p. 1). The majority within the world's scientific community has reached an '*unequivocal*' consensus according to the fourth IPCC report.

The publication of the IPCC report in 2007 included data that had been peer reviewed and published prior to June 2006; since that time there has been a significant body of peer reviewed science published. A summary of the scientific findings published since June 2006 indicates that the imperative for action has increased since then.

Current research indicate a direct linkage between increasing levels of GHG emissions and the timing of seasonal freeze and thaws of lakes around the globe. An increase in the rate of ice melting in the Arctic and a more rapid collapse of Antarctic ice fields, than previously anticipated, has also been documented (Pew Center, 2009b).

The discussion of climate change in the past has been restricted to measurements of atmospheric uptake, but did not consider the measurement of oceanic uptakes and the implications that this may have for increased acidification (lowering pH) of the oceans.

Increasing ocean temperatures, along with the recorded change in pH, is impacting coral reefs, shellfish and marine ecosystems generally (Pew Center, 2009a). Change in the acidity of oceans is the result of a basic chemical reaction between carbon and water occurring on the surface of the ocean. The mixture of CO_2 and H_2O results in the creation of carbonic acid (NOAA, 2010).

Controversy over climate change science has been common through this period of time and rose to a crescendo in the later part of 2009 with the release of '*hacked emails.*'[5] The public release of this information resulted in the implication that some level of scientific misconduct was evident. The controversy erupted at the University of East Anglia Climate Research Unit (CRU) in the United Kingdom in November 2009.[6]

Climate change was challenged to revalidate the data notwithstanding the fact that the data sets involved had been reproduced independently, by other scientists, in numerous countries and have yielded similar conclusions (Pew Center, 2009a). The response of the scientific community has been strong and is embodied in the statement issued by the Pew Center in the United States.

> *"Although there is no clear evidence of scientific fraud or misconduct at this stage, if further investigation were to reveal that misconduct had occurred, the scientific consensus regarding human-induced climate change, as stated by the IPCC, the U.S. National Academy of Sciences, and virtually every relevant scientific body, is not likely to be affected* " (Pew Center, 2009a, p. 4).

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[5] Hundreds of private emails and documents hacked from a computer server at a British university are causing a stir among global warming skeptics, who say they show that climate scientists conspired to overstate the case for a human influence on climate change (Revkin, 2009).

[6] There are two other CRUs, both in the US, one run by NASA and the other by NOAA.

The Stern Review

Concurrent to the development of the fourth IPCC Assessment in 2007 was the release of Sir. Nicholas Stern's report on climate change late in 2006. This report was commissioned by the British Treasury to assess the risks for, and the impact on, the world economy and the implications for Great Britain in particular. This economic review of the impacts of climate change on the world economy documents a growing consensus in the economic and ecological scientific communities.

The Stern Review findings disclosed facts which illustrated that all countries will be affected by climate change, but it is the poorer countries and peoples of the world who will feel the effects first, "*climate change is a serious global threat that demands an urgent global response*" (Stern, 2006, p. 1). The Review estimates that each additional tonne of CO_2 emissions is causing $85 of damage to the environment, and these costs are not being integrated into the economy at this time.

Canada's National Climate Change Process comprised a two year long series of consultations and consensus gathering aimed at developing a Climate Change Strategy called Action Plan 2000. At that time the, marginal public cost of the production of one additional tonne of GHG emissions was no less than $50 (Canada, 2000). These unmitigated costs represent a liability which is not being considered by individual consumers and corporations on a daily basis (MA, 2005a; Stern, 2006).

Sir Nicholas Stern argues that that the looming carbon crisis represents as large a threat to our economy as the Great Depression was to our predecessors. Stern estimates that the dangers of not acting on climate change could be equivalent to 20% of global GDP. This is estimated to

be five times the cost of mitigation, assuming that we act soon. The Stern Review advocates a shift to a low carbon economy, one which is based on a cap and trade system of free market carbon emission valuations, and one which supports the development of low carbon technologies[7]. Overall the main points of the Stern Review can be generalized by saying that three key elements are needed to enable an effective economic response; carbon pricing must be established through taxation or trading, innovation must be encouraged in low carbon industries, and efforts must be made to inform, educate and persuade individuals to respond to the challenge (Stern, 2006).

The Stern Review states that pre-industrial levels of carbon were 280 parts per million (ppm) and were in a steady state for thousands of years. Current levels of carbon in the atmosphere are now at 430 ppm, unprecedented in our understanding of the global record, CO_2 levels are still increasing due to current levels of carbon based fuel consumption. Climate change resulting from the industrial emissions will affect the basic elements of life, such as access to drinking water, the geographic distribution of food production and human health from more extreme weather patterns.

These wide ranging effects are being seen around the globe from coral bleaching to sea level rise; the changes that are being recorded in sea level rise are clearly a threat to the future well-being of human life and security on small islands (UNEP, 2006). The impacts of climate change are expected to be long term and the effects wide ranging and persistent (Stern, 2006).

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[7] Although cap and trade systems or the imposition of a carbon tax has been discussed for years in Canada, no politician will get elected on the promise of tax increases. The consensus in Canada is that the only way to move toward the Kyoto carbon targets in Canada is to bring in an integrated array of tax changes and new market mechanisms like cap and trade systems combined with stiff regulation (NRTEE, 2009).

The Stern Review indicates that the costs of stabilizing CO_2 emissions are substantial and that significant reductions are required from present day emissions levels in magnitude of 80% (Stern, 2006). The achievement of this reduction target represents a major technological challenge to continental and island economies and our innovative capacity to adapt. Future economic development frameworks are recommended to include emissions trading schemes, reforestation and reduced deforestation, technological innovation and climate change adaptation strategies which involve the relocation of infrastructure away from threatened low lying coastal zones. It is also clear that in Canada as well, this global warming climate change challenge presents new opportunities and business markets for emerging low-carbon technologies as economic growth becomes less dependent on fossil fuel technology (NRTEE, 2009).

The ethics of climate change present another challenge to developed nations in that poorer countries, and poorer people, will be suffer the most severe effects, and will suffer the effects earlier than developed countries and wealthy individuals (Stern, 2006). The findings of the Stern Review in this regard, as well as the United Nations MA, identify the impacts of climate change affecting firstly, the most vulnerable in society; women, children and indigenous people. The decline of the ecosystem on a global scale reduces the ecosystem services or 'common pool resources.'

For costs such as pollution, environmental degradation or loss of habitat, there are frequently high social costs attached in the dependent community. The poorest of people and the poorest nations disproportionately depend on ecosystem services more than others in our society because of the high portion of income that is dependent on 'free' ecosystem dividends, such as the provision of clean water, clean air, and the relative abundance and variety of wild food sources available in a healthy environment (Stern, 2006).

Chapter Three

Natural Capital

Robert Costanza helped construct the foundation for the theory of natural capital economics by defining and valuing ecosystem services in terms of financial measurements commonly used as GDP metrics of measurement. This estimation of the financial values for nature would provide a framework for the valuation of the Earth's natural capital assets relative to the size of the industrial economy. Costanza postulated that while global GDP in the early 1990's was estimated to be $18 trillion US dollars, the total value of nature's ecosystem services for the same year was estimated to be $33 trillion US dollars (R. Costanza, et. al. 1997).

Many ecosystem values have been established in the past couple of decades as a result of the conceptual development of 'ecosystem services'. As an example of this valuation framework, ecosystem services are considered to be the production of clean air or clean water by natural means as a service provided by our environment which in many ways add value to our economy. These life sustaining services can, in some instances, be replaced with mechanical systems such as water purification plants or air filtration systems, but no one would suggest that all the services provided by nature can be replaced by modern science. Many ecosystem services are provided outside of free market mechanisms and are then considered non-market items.

Efforts to value the environment in the Canadian and Prince Edward Island context have been subsequently published by a variety of institutional and official sources (Ken Belcher, 2001; Mark Anielski, 2005; Martha McCulloch, 2002; PEI, 2003; Wildlife Habitat Canada, 2006). Annual nonmarket values of forest ecosystems in Canada have been estimated at $50 per hectare (Mark Anielski, 2005), wetland ecosystem services have an estimated value of providing over $934 hectare of ecosystem services per year (Martha McCulloch, 2002). Non market

values of ecosystem services are estimated to be 2 to 2.5 times greater than the net market value of natural capital extraction (R. Costanza, et. al., 1997; Mark Anielski, 2005).

Natural capital values are a critically important contributor to the economy, whether measured in terms of GDP, household income, or employment. Canadian applications of natural capital theories of value are based in a perceived moral obligation within the society; the acceptance by the general population of some responsibility towards nature is evidenced by support for species at risk legislation and various environmental regulations. Canada's natural heritage is a cornerstone of our national identity and it is a trait by which others define us as well beginning with the most recognizable emblems of our heritage in the maple leaf. Most Canadians recognize a personal responsibility to prevent pollution, to contain urban sprawl, to conserve our ocean resources, and protect endangered species (NRTEE, 2003).

In recent years, the measurement of nature values has become of interest to other disciplines, not just to economists. *"Altogether it has become evident that the concept of critical natural capital is by no means rooted solely in the natural sciences but also in the full array of social sciences and the humanities"* (Brand, 2009, p. 608). Natural capital sustains all other forms of capital; social, cultural and built capital. Natural capital is considered to be a public good, and free market financial data alone, cannot integrate these public values into the decision making process of business or government. The total economic value of nature is greater than the financial values that are presented in the economy (Costanza, 1992).

Natural capital includes tangible resources such as water, minerals, fish, oil, trees and also encompasses living systems like oceans, coral reefs, rainforests and estuaries. Natural capital theory defines economic progress to mean more than what is reflected in GDP by adding factors such as human welfare, the sustainable wellbeing of people, the economic contributions

of family, friends, and other social relationships on many scales, in addition to values in human health and education (Costanza, 2006). The development of ecosystem valuations and the integration of natural capital theory into decision making processes depend on the determination of use values, non-use values, indirect use values, and option values (World Bank, 2004).

It is important to consider the total stock of nature and the decline of natural capital inventory when considering the costs and benefits of the free market economy in economic theory. The International Union for Conservation of Nature (IUCN) is the world's best authority for information on the health of our ecosystem as a whole, as well as on a regional and local scale (IUCN, 2010). The IUCN, governed by the World Conservation Council, has been working to establish a world standard of identification and documentation of the species most in need of conservation attention and to establish a global index of the state of change of biodiversity. The development of this international standard lead to the establishment of the '*The Red List*' first published in 1963. Since then it has been developed under rigorous scientific consultation and widespread field testing. This work has resulted in a baseline of information from which to monitor changes in the status of species with considerable effort being expended to maintain a clear and transparent process. The methodology is primarily based in the assessment of species population and the identification of threats to critical habitat for particular species.

The latest update from the IUCN Red List of Threatened Species™ was published in 2004; it now shows that 17,291 species out of the 47,677 assessed species in the world are threatened with extinction (IUCN, 2004). This IUCN research reveals that currently, 21 percent of all known mammals, 30 percent of amphibians, 12 percent of birds, 28 percent of reptiles, 37 percent of freshwater fishes, 70 percent of plants, and 35 percent of all invertebrates assessed so

far are under threat. These pronouncements are important to consider when contemplating the economic framework of sustainable development and natural capital economics.

It is evident that economic growth around the globe, as well as on Prince Edward Island, has reduced our stock of natural capital. *"Growth is destructive of natural capital and beyond some point will cost us more than it is worth – that is, sacrificed natural capital will be worth more than the extra man-made capital whose production necessitated the sacrifice"* (Herman E. Daly. Robert Costanza, 1992, p. 43). It is also evident that this reduction in natural capital assets will reduce our economic potential in the future. *"We know that at larger spatial and temporal scales more biodiversity is needed to supply a steady flow of ecosystem goods and services, hence biodiversity is a key economic, social and ecological goal"* (Fisher, Costanza, Mulder, Liu & Christopher, 2006, p. 251). It is then imperative to investigate the economic value of natural capital.

Natural Capital Economic Theory

The development of financial values for nature provided the theoretical basis for natural capital economic theory. Paul Hawken refers to the 'Next Industrial Revolution' as the transformation of the current industrial economy into the new century. In the next century, as human population doubles, the resources available per person drop by one half to three fourths which provides a remarkable opportunity for transformation of industry and commerce. Hawken maintains that the basic economic driver of the original industrial revolution was simply increased manufacturing productivity and that this formula must be applied to natural resource use in this century in order to improve prosperity in the future (Hawken, Lovins & Lovins, 1999).

Natural resources have been traditionally divided into three categories; renewable resources, non-renewable resources, and continuous resources from thermodynamic natural resources such as solar, geomagnetic, tidal and wind energy. Natural capital economic theory expands these definitions to include both use and non-use values, as well as marketed and non-marketed products. Natural capital theory summarizes the non-marketed contributions to human welfare in four basic types of capital that is necessary to support the real human welfare producing economy; (1) built capital, (2) human capital, (3) social capital and (4) natural capital (Agenda 21, 1992; Costanza & Farley, 2007; MA, 2005b).

This four pillared approach is key to the international consensus, developed on the sustainability journey from its beginnings with Brundtland, to the state of discourse today. Social justice dimensions conceptualized by Gro Brundtland include new value factors like inter-generational equity, the preservation of ecological value for the next generation and intra-generational equity, the sharing of ecological values and growth opportunities in the present tense with all those living in the world today.

Natural capital economic theory has been proven effective in many production and manufacturing business models by Paul Hawken and Amory Lovins; however, macro-economic applications are limited. This may be the result of nature valuation techniques which are not robust enough to incorporate into market models of development, "*valuations are unlikely to satisfy normal accounting standards of verifiability and reliability because they are likely to be arbitrary and artificial*" (Barton, 1999, p. 219).

The micro economic application of natural capital economics is simply to turn production cycles into closed loop systems which mimic ecological cycles in life. Natural capital theory postulates that waste becomes a resource which naturally renews the business cycle. Lovins and

Hawken applied engineering and environmental principles to radically improve natural resource productivity and profit as the cornerstone of natural capitalism. The benefits of reducing material inputs slows material consumption, lowers the amount of pollution produced and reduces manufacturing costs, and therefore, increases profitability (Hawken, Lovins & Lovins, 1999).

Bio-mimicry is incorporated in natural capital business systems through the design of industrial systems on biological lines to enable the constant use and reuse of materials in continuous closed loop cycles (Benyus, 1997). Biomimicry follows the natural laws of growth and development found in nature. The biomimicry hypothesis holds that the application of the natural law of thermodynamics and entropy to business and free enterprise is a necessary and profitable element of success.

Ecosystem Services

Nature provides the economy with a stream of outputs from a stock of natural capital. The outputs from nature are estimated to be substantially larger than the annual global GDP (Costanza, 1999). A conclusion can be reached as a result is that a forest has more economic value than that of the financial value of the timber contained alone. The fertility of a forest is mainly in the trees and the fertile topsoil built up over centuries, however this topsoil can be eroded away in a very short period of time after deforestation when fires, agricultural cropping or a severe weather events can much more easily remove topsoil. The stream of ecosystem services which are received from forested areas can be seriously affected and impaired if only the forest timber is valued by the economy.

A functioning forest provides a stream of income and value which are considered life supporting ecological services. These services include the provision of a continuous stream of clean air and clean water, as well as an untapped source of new pharmaceuticals, crops, fibers, pulp, petroleum substitutes and many unknown species which could fuel future economic endeavours with as yet unknown scientific values and benefits. This theory would suggest that nature, left intact, can continue to provide many non-market benefits to society and yield as yet unknown scientific discoveries with new higher values in the future (Costanza, 1997).

E. O. Wilson argues that nature preservation should dominate at least 50% of our landscape in order to improve society's ability to survive. The loss of forest is one of the most significant causes of environmental decline, and E.O. Wilson documents how the impact on biodiversity is automatic and severe. Wilson suggests that three levels of organization define the structure of the natural order of man's dependence on nature. At the top level are the ecosystems, like the forests and lakes. Next are the species, composed of the organisms of the ecosystem, whether they are butterflies or people. At the bottom are the genes that compose each species. "... *while the removal of 90 percent of the habitat area allows about half the species to hang on, removal of the final 10 percent of habitat can wipe out half in one stroke*" (Wilson, 2002, p. 59).

The current conceptual framework of life supporting ecosystem services provided by nature is defined by the UN Millennium Ecosystem Assessment Report (MA, 2005a).

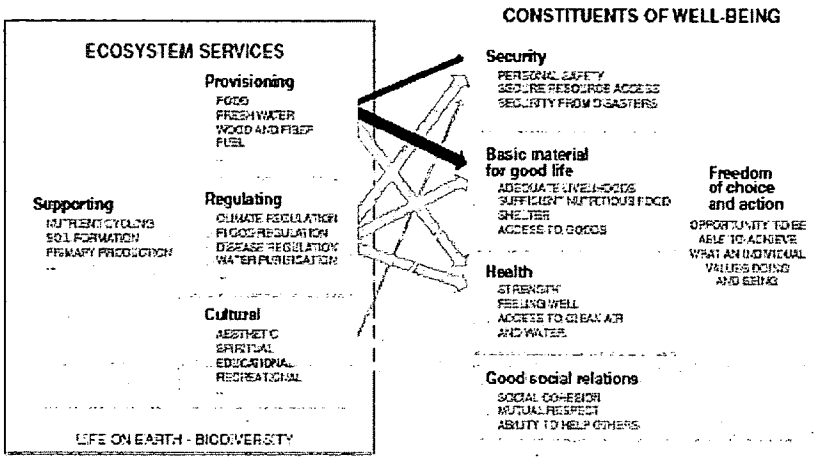

Figure 5 Linkages between ecosystem services and human well-being Millennium Assessment Conceptual Framework (MA, 2005).

The identification of ecosystem services in natural capital economics has added the dimension needed in economic frameworks to integrate ecology and economy[8]. Ecosystem services are those which include the total economic value of the provisioning, regulating, cultural and life supporting services that nature provides. Ecosystem services are essential for the development and well-being of human society; the Millennium Ecosystem Assessment framework outlines the multifaceted interdependence that E. O. Wilson refers to as biophelia, and only a fraction of these values are covered by market prices or perceived by most people.

Ecological resilience is defined as the capacity of an ecosystem to resist disturbance and still maintain a specified state; the most sustainable way then, to maintain our GDP, household income and employment is to maintain ecological resilience. "*The long term maintenance of vitality in an ecosystem is dependent on two structure related attributes: efficiency...and resilience....both are related to levels of diversity and connectedness...*" (Goerner, Lietaer & Ulanowicz, 2009, p. 77). The concept of critical natural capital is based on considering social

[8] Dutch ecologist Rudolf S.de Groot published his findings on integrating market and nonmarket services with Carl Folke and Robert Costanza in 1994 based on previous research which de Groot published as early as 1991.

utility, ecological utility, the non-substitutability of natural resources, economic inter-dependence, as well as human survival needs of water and food (Brand, 2009).

The demand for ecosystem services has grown significantly around the world in the last fifty years as the population of the Earth grew from three to six billion persons and economic activity increased by more than six times. To meet this demand for food, shelter and water there have been large increases in the appropriation of life supporting ecosystem services; water use has doubled, wood harvest tripled and food production has increased by more than two times. Human populations are creating unprecedented demands on the environment and ecosystem services (MA, 2005a).

The increasing demands of the market economy have created the conditions for ecological collapse, and subsequent financial collapse of the economy. The Atlantic cod fisheries provide a regional context and a world class event which illustrated on a local and global scale that the ability to catch wild fish is not restricted by the number of fishing boats, or by the technology used to catch fish, but is evidently restricted by the health of the ecosystem and the number of fish that are available to be caught. The exploitation of this natural resource created income which resulted in improved livelihoods and incomes for thousands of people, fortunes for some, over a period spanning 500 years. The depletion of this natural capital asset has resulted in significant regional economic decline.

Natural areas previously set aside for nature protection and wildlife in North America were not always chosen with ecological values in mind. The 'ad hoc' approach to conservation has left Canada, the United States, and Mexico with systems of protected areas that are too small, too isolated from each other, and which represent too few types of ecosystems to sustain native wildlife over time (The Wildlands Network, 2001).

Figure 6 Large scale wildlife networks.[9]

A 'working landscape' presents the notion of harmonious relations between man and nature in a large landscape setting where the actions of man and the economy do not result in the degradation of the surrounding ecosystem which supports the economy. The concept of a working landscape integrates wildlife preservation with economic objectives (Noss, 1991). It has been argued that the transportation system, and the resulting roadway network present the strongest threats to the preservation of biodiversity; that large areas of wilderness are needed to buffer the effects of fragmenting the landscape and decreasing wildlife populations (Bader, 2000). In addition to the necessity of preserving large tracts of wilderness lands, it is also critical to connect wilderness fragments to each other to enable the genetic viability of remnant populations of wild species (The Wildlands Network, 2001). While the preservation of wilderness alone will not guarantee the preservation of biodiversity, it is generally agreed that wilderness will provide the most secure refuge for wildlife (Noss, 1991). Declining populations

[9] Continental wildlife networks (The Wildlands Network, 2001)

of resource species and increasing risk to rare ecosystems and species are the main signs of impaired ecological integrity (MA Canada, 2005).

These principles apply on islands as they do in larger continental situations; increasing biodiversity in an island ecosystem increases the ability of the environment to buffer the effects of climate change and environmental degradation in the future. Increasing biodiversity improves the ecosystem's ability to provide benefits of pollination, seed dispersals and predation (MA Canada, 2005).

> "*Although nature preserves play a useful role in conserving endangered species that occur within them, reducing extinction rates in a region will require integrating conservation strategies with agricultural and urban land-use plans to protect areas outside formally protected nature preserves*" (Deguise, 2006, p. 48).

As it has been shown in continental situations, islands need to enlarge the extent and range of protected areas to sustain ecological integrity. Maintaining biodiversity values for nature preservation, include measuring and maintaining species, the metrics of rarity, endemism to a particular landscape, population status, the size of area available from edge to edge, the fragility of the species, relative freedom from human influence, and connectivity are basic to the IUCN Red List (IUCN, 2010).

Connectivity is known in continental and island landscape circumstances to link isolated and dispersed elements of biodiversity; connectivity provides many benefits to the maintenance

of ecosystem services and the overall stock of natural capital assets. Protected areas provide species integrity where nature can flourish relatively isolated from human interference.

Natural Capital Law

The law of thermodynamics is a fundamental natural capital law, just like that of the law of Gravity. Natural capital laws have been described by David Boyd as "*immutable, irrevocable, written in stone*" (Boyd, 2003, p. 350). This statement of fact is hard to dispute on any grounds, as the Natural Law of Gravity would tend to provide concrete evidence to any contrarian. Early work by Carnot and others founded the scientific discipline of thermodynamics; the law that states energy can be neither created nor destroyed. The discovery of thermodynamics eventually led to articulation of the second law of entropy; entropy law dictates that energy available in a closed loop system only decreases with use.

The first law of thermodynamics is that energy can be transferred from one system to another in many forms, but it cannot be created or destroyed. The second law of thermodynamics is that natural processes that involve an energy transfer must have one direction which dictates a declining level of energy at each transfer, and that these natural processes are irreversible.

This rational is supported by Albert Einstein's observation that everything that takes place on earth is determined by laws of nature. Einstein's famous equation (E = mc squared) suggests that the relationship between energy and matter is interchangeable, but that the quantity of energy and matter in total is fixed (Einstein, 1920).

Based on the laws of thermodynamics and entropy, some food stuffs would consume more energy when grown, processed, transported, refrigerated, and distributed around the globe

than would be imparted (contained) in the consumable product. Considering that these products impart less energy when consumed than the amount used to create them, they conflict with natural capital values and the natural capital economic order. Carbon consuming products represent a net loss in economic terms. It can be concluded that in natural capital economic theory at least, activity must follow the principles of energy conversion that are governed by the law of thermodynamics and entropy (Boyd, 2003).

Natural Capital Valuation Methods

Traditional natural capital values have been established based on public perception of recreational and water quality values, these nature consumption values have dominated discussions on what nature is worth (Liu, Costanza, Farber, & Troy, 2010). However, there are a range of methods that have been developed to estimate the value of natural capital and ecosystem services. Natural capital economic theory illustrates, our natural environment provides value to people in a variety by providing a flow of ecosystem services that we depend on for our quality of life; the provisioning, regulating, cultural and life supporting services that flow from a living ecosystem (MA, 2005a). How much any given ecosystem is worth in terms of how much it is contributing to the economy is one question that can be asked at any scale of measurement, local or global, and places nature values in the context of how much economic activity is generated directly into the GDP (WorldBank, 2004). Much of the Millennium Assessment research (MA, 2005b), along with the Stern Review (Stern, 2006), indicates that low lying coastal areas and islands present the highest of values as a result of the application of natural capital valuations. It would follow then that islands, would generally speaking, contain some of the best opportunities for the application of this economic theory on a macroeconomic scale.

The distribution of income benefits from ecosystems also affects the value placed on the environment by society; some groups in society receive more benefits than others (Stern, 2006). The identification of the benefactors of ecosystem services and nature conservation as well as quantifying the value of the benefits received will identify both potential financing opportunities and key stakeholders.

Outside of traditional recreation and water quality values, many additional methods have been developed in current economic analysis to value nature and ecosystem services. These methods of valuation include among other methods, market price methods, productivity methods, hedonic pricing, travel cost method, contingent valuation, contingent choice methods, benefit transfer methods and replacement cost analysis.

Hedonic values can be seen in coastal zones where increased real estate values reflect the natural value of the ocean viewscape compared to inland locations. Travel cost methods of valuation of recreation areas assumes that visitors must be willing to pay at least what they are willing to pay to travel to the destination. Contingent choice methods evaluate hypothetical scenarios with alternative nature values. Replacement cost analysis is used to compare man-made systems with natural systems, such as improving buffer zones on waterways to forego water purification costs. Avoided costs are those which would have been incurred without nature services, like flood control, or storm surge protection services.

Genuine Progress Indicators (GPI) seeks to provide a measure of total economic value. The total economic value of natural capital would include quantifying to some degree, the quality of life, received by society as a result of the availability of higher or lower environmental assets.

A landscape approach to conservation and natural capital measurement criteria has been developed in the last several decades which incorporate values which are authentic to particular landscapes. This as well can be applied to the study of islands. A landscape approach evaluation framework provides a scientific foundation for the addition of cultural and social values, along with economic values into economic development plans. Natural capital values generally result from specific measures of rarity, distinctiveness, endemism, richness and diversity, natural ness and protected status (IUCN, 2004; MA 2005a; Cassar, 2010).

Small group deliberations present another approach to ecosystem valuation; founded on principles of deliberative democracy that suggest public decision making should come from a process of open public debate. *"Small group deliberations provide a decentralized and therefore specialized environmental policy formulation and an opportunity for non-experts to participate in decision making groups"* (Farber, S. 2002, p. 390). Farber and others maintain that there is not one correct set of concepts for ecosystem valuation, but rather there is the need to think outside the box. The calculation of total economic values appears to be based in trans-disciplinary methodologies which incorporate science from a variety of disciplines in addition to economics, such as biology, physics, social sciences, and psychology.

Chapter Four

The Small Island Dilemma

The modern development of islands mirrors the human dilemma and tendency of civilizations and economies to repeat history. Ronald Wright, writing in ' A Short History of Progress' so aptly describes the human dilemma as *"the progress trap"* (Wright, 2004). This is what happens when natural resource extraction based economies find themselves in a situation when natural resources are depleted.

The progress trap that Wright is referring to is one where most cultures get caught; this pattern of economic development typically results in first, the economic demise and then the complete collapse of the social order because the environment which supports the economy has failed. Small island economies could benefit from these historic lessons by placing a higher financial value on limited natural resources available for economic exploitation, and in doing so, provide themselves with a more secure foundation in nature capital assets to provide continued economic contributions to sustain future generations.

Like the planet Earth, small island economies could be, by definition of geography, considered closed loop economic and environmental systems. This is the 'island dilemma' that I refer to; that despite the success of natural capital applications in micro economic situations, particularly in manufacturing and production settings by Paul Hawken and others, the transfer of these economic theories into macro-economic situations on islands, as well as in the larger economy (the macro-economic application), has not been immediately apparent.

Typically, the logging of hardwood from the forest cover (in continental or island locations), and replacement of forest cover with agriculture and open soils, leads to the loss of soil fertility through erosion forces or loss of soil fertility. Ronald Wright describes the

historic cycle resulting from the loss of tree cover as a process which eventually leads to the collapse of the underlying agricultural system and a breakdown of the social order. *"Once nature starts to foreclose – with erosion, crop failure, famine, disease – the social contract breaks down"* (Wright, 2004, p. 84).

This world history of economic development repeats itself in a cycle of population growth, followed by destruction of the environment, resulting in an ecological disaster, and ultimately ending with a population crash. Easter Island is presented as one of the most recent and outstanding examples of this stereo-typical economic development cycle. *"Its isolation makes it uniquely important as a microcosm of more complex systems, including this big island on which we drift through space. Easter Island punched well above its weight..."* (Wright, 2004, p. 64).

Margaret Mead used the metaphor of Easter Island in her writings, Easter Island tends to provide a symbol of the need to act to achieve sustainable development goals. The demise of population and culture on Easter Island symbolized and motivated Mead to realize the typical outcome of development patterns in the industrial economy would tend to follow the pitfalls of Easter Island. This island as planet metaphor, presents a clear comparison to the fate of the planet Earth and a reminder of the consequences of environmental degradation. Decreased natural capital assets and ecosystem services on islands increases dependence on outside remittances or aid; for the planet Earth, there is nowhere to go for outside aid.

The study of small island vulnerabilities and resilience has become an important mirror on environmental and economic challenges facing the millions of people around the world who live close to the coast. Globally 40% of the population lives in coastal areas, on islands this percentage is much greater (Costanza & Farley, 2007). Islands tend to provide advance

indicators of structural economic and environmental problems because of the direct interconnected nature of their cultures and the ecosystem surrounding them (Baldacchino, 2004). Small island economies serve as an indicator of global difficulties in creating change at the margin of the economy. "*There is growing consensus that Easter Island is an example of the devastating consequences of human societies on their environment*" (Nagarajan, 2006, p. 289). Economically, there are limitations of small scale, remoteness and vulnerability to outside influences that present special challenges for their sustainable economic development within limited island resources (UNEP, 2006).

In many island cultures there is also a high concentration of built values in coastal zones which presents a direct conflict with the preservation of biodiversity and natural capital heritage. Coastal environments provide system services, including essential storm protection services which are demonstrated by the absorption of the first impacts of severe weather events. Healthy ecosystems in coastal zones are required to buffer islands from severe weather events which otherwise cause even greater coastal erosion. This has been evidenced in many small island locations.

Marine environments and intertidal zones resources are also essential to islands because the majority of their natural capital assets are in the marine environment; "*marine resources account for 63% of natural capital values whereas land base or terrestrial resources account for 37% of the biodiversity*" (Costanza, 1997, p.259). Since small islands have relatively large coastal zones in relation to land mass, there is also a high risk to sea level rise and extreme weather events because island communities generally have more infrastructures built along the coastline where there is poor placement relative to high value ecological assets and existing ecological services (Briguglio, 2003; Costanza & Farley, 2007; Mimura, 2007).

In 1992, Agenda 21 directed events that led to the UN Global Conference on Sustainable Development of Small Island Developing States, as well as the establishment of the 1994 Barbados Program of Action. In this context, it is recognized that the potential for small islands to pursue sustainable development "*depends on their ability to maintain the quality of certain, necessarily limited natural resources; water supplies, soil fertility and ecosystem services*" (Baas, 1995, p. 9).

The island factor in sustainable economics is clearly unique; living on an island forces the economy to adapt to defined geographic limits. The island economy develops around different assumptions and goals than those inherited from colonizers and major trading partners (UNEP, 2006). It is clear that protecting forests and trees is essential for warding off environmental degradation and rural poverty (FAO, 1994).

Small islands around the world are considered to face similar challenges to their environment and economy. Small size on an island means greater risks from extreme weather events, limited export opportunities into traditional natural resource based commodity markets, dis-economies of scale because of small domestic markets, high costs relating to transportation to and from markets creating price taker dependent scenarios, a high dependence on imported energy sources and typically unsustainable resource extraction models of economic development (Briguglio, 2003).

> *"Small Island Developing States (SIDS) face vulnerabilities and challenges that other developing countries are spared. They have to contend with challenges arising from their physical size and archipelagic formations, their geographic location and other factors relating to their 'islandness.' Vulnerabilities arise*

from exposure to external shocks beyond their control, and from structural handicaps – exacerbated by, among other things, a high degree of openness, export concentration and dependence on strategic imports; remoteness and high transport costs; and susceptibility to natural disasters made worse by climate change and sea-level rise" (United Nations, 2005, p. 83).

Culturally, island societies develop along subtle axis of power in order to deal with this myriad of economic challenges. The use of gentlemen's agreements and moral undertakings to resolve some of the most bitter of disputes between factions is common, and in many cases, desirable. [10] Challenges to the balance of an island economy present numerous opportunities for conflict which once started are often long lived, especially when it involves vested interests and traditional streams of income. Close knit community connections are evident through both family and friends, perhaps making islanders more adept at avoiding divisive issues and change, and not dealing with the real issues. It has been noted that islanders become expert at muting hostility and avoiding dispute in the interest of stability and compromise (Baldacchino, 1997). This cultural tradition of avoiding hostility, which is typically found on small islands, is perhaps one illustration of a significant contributing factor to what E.O. Wilson describes as the larger world problem which is a lack of self-understanding and a "*paleolithic*" obstinacy to change (Wilson, 2002). Islands are typically affected by economic, social or environmental changes on a larger scale than mainland counterparts. The scope and scale of events such as severe weather

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[10] Contentious island economic issues include fisheries in the coastal zone where it is a traditional practice to resolve community disputes with gentlemen's agreements. If these agreements expire, hostility sometimes results as it did in the herring dispute in 2003 (Surette, 2004).

impacts or changes in free market commodity prices affect changes across the landscape. The impact of a single weather event is more pervasive and relative damage is more intense than in a continental situation (Baldacchino, 2004; Briguglio, 1995, 2003; McCall, 1994; Stephen Baas, 1995).

Islands must also consider the effects of agriculture and forestry on their limited natural resources and how this will affect their marine resources. It is generally accepted that "*Most studies indicate that fertilizers and runoff from human sources is one of the major stresses impacting coastal ecosystems*" (NASA, 2004, p. 1). Summer rains wash nutrients and dissolved organic matter out of rivers into the sea creating large phytoplankton blooms which create conditions devoid of oxygen so that sea life cannot live there.

Northern islands such as Prince Edward Island are more vulnerable to sea level rise because of changes in climate. Coastal zones in northern climates are exposed to higher rates of erosion as a result of the lack of ice cover and the resulting increase in wave action of open water during more months of the year. Frozen coastlines decrease the severity and impact of extreme winter weather events on coastal areas, less frost increases coastal erosion (Martha McCulloch, 2002).

Soil resources are also, by definition, limited on an island, largely because of small size resulting from geological forces and isolation from larger land masses. The loss of soil erodes the basis for agricultural economies in general; the problem of soil loss is more acute on islands because of the limited nature of their natural resource base. Small islands typically have a high level of impact on the environment from economic activities leading to a depletion of agricultural resources through siltation and nutrient loss, and loss of tree cover. This presents

challenges in maintaining finite natural resources such as water supplies, soil fertility and coastal erosion (Briguglio, 2003).

Island economies usually rely on a narrow range of exports which provides a narrow economic base subject to the vagaries of foreign commodity markets. Dependence on the production of commodities for world markets with relatively small domestic market increases risks for the economy. Exporters are dependent on market influences outside their control and are essentially price takers in the marketplace. Small islands have neglible control on the prices of the products that they export/ import and island economies tend to be price takers to a much higher degree than others in the world marketplace (Briguglio, 1995).

Metropolitan populations and their demand for products, upon which small island economies are so dependent, dominate access to, and market conditions for, limited natural resources. Local populations have a small share of the benefits from the extraction of natural resources compared with the large share flowing to corporations outside the region. Although island economies are, by definition of geography, closed loop economic systems, the limits and viability of their independence is often established in foreign, not domestic markets. Local populations do not drive change, but instead are driven to change by forces outside their control. In a study of coastal British Columbia, the Millennium Ecosystem Assessment found these small island tendencies driven by economic change in the global economy forces island populations into or out of regions, with a resulting detrimental effect on their natural resource base (MA Canada, 2005).

The framing of island vulnerabilities into economic and environmental indicators illustrates what many authors and researchers have postulated; that economic success measures alone, such as those used to develop GDP metrics, do not illustrate the long term sustainability of

an island economy (Baldacchino, 2004; Briguglio, 2003; McCall, 1994; Nagarajan, 2006; Stephen Baas, 1995; Stern, 2006; UNEP, 2006; Wright, 2004).

Chapter Five

Prince Edward Island Case Study

Prince Edward Island was first discovered by Europeans in 1534 when Jacques Cartier claimed the island for France. Colonization took place slowly over the following 200 years until the island was ceded to the British in 1763 with the Treaty of Versailles. The island joined the Canadian Federation 110 years later in 1873 (BNA Act, 1873).

Prince Edward Island is located in the Gulf of St. Lawrence in eastern Canada and is 5,560 square kilometers in size. The island is clearly influenced by its proximity to water. Surrounded as it is by the Gulf of St. Lawrence and the Northumberland Strait, the island has a 1,836 kilometer long coast line; no point on the island is more than 30 kilometers from the coast and the maximum elevation above sea level reaches only slightly more than 60 meters. The coastal and marine environments encompass important estuaries like Malpeque Bay and the Hillsborough River where the coastal zones, including the salt water wetlands, and fresh water marshes provide critical and diverse natural wildlife habitat for marine and terrestrial inhabitants, including Prince Edward Islanders.

While the island has some of the best freshwater wetlands and coastal systems in the entire Northern Appalachian – Acadian Eco-region, they are also some of the most threatened due to pressures from increased coastal development and tourism impacts. Most of the island has been affected over the centuries by land clearing for agriculture and timber harvesting; very little remains of the old growth Acadian forest that once covered the island (Sobey, 2006).

The early economy of the island was based in its rich legacy of natural resources combined with an ingenious creativity of the inhabitants who made their living from the land and the sea. There has been a dramatic change in the culture of the island in the last one hundred

years as in most western nations. Primary industries are losing jobs while the service sector is employing more people every year. The island economy is now predominantly service oriented, but is still dependent and tied to its traditional investment in the specialized agricultural industry.

At the turn of the last century, in 1900, there were more than 10,000 farms scattered across the landscape in a patch work quilt or mosaic of field and forest. As we enter the New Millennium there are less than 2,000 farms remaining in the agricultural economy. This rural decline is directly attributed to the dependence on seasonal and primary industries and their loss in value relative to the rest of the economy (MacKinnon, 1996).

The island economy has grown away from its rural past in an urban direction towards Charlottetown, and to a lesser extent, the developing regional centers in Summerside, Bloomfield and Montague. Much like the rest of Canada, the availability and attraction of employment in urban centers has caused a major shift in population from rural areas into larger service centers. Population growth has been relatively low on the island, but shifts in the population concentrations are occurring into urban areas following employment opportunities in health, education, and public administration.

Service industries now far outweigh the traditional agrarian economy; service industries now represent 73% of economic activity. This change in the economy has been particularly dramatic since the beginning of the industrial boom in the 'post war' years following the Second World War. These trends continue on the island to present the present day as employment in goods producing sectors continues to fall, while the service sector continues to grow at an above average rate of 2.5% (PEI, 2008). Currently, the largest increases in the economy are occurring in public administration including health care, finance, insurance, real estate services, and

education. The largest declines in the economy have been in manufacturing, agriculture, forestry, fishing and hunting (PEI, 2009b).

The island is still heavily reliant on goods producing industries even though they are in decline; traditional industries such as agriculture, construction and manufacturing account for 27% of economic activity (PEI, 2008). Agriculture, once the mainstay of the island economy, now represents only 8% of economic activity.[11] It is now conceivable that the island has entered a new era, one where both farming and fishing are less important than tourism in the local economy. Current industry data indicates tourism has grown to represent 10% of provincial economic activity (TAC, 2007).

Over the last 20 years, Canada's population and economy has been growing in predominantly urban centers, and rural regions of Canada have lagged behind (Statistics Canada, 2005a). The migration of economic activity from rural to urban areas is also reflected in patterns of population movement within the rural and urban regions of Prince Edward Island (PEI, 2009b).

Economic growth, as defined by the system of accounts in provincial GDP, has been relatively good in recent times on the island and has been averaging 2% over the last decade.[12] However, labor productivity which is stagnant at 70% of the Canadian average (PEI, 2008), and personal incomes continue to remain well below the national average, close to that of other Atlantic provinces (Statistics Canada, 2009a).

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[11] Agriculture is still twice as important to the economy in PEI as it is in the rest Canada (Statistics Canada, 2009b).

[12] The island economy is expected to record positive growth in 2009 in contrast to the larger global recession recorded in other jurisdictions (PEI, 2009b).

Unemployment continues to remain at a very high rate, which on the island means 11% or higher in almost every year of the last twenty. Currently, unemployment is trending upward and has surpassed 12% (PEI, 2009b). The long term unemployment trends which remain high, as well as the current spike in unemployment, illustrate the high degree of dependence on the outside economy that is embedded in island society. This high unemployment rate results in a higher rate of federal government transfers into the province.

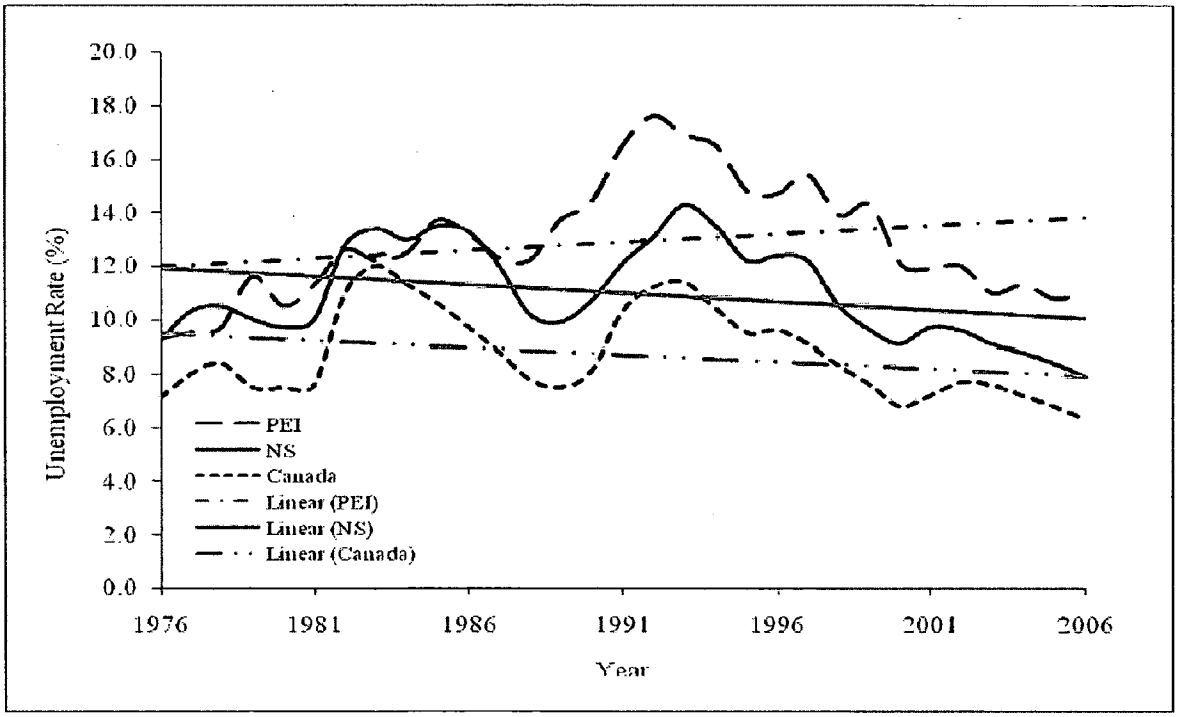

Figure 7 Long-term Trend in PEI Unemployment (Scott, J., 2007).

The rise in unemployment in 2009 was attributed to the increased number of Islanders who are returning home after being laid off from employment elsewhere in Canada. Many Islanders have traveled to other provinces in Canada for employment in the last decade, most notably to western Canada, as a result of economic growth in the petroleum industry in Saskatchewan and Alberta.

Productivity on the island, expressed as per capita GDP, has remained unchanged since the early 1990's; economic productivity on the island relative to the Canadian average is 70%. During the decade from 1985 to 1995 per capita productivity grew from 55% of the national average to 72%. It has been 15 years since this significant shift in relative economic productivity was witnessed in the island economy (PEI, 2008). Although constantly in a state of economic change during the last two decades, the island has failed to improve productivity within the traditional economic framework set out by free market conventions.

The Canadian Context

Natural resources in Canada are owned by the Crown and are held in trust for the public by federal, provincial and territorial governments. The government's interest in natural resources is reflected in the tax treatment of income flows resulting from resource extraction models of economic development.

There are several influences on tax changes in Canada including election timing issues, the level of dependence on federal government transfers, and the level of own source revenue from natural resource assets. Some tax measures have a more harmful effect on the economy than others.[13] The general consensus appears to be that personal and corporate income taxes have a harmful effect on growth. Taxes on land use and consumption taxes present more equitable methods of government revenue generation. Current tax theory and debate suggests that less income tax combined with broad base consumption taxation is the preferred option for

[13] OECD argues that existing Canadian tax deductions for mining and other natural resource based industries and activities should be removed. (OECD, 2008)

change.[14] Broadening the tax base and lowering the general tax rate shares the tax burden more equitably throughout the economy and amongst the income earners (Boyd, 2005; Daly, 2009; Mintz, 2007; OECD, 2008).

Federal government spending in Canada has changed dramatically in the last decade with the largest decrease in spending coming from the reduction of transfers to provinces; as a share of GDP, federal government spending has fallen from 22% to 15% during the period from 1994 to 2008. Provincial government spending has also fallen across the country from a high of 21% in 1992 to 17% today (Canada, Dept. of Defence 2008).

Changes in fiscal policy in Canada since the end of the Second World War have re-shaped the taxation system, allowing provinces to take divergent paths of taxation and own source revenue generation. The growth of direct federal transfers to individuals is a new phenomenon which diminishes the ability of provinces to control their economies. The recent introduction of per capita funding mechanisms in federal transfer agreements places rural areas at a disadvantage because of the widespread depopulation of rural areas in favor of large urban centers.

In the Canadian context, the economy and treatment of natural resource based income streams is shaped by the tax base which is wholly defined by the federal government system of accounts. The federal government definition of income streams provides the economy with guidance and the methodology allows provinces to apply one rate to the basic federal rate; there is then broad simplification at the administrative level. Tax rates diverge between provinces

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[14] The OECD goes on to suggest that "*tax reform should be revenue neutral and should come from increases in the efficient tax bases in consumption taxes including provincial VATs, property taxes based on land use and government service users fees*" (OECD, 2008, p. 6).

because they have different strategies, ideologies, political histories and varying natural resource assets (Jack Mintz, 2009).

Provinces have the ability to raise taxes independently and do so with taxes on such things as alcohol, gambling, tobacco or a variety of resource taxes. There is some flexibility for the provinces to change their relative emphasis on Personal Income Tax (PIT) or Corporate Income Tax (CIT) and the ability to create CIT credits, as well as adjusting physical asset depreciation rates. Taxation patterns create preferential treatment for some forms of financial capital and income streams over natural, social or cultural capital, and this is seen to be an impediment to economic growth (OECD, 2008).

Canadian taxation policy appears to have distorted the value of natural capital in the economy and in doing so also affects natural capital values on Prince Edward Island.

> "*A variety of permanent preferences in the tax code divert resources away from their most productive uses toward tax favored ends, notably in traditional sectors like manufacturing, natural resources and agriculture to the detriment of market services sectors that have been some of the key sources of recent U.S. growth*" (OECD, 2008, p. 6).

Canada ratified the United Nations Agenda 21 agreement in 1992, but has since then been slow to implement this international agreement domestically. One of the key policy objectives of Agenda 21 was to create capacity for local change through the development of local action plans; the current development of Integrated Community Sustainability Plans (ICSPs) is the Canadian response to the call for local action plans. Recently mandated by the

Canadian government in bi-lateral federal-municipal Gas Tax Funding Agreements with municipalities, ICSPs are being implemented as a result of Canada's commitment to implement a program of change as outlined in Agenda 21. The achievement of this goal (the implementation of local action plans) by the end of March of 2010, comes almost twenty years after the Earth Summit in Rio de Janerio where this goal was established and committed to.

During the intervening period of time, many examples of dramatic declines in the stock of natural capital have occurred in Canada and include the collapse of the cod stocks on the east coast of Canada, the salmon stocks on the west coast of North America, and recently, the sudden disappearance of vast caribou herds in Canada's north reaches (Weber, 2009). These dramatic declines present a clear example of how a trigger point can be reached in ecosystem health, and once this point is reached, results in the sudden collapse of trophic species and significant declines in the stock of natural capital (MA 2005a;). Decline and complete collapse of environmental conditions can be so swift and dramatic that they come as a surprise to many.

This has been the case in Canada and the collapse of numerous salmon runs in the west (MA 2005b; Harper, 2009). Once the hallmark symbol of ecosystem health, the salmon population collapsed and this sparked the creation of the Commission of Inquiry into Decline of Sockeye Salmon in the Fraser River, in November 2009, by the Government of Canada. This event was precipitated by the 'disappearance' of Sockeye Salmon in 2009 for the third year in a row. The decline is attributed to a combination of factors, including environmental changes along the Fraser River, marine environmental changes and fisheries management in general. The sockeye collapse has effectively eliminated a once-profitable and thriving commercial fishery and curtailed both an aboriginal food fishery and a recreational fishery in the Fraser River. These changes in the ecosystem present a clear linkage between ecosystem health and our ability

to sustain future generations. These changes also present to us, evidence of the limited knowledge base that we have of our natural capital assets as 2010 brought with it an uncommonly large return of sockeye salmon.

Sudden changes in ecosystem health continue to provide an element of surprise to observers, as witnessed in Canada in the recent past. The sudden, large scale collapse of the Beverly Caribou herd in the central Arctic, discovered during the autumn of 2009, is another current example. Aerial survey teams couldn't find enough pairs of caribou to get statistically valid data entry for herd population counts. A caribou herd that numbered 280,000 animals only 15 years ago was simply gone, and environmental degradation in the form of climate change is suspected as being behind this recent widespread collapse in numbers (Weber, 2009).

Rural Decline

Prince Edward Island presents a lagging economy. This appears to be the result of its economic dependence on traditional models of a natural resource extraction based economy (OECD, 2008). The OECD's definition of a '*lagging economy*' is a geographic region where growth is below the national average for three consecutive five year periods. This has been true of PEI as well as the rest of rural Canada (Statistics Canada, 2005a). The only growing rural communities in Prince Edward Island are those adjacent to urban centers and this as well is consistent with population changes in the rest of Canada; larger communities are growing and smaller communities continue in decline (Statistics Canada, 2005a).

World population has continued to grow during this time, achieving a record population of Six billion people in 1999. World population growth has slowed somewhat from peak population growth rates of 2% during the late in the 1960's to the current global population

growth rate of 1.17%. Comparatively, population growth has been modest on the island for the last twenty years, growing at a rate of 1.1%, this being less than the rate of growth in the world and in the rest of Canada (P.E.I., 2009). Currently, as a result of increased international immigration to the island, there has been modest population growth, the first since 1984 (PEI, 2009b).

Employment creation on the island is dependent on seasonal enterprises which create half of all new jobs in the island economy. Almost one third of all existing jobs in the economy are reliant on traditional, seasonal resource based industries (HRDC, 2000; PEI, 2008). The industrial and manufacturing base on the island is equally embedded in seasonal production and is heavily reliant on strong seasonal variations. Seasonal fluctuations in the economy are compounded by long term cyclical fluctuations in industries which are reliant on export earnings such as agriculture, tourism, fisheries and forestry.

The structure of Prince Edward Island's industrial sector has changed only slightly since the 1990's, with a relative increase in the share of non-food manufacturing in the province's GDP. This change has been attributed to the appearance of the high tech aerospace industry in Summerside which occurred as a result of provincial tax concessions put in place for a period of 20 years,[15] these tax concessions appeared to attract new industry (P.E.I., 2010). Overall, non-cyclical manufacturing industries are gaining relative importance in the island economy as nonfood shipments increased from 27% to 37% of total manufacturing shipments between 1981 and 2002 (Wilkenson, 2003).

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[15] Tax concessions granted by the province to the aerospace industry in Slemon Park include a full rebate of corporate income tax, provincial sales tax and real property tax commencing January 1993 and ending December 2012.

It is evident that continued reliance on resource harvesting and primary processing alone cannot generate growth in the island's economy. Successive premiers have recognized this fact including current Premier Robert Ghiz who has stated "*However, many of our more rural communities have experienced declining economic fortunes, and need strategies to achieve renewal and prosperity*" (Ghiz, 2010, p. 3). The compelling need to add more value to the region's raw resources if sustainable economic growth is to be achieved is evident on a provincial scale as noted, and on a regional scale as reflected by the following assessment of eastern Prince Edward Island.

> "*The economy of the area is heavily dependent on the sale of raw and semi-processed resources, many of which are in limited or diminishing supply. Business ventures built on these traditional industries have become riskier ventures due to volatile international market conditions, inconsistency of supply, environmental challenges, trade barriers, foreign protectionism and disease or food quality challenges. The implementation of new technology and processing innovations has largely been focussed on cost reduction in production, rather than on new product development and innovation*" (ACOA, 2002, p. 5).

The result of these economic trends in rural areas, where there is a long standing attachment to the dominant natural resource economic base and traditional economic development schemes, have created lower income job opportunities and economic uncertainty for a high percentage of island workers. Cultural pressures on the island encourage workers to migrate to long term full time employment opportunities, and young people generally do not

consider seasonal work to be a viable career option which results in an increasing rural exodus of youth (Statistics Canada, 2005a).

The decline of rural areas has made it more difficult for islanders to relocate when and where opportunities appear elsewhere. Homes or other built assets in rural areas are bound up within a rural economic community which is continually worth less in relative terms to the outside economy; if you can't sell your capital assets, how can you afford to move?

Despite the evidence of limited job prospects for many islanders, labor force participation remains high, over 68% which is slightly above the national average of 67%. There were 69,000 jobs available on the island in 2008; approximately 22,000 are which are seasonal in nature (PEI, 2009b). Other occupational fields on the island include 3,000 provincial government employees and 3,500 federal government employees, as well as 900 municipal employees, 4,200 health sector employees and 4,700 educators (PEI, 2008).

Prince Edward Islanders have an industrious nature as is evident in high labor force participation rates, this is illustrated as well by the fact that there are actually more jobs than individual workers. Although that would appear to present a contradiction, more jobs than workers, many of these jobs present short term employment opportunities, and more than one job is needed to provide year round employment. Many workers, more than 40%, have more than one job, and more than 90% work more than the minimum needed to qualify for unemployment insurance. Workers also tend to combine various seasonal opportunities in order to be employed year round, in addition, 15% of seasonal workers have some form of self-employment (HRDC, 2000). The majority of seasonal workers work when jobs are available, and most express a strong desire for permanent employment (Service Canada, 2004).

Imports

The provincial trade deficit has grown during the most recent period of economic growth at a very fast pace; as Island exports grow, imports grow faster, (at a rate of 2:1) and consume an increasingly disproportionate share of export earnings. The importance of imports into the island economy has been increasing in the recent past; imports present a challenge to sustainable development growth as they reduce the scale of internal island economic activity.

During the latest five year period, energy costs added approximately $200M of the $700M increase in provincial imports. Earlier import analysis conducted by Statistics Canada for the period 1992 to 1998 indicates that energy is the dominant import product in various forms. Food products also present as significant import challenge having increased by four times the same period, just slightly more than motor vehicle and machinery imports which increased by three times (Statistics Canada, 2000).

Total spending by islanders on energy consumption is significant; islanders spend over $3,000 on gasoline and heating oil, as well as $1,000 per year on electricity (PEI, 2008). Major increases in the cost of energy and petroleum products are a significant contributing factor to increasing import consumption, but do not account for all the leakages in the economy (Statistics Canada, 2000, 2002; UNEP 2009).

Long term trends from 1981 to 2008 show an increasing dependence on imports used in the maintenance of economic production on the island (Statistics Canada, 2009b). Between 2002 and 2008, the annual trade deficit has doubled growing from $680 million to a level of $1,377 million (PEI, 2008).

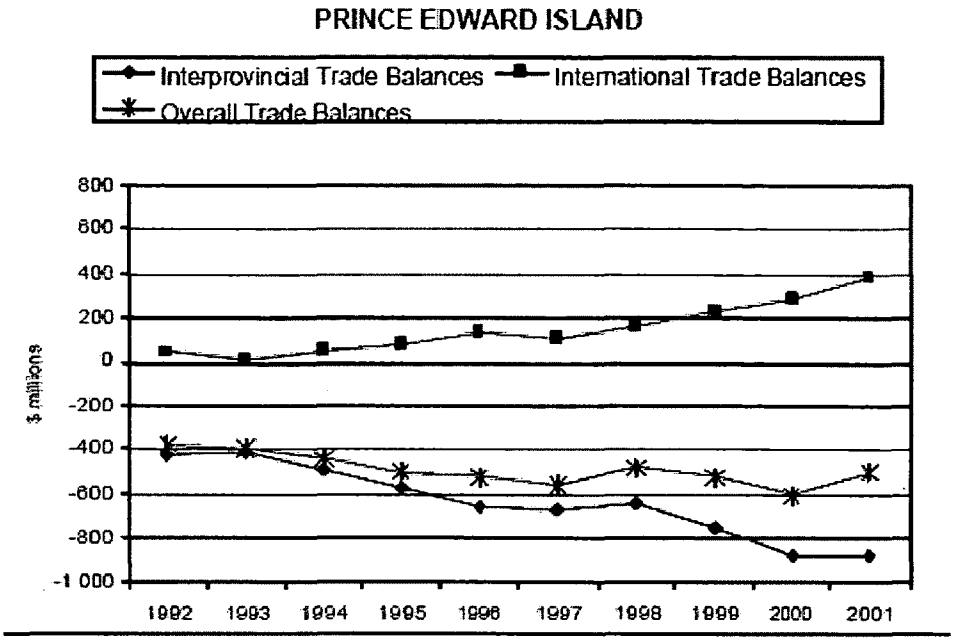

Figure 8 PEI Trade Deficit from 1992 to 2001 (Statistics Canada, 2002).

Prince Edward Island used to exhibit an international trade balance and even exhibited a small surplus in the latter part of the 1990's as shown above in the information provided in Statistics Canada analysis. That period of time does correspond to the development of the aerospace industry in Summerside, as well as the addition of additional potato processing capacity with the arrival of the McCain potato processing facility as well as the expanded potato processing capacity installed by the Irving Group at the Cavendish Farms facility (Wilkenson, 2003).

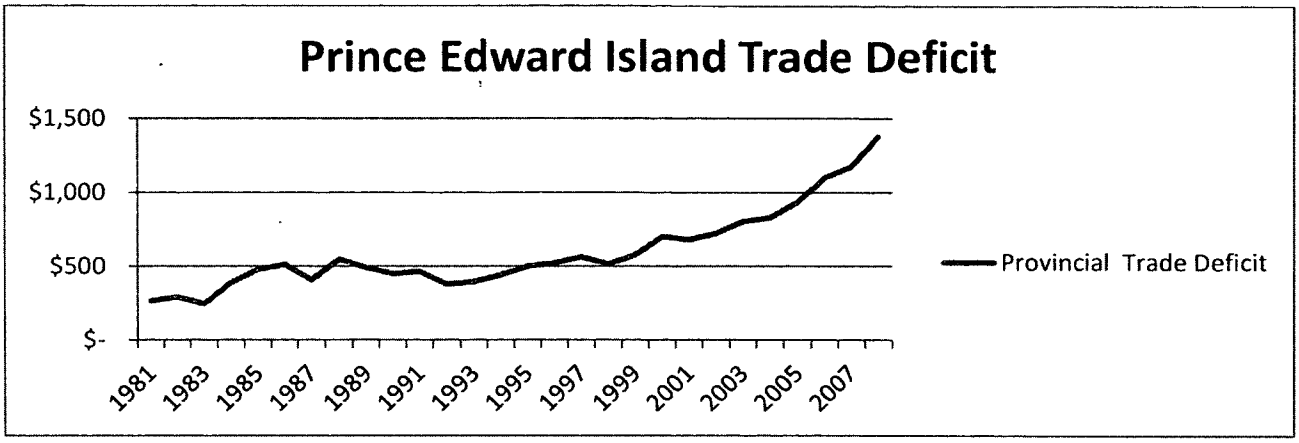

Figure 9: Prince Edward Island Trade Deficit, Long Term Trends 1981 to 2008 (Millions of Dollars).[16]

The island province had a relatively stable annual trade deficit of about $500 million dollars throughout the period from 1985 to 1998. It appears that the provincial trade deficit remained relatively stable until the construction and opening of the Confederation Bridge to the island in 1997. Since the Confederation Bridge opened the economy to mainland influences and lower transportation costs, the growth in the provincial trade deficit has been accelerating.

Assuming the economic definitions of GDP being equal to Consumption + Investment + Government Spending + (Exports – Imports). The constant dependence on remittances from off island is a significant factor which will affect the independence of the island economy and society in the future. As federal government remittances grow in importance to support imports, independence on the island is diminished.

The chart below depicts imports within the context of current grocery retailing industry on the island. The substitution of imports for domestic production is prevalent in local markets

16 The Prince Edward Island Annual Statistical Review.

which are supplied by major retailers Sobeys and Superstore. However, Co-op Atlantic data illustrates a regional capacity to supply local food, replacing imported products in the market, in contrast to prevailing economic trends.

Grocery department	Average of leading retailers including Superstore, Sobeys, Co-op Atlantic	Co-op Atlantic
Meat	23%	63%
Produce	18%	32%
Dairy	50%	54%
Seafood	40%	61%
Frozen	47%	57%
Bakery	61%	75%
Deli	36%	75%
Packaged goods	10%	22%

Figure 10: Grocery Retailers Purchases within Atlantic Canada in 2007 (Jennifer Scott, 2007)

It is evident that more can be done to support local business and increase sustainable development opportunities on the island. Co-op Atlantic is an unusual business model that drives purchasing decisions toward sustainable economic development goals. Major retailers Sobeys and Superstore appear less able to maintain local food purchasing in the free market business models facing the island.

There are other import leakages in the island economy which commonly affect small economies worldwide, including the loss of between 40% and 50% of gross tourism earnings because the import requirements of an island.[17] Import leakages from the island tourism industry can range up to the 85% rate of leakage exhibited in the cruise ship sector of the industry (UNEP, 2002).

[17] This UNEP report details what is called 'enclave tourism', typified by the cruise ship industry, where limited opportunities to buy local product in ports of call increase tourism import leakage.

Tourism

Tourism is an important primary industry for many islands and Prince Edward Island is no exception, as tourism seems to present an opportunity for rural economic viability and future development plans of the provincial government as detailed in the Rural Action Plan (PEI, 2010). Tourism presents a significant economic engine for the island with 10% of total economic activity. The industry employed approximately 7,000 islanders in 2007 and is viewed by many as a primary industry of growth, a contributor to export sales, and a significant employer (TAC, 2007).

Tourism capacity on the island expanded steadily in anticipation of the opening of the Confederation Bridge in 1997. The industry expansion continued for several years after the opening of the fixed link, peaked, and then slowed after tourism visitation declined following the September 11 event in 2001. While the fixed link increased mobility in the region, Confederation Bridge traffic remained stable and did not exhibit signs of growth (PEI, 2009b). The tourism industry on the island is currently exhibiting declines in visitation, annual rates of decline during the last eight years have been in the 2-3% range (PEI, 2008), (this would indicate increased domestic use of the Confederation Bridge during the same period). There is widespread agreement within the local tourism industry that this current decline in visitation is long term and island wide, although it does seem to be more acute in rural areas (TAC, 2007).

The global tourism industry, in contrast, has been growing throughout the last couple of decades despite setbacks in the financial system and increased threats to public security. At an annual growth rate of 4.6%, global tourism growth exceeds island economic growth rates, as well as growth in the tourism industry in particular, on Prince Edward Island (TAC, 2007). Effectively, this translates into a shrinking of the island tourism industry relative to world

markets, even as the industry as a whole is growing worldwide. Prince Edward Island market share is declining.

Global tourism trends employment characteristics and trends appear to mirror those on PEI where the seasonal character of the tourism industry continually challenges workers. Common problems include a lack of job security, advancement and training opportunities, medical benefits and long term pension plans (UNEP, 2002).

Despite significant growth in the industry worldwide since 1980, small islands appear to have been losing market share in the tourism industry and this trend has been increasing since 2001 (Craigwell, 2007). Small island tourism throughout the world mirrors the decline in tourism visitation to the island where visitation peaked in 2001 and has been in decline since (TAC, 2007). This long term decline in visitation is divergent to the continued growth in tourism worldwide, as well as the long term increase in infrastructure and fixed roof accommodation capacity that occurred with the completion of the Confederation Bridge link to the mainland.

One of the major contributors to the high cost of an island vacation is the price of accommodations. On a global level the price of accommodations in the island tourism industry is almost twice that of mainland competitors (Craigwell, 2007). One tourism industry dilemma is the low hotel occupancy which contributes to high overhead costs. With average occupancy of just 40% (PEI, 2008), the level of utilization is low in comparison to neighbouring mainland provinces New Brunswick and Nova Scotia where occupancy rates exceed 50% (New Brunswick, 2010; Nova Scotia, 2009).

Over-capacity in the island tourism industry is evident and is centered in the rural areas of the island; the Charlottetown market has higher occupancy rates than do outlying areas (TAC, 2007). Historically, the tourism industry has increased capacity from 3,575 roofed

accommodations units in 1975 to a current level of 6,700 units in 2006 (Coopers & Lybrand, 1990; TAC, 2007).

Average earning indicators for wages and salaries in the island tourism industry present low paying job options. Relative to a minimum wage in 2006 of $14,300 per year, pay scales in the tourism industry range from $15,000 to $21,000 per year for core industry trades (Service Canada, 2006). Most tourism employment is seasonal and workers earn a fraction of the full time equivalent wages illustrated above; worker's incomes are supplemented with employment insurance schemes. Tourism industry wages are below provincial average wages, which in turn, are below national averages (PEI, 2008).

Low income tourism opportunities are evident throughout Atlantic Canada and over half of those employed in tourism live in rural areas (Statistics Canada, 2001, , 2005a). The seasonal nature of rural incomes is compounded on the island by the dominant influence of other seasonal industries in outlying areas; overall, 82% of seasonal workers are located in rural areas (Service Canada, 2004).

Nature on Prince Edward Island

The natural capital legacy of Prince Edward Island has been based on the original inheritance of abundant natural capital wealth found by European settlers when they first arrived on the shores of the island almost 500 years ago. The ecosystem analysis conducted by the Millennium Ecosystem Assessment reveals worldwide declines in natural capital assets and there is much evidence to support these findings being mirrored on the island.

Early descriptions of Prince Edward Island forests include many natural features, in both flora and fauna, which are missing from the environment today (Sobey, 2006). The once

abundant forest cover is now gone, and the diversity of life that it once supported has been diminished since the decline or disappearance of lynx, marten, river otter and bear since the arrival of the British and the disappearance of wolves and caribou which were most likely extirpated from the island during the French Acadian era prior to 1758 (IUCN, 2009).

The conversion of the island from forest to agriculturally cultivated land was initially begun by the early Acadian settlers and was completed after the arrival of the English in 1758. The total acreage of cleared land on the island reached its peak in 1911, a process of land clearance that had begun in the 1770's near the shoreline and in the estuaries was virtually complete by the census of 1911. Early settlers on the island employed a variety of techniques to clear the land, from cutting trees and pulling stumps, to burning forests in great fires. It may show the degree of frustration felt by early settlers that they resorted to burning the woods in an effort to speed up the process of land conversion (Sobey, 2006).

Soil erosion primarily occurs as a result of deforestation and agricultural practices and remains one of the most long standing environmental problems on the island. Soil erosion rates and the accompanying siltation of surface bodies of water continue to be indicators of soil health and ecological integrity (PEI, 2003).

Soil erosion generally occurs when there is no vegetation to protect the soil from being washed away by heavy rains or blown away by strong winds. Clearing forests, growing crops on steep slopes, or growing crops in large fields without protection all lead to erosion. Ploughing too deeply, failing to rotate crops, planting crops up and down hills rather than along their contours, or grazing too many animals on one piece of land can also contribute to soil erosion. Soil degradation in developing countries is closely linked to poverty, both personal and national (FAO, 2009). Prince Edward Island has been unable to escape this cycle of soil loss due to

erosion as farms become larger and industrial agriculture practices fail to provide adjustment mechanisms.

Soil surveys on the island at the turn of the millennium show that almost half of the farms did not meet criteria indicating good soil health; the table below illustrates a minority of soil samples in excess of 3.5% organic matter content when it is critical for soil health to have levels in excess of 3.8% (Jennifer Scott, 2007).

Organic Matter (%)	Percentage of province-wide samples	
1.5–2.0	2.0 %	
2.1–2.5	8.3 %	
2.6–3.0	21.5 %	
3.1–3.5	24.7 %	68% above 3%
3.6–4.0	18.0 %	
> 4.0	25.7 %	

Figure 11 Soil Organic Matter content on PEI Farms 1998 – 2000 (Scott, J., 2007).

Phosphorus loading in island estuaries is consistent with long term trends of soil erosion as phosphorus is a soil born element (PEI, 1999). Severe weather events have caused repeated years of fish kills in island watersheds and ongoing land use patterns continue to affect the shell fish industry. Significant areas of the province's shellfish growing areas are closed to direct harvesting because of environmental degradation.[18] It is estimated that production of shellfish on Prince Edward Island would increase significantly (by 3 times) in the absence of siltation and that siltation increases the cost of shellfish production by 20% (Belcher, K. 2001).

[18] Shell fish may be grown in areas known to have high nutrient levels but must be moved for a period of time to live in a "clean" environment before human consumption is safe.

The 2003 PEI State of the Environment Report established benchmarks necessary for the identification of key environmental indicators on the island. The 2003 review identified emerging concerns of ground water and surface water quality which exhibited increased levels of nitrates and phosphorus loadings, double the rates found in the previous 30 years. Deteriorating water quality was attributed to nutrient loading and from agricultural and residential sources. Water quality has a direct effect on human health as well as the shellfish industry and all other aquatic life in the affected watersheds (PEI, 2003).

Atlantic salmon was once present in every watershed on the island but is now threatened with extirpation.[19] In 1960, at least fifty-five watercourses recorded evidence of native Atlantic salmon. By 2002, Atlantic salmon remained in only thirty-three rivers, many of which had very low populations. Since 2002, Atlantic salmon runs have disappeared from eleven more rivers. Many streams that still have salmon have serious habitat problems, and often, only one year class is present in the river indicating that salmon populations are barely hanging on. *"At the current rate of decline the population will be lost in a few years"* (Guignion, 2009, p.xiii).

Agricultural crop rotation practices have changed over time with the increase in frequency of row crops, which resulted from a change from mixed farming to more intensive specialized farming practices. Pre-industrial agriculture methods utilized a seven year rotation, although the actual length of the rotation cycle varied from four to eight years depending on the farm. Farmers were strongly committed to strict crop rotation practices and potatoes in particular were never grown for more than two years in a row. Fall plowing although practiced, was not as wide spread then as it is today. Other contributions to increased soil erosion include

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[19] Prior to European settlement the island had about 50 rivers with Atlantic salmon (Guignion, 2009).

the increase in field size over the last century, leaving larger areas open to the dangers of windblown soil erosion (Wayne MacKinnon, 1996).

These observations and others led to the conclusion that estuary water quality continues to show low dissolved oxygen levels due to excessive nutrient inputs from land use and this trend could be worsening (PEI, 1999). Levels of soil and water borne contaminants have implications for increasing eutrophic conditions in island estuaries. Water quality reports indicate that long term trends in island estuaries (where there are both fresh surface water and ground water sources) have been deteriorating since at least 1979. Nitrogen levels in groundwater are becoming an increasing concern for island residents and the increased nutrient loadings in drinking water is occurring in all surface bodies of water. The nitrate content of groundwater can be expected to have a detrimental effect on surface water quality because of the significant contribution of groundwater sources to surface water bodies on the island (PEI, 2003).

Nitrogen levels in the Hillsborough River estuary, for instance, are estimated to be dominated by agricultural sources; 300 metric tonnes of nitrogen are deposited in the watershed and flow into the river from agricultural practices on an annual basis. This is consistent with the approximately 580 tonnes of nitrogen that is used in agricultural practice. Point sources of nitrogen also include the discharge of 150 tonnes of nitrogen annually from the Charlottetown sewage treatment facility, and 30 tonnes from Charlottetown Airport land use. Nitrogen loads tend to increase and peak at 8mg/litre in the upper reaches of the Hillsborough River near Mount Stewart. These levels increase by a factor of 10 during periods of heavy rainfall and take several days to flush with tidal action after storms (J.M. MacNeill, 1992).

Nitrogen sources in estuaries are attributed to three major sources in the Dunk River watershed on the island, an area representative of many working landscapes. Additional loadings occur from sewage treatment facilities in more heavily populated areas.

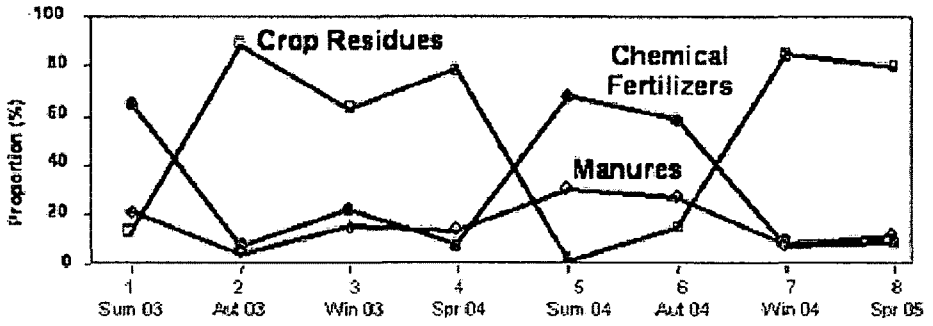

Figure 12 Nitrate Sources in PEI (M. Savard, 2006)

Climate change is a risk on the island because of the combined effects of sea level rise and the expected increase in extreme weather events in the future. Prince Edward Island is one of the region's most vulnerable areas and is most susceptible to sea-level rise in the entire country (McCulloch, 2002). Coastal erosion is compounded by the effects of climate change, sea-level rise, severe weather events and the island's characteristically soft sandstone bedrock and sandy, dynamic coastline which is dominated by extensive low lying estuaries and salt marshes.

Long term trends in coastal erosion average 50 meters per 100 years. The rate of coastal retreat can exceed this in some unprotected areas such as Savage Harbour or Tignish Run. This rate can exceed 2.5 meters per year (250 meters per 100 years). Impacts of coastal erosion on the island in the recent past have included the destruction of wharves in Rustico Bay and the abandonment of a store and landward relocation of houses in Tignish Run. It is reasonable to assume that more severe effects will be experienced in the future (Martha McCulloch, 2002).

One alternative to protecting a coastline with improved vegetative cover and ecosystem preservation techniques is the creation of sea walls. Man-made walls are designed to trap sediments in the foreshore and reduce coastal erosion. These structures are in general, very costly and protection is short lived. Thermodynamic wave energy generated during regular weather events and extreme storms will undermine shoreline protection structures. An end effect is created when energy is transferred to down drift locations which are starved of sediments. Down drift locations erode more quickly as a result of shoreline protection structures which cause increases in erosion in neighbouring areas.

Storm surge events are becoming increasingly common during the last decade and the most recent extreme event of January 2000 occurred when a large weather event combined with the cyclical nature of tidal forces to cause record high sea levels in Prince Edward Island. The combined high tide and a storm surge event which resulted had the effect of creating water levels 4.5 meters above mean high tide. Storm surge events in Prince Edward Island over 3.6 meters above mean high tide can be expected at least once every seven years. This level of flooding already affects significant areas of PEI including downtown Charlottetown (Martha McCulloch, 2002).

Protected Areas

Protected area land assembly is of continuing importance on Prince Edward Island. The preservation of 12% of the landscape is a benchmark established by Gro Brundtland and used by Canadian and provincial governments as a measure of success. There are some who would suggest that this target is too low. E.O. Wilson would argue that 50% of the landscape must be set aside for the provision of ecological services and biodiversity preservation (Wilson, 2002). A

significant barrier to the achievement of this goal, or the achievement of any target, is the large number of independent land owners and the high percentage of private ownership on the island. More than 90% of land is held by private land owners (PEI, 2003).

The identification and preservation of lands which serve as the core of a protected area land use plan will provide 'biodiversity hotspots,' an important first step to preserve biodiversity. Once important landscapes are identified, land purchase efforts can be directed towards their assembly for preservation. Protected area land assembly on the island is also challenged because the island does not have an inventory of Crown Land from which to draw. Currently 3% of the island land mass is protected (Griffin, 2009).

More than 16,680 hectares of land is protected on the island now; the achievement of the 12% land set aside, which is the provincial and national target, would require the acquisition of an additional 50,000 hectares of land on Prince Edward Island.

Chapter Six

A Small Island Perspective to Natural Capital

An understanding of the economic situation of islands, the 'island dilemma', in terms of natural capital economic theory provides a paradigm bounded by science and nature. Economic development on small islands should include science based natural capital considerations. It is clear in this study of natural capital that a broad based and holistic approach must be taken into account to ensure our economic survival, ecosystem preservation, landscape management and biodiversity preservation and must include social and cultural dimensions. *"It is clear that islands require unique forms of development adapted to the limitations of the environment, and drawing as much from the traditional societies that successfully lived within those limits for generations as from the modern world"* (UNEP, 2006, p. 9).

The adaptation of natural capital theory to the finite ecosystem and economic indicators defined on an island provides the opportunity to benefit from a profitable micro-economic theory in a macroeconomic setting. The challenge for islands is to create policy and economic frameworks that sustain natural capital resources, *"closing ecological cycles so that wastes become resources, and resources are renewed"* (Baas, 1995, p. 12).

The opportunity for islands is that a number of conclusions can be drawn from the research presented that could direct small island economic development in the future. Natural capital theory reveals nature preservation initiatives can be undertaken with certain knowledge of their effectiveness for sustainable economic development. The following areas of economic development appear to have wide spread acceptance in the literature reviewed; the development of integrated community sustainability plans, the introduction of cap and trade systems to create carbon markets, ecosystem restoration investments, protected area land assembly, climate

change adaptation measures, import replacement schemes and ecological tax reform of the fiscal system.

Broad goals for nature preservation must be established in order to effect change in the island context.

> *"Once the broad goals are democratically arrived at, they can be used to limit and direct preferences at lower levels. For example, once there is general consensus on the goal of sustainability, then society is justified in taking action to change local behaviors that are consistent with this goal. It may be justified, for example, to attempt to change the preferences for driving automobiles, or the price of doing so..."* (Carl Folke, Robert Costanza, 1997, P. 59).

Once broad goals for conservation have been set, the precedence for implementing actions are justified by sound science based management that has informed the decision making processes.

> *"Where externalities occur, private markets cannot operate efficiently in the context of optimizing social welfare and market failure occurs. Externalities provide the fundamental economic justification for the existence of governments and their provision of public goods not supplied by the private markets"* (Barton, 1999, p. 210).

Integrated Community Sustainability Plans

The necessity of creating an island wide sustainability plan began with the establishment of international agreements on the definition of sustainability in 1987 by Gro Brundtland in 'Our Common Future' and the subsequent adoption of Agenda 21 by Canada and numerous other international parties in 1992. International agreements document Canada's and Prince Edward Island's acceptance and intention to implement planning and legislative schemes to bring these agreements to life in the form of Integrated Community Sustainability Plans (ICSP). Even though Agenda 21 was adopted by Canada in 1992, the integration of the articles of agreement in Canada and on Prince Edward Island has been slow. Chapter 28 of the Agenda 21 agreement specifically addressed the need for developing 'Local Action Plans.'

> *"Each local authority should enter into a dialogue with its citizens, local organizations, and private enterprises and adopt 'a local Agenda 21'. Through consultation and consensus-building, local authorities would learn from citizens and from local, civic, community, business and industrial organizations and acquire the information needed for formulating the best strategies"* (Agenda 21, Chapter 28, sec 1,3.).

The stage was set for the integration of nature values into basic levels of governance in the economy through local initiatives. Subsequently, implementation of this objective was begun in Canada in various communities on an ad hoc basis; full scale implementation was not begun in earnest until the federal government inserted a new clause in municipal funding agreements. In March 2010, a requirement for local planning to support the rational for community

infrastructure investments was required. The stated objectives of current federal provincial Gas Tax Funding Agreements include:

> "*The requirement for municipalities to develop ICSPs in Canada was designed to accelerate the shift in local planning and decision-making toward a more long-term, coherent and participatory approach to the achievement of sustainable communities. ICSPs have been identified as a means to help cities, communities and First Nations to effectively plan and manage their assets and resources to achieve identifiable outcomes, deliver services and address priorities within an integrated framework encompassing the economic, environmental, social and cultural dimensions of community sustainability*" (Infrastructure Canada, 2007, p. 24).

The development of Integrated Community Sustainability Plans (ICSPs) across the island has been proceeding since the new federal government requirements were implemented, the objective being both the implementation of Agenda 21 and improved economic conditions for citizens most in need. The combination of community participation and the consideration of social and cultural dimensions in community planning are designed to share the wealth natural resources across income groups and amongst disadvantaged persons (ICLEI, 2010). It follows then, that as capacity is developed in the planning and delivery of community services on a local level, the benefits of economic growth on the island will be shared on a more equitable basis across all sectors of society.

Community representation is used in most often in natural capital governance models to gather consensus amongst stakeholders and to determine directions for governance. Nissology would suggest that consensus development results from and provides strong social cohesion in an island setting. However, it can also be said that consensus based decision processes serve to mute dissent and provide a strong group motivation towards making no changes, in order to protect the status quo (something islanders are usually pretty good at). Consensus governance may in fact impede progress towards change and community sustainability when vested interests determine the outcome of deliberations.

Improved community development planning capacity created by ICSPs will increase economic conditions and activity in the economy in a number of areas which include social, cultural and environmental dimensions. The stage is set for the integration of nature values into basic levels of governance in the economy through local initiatives. There is a high degree of certainty in the effectiveness of this approach towards economic development which is supported by expert sustainability organizations in Canada such as the International Development Research Center (IDRC), International Institute for Sustainable Development (IISD), The Energy Research Institute (TERI) and The Natural Step (TNS).

The best available science based evidence supports the decentralization of decision making and encourages a high level of public participation in local planning initiatives; the conclusion that can be being drawn is that contributions to participatory democracy will lead to a stronger, more resilient island society. The consultative processes for the development of local action plans for the preservation of the environment, ICSPs, have focused on the creation of small group deliberations to provide stakeholder input. The dialogue which is enabled in this collaborative process often serves to counter individual preferences with societal concerns in an

open public forum and debate. *"In this manner, discursive methods such as citizen juries, consensus conferences, and deliberative contingent valuation techniques have been increasingly proposed and used in North America, Europe and Australia to inform environmental decision making"* (Farber, S. 2002, p. 390).

Community engagement via stakeholder discussions in small group deliberation setings improves the decision making processes, it enables communities an opportunity to think outside the box and is widely seen as providing better decisions for the preservation of natural capital in the future. *"Stakeholder involvement is now an accepted part of environmental decision making. While stakeholder involvement increases cost and time of a project, stakeholder involvement is better equipped to reflect the wants and needs of diverse constituencies"* (Randhir & Shriver, 2009 p. 3042).

This field of study and implementation continues to refine public consultation processes; the addition ot participatory research methods of GIS mapping techniques reflects societal values in the social and cultural dimensions (Cassar, 2010).

Small islands in general need institutional strengthening and multidisciplinary approaches to economic development. The need for community involvement in valuation and remediation plans is a key lesson from natural capital economic theory. The application of this lesson is currently exhibited in the development of watershed management plans on Prince Edward Island (PEI, 2009a). The development of ICSPs in the Prince Edward Island context treats sustainability as a goal which requires a constant cycle of community planning and adaptive management. Sustainability is considered to be a moving target as opposed to a static goal which does not allow for the adoption of new science or knowledge from lessons learned.

Prince Edward Island municipalities are not incorporated to cover the whole land mass of the island and because of this, the influence of municipality based sustainability plans will not benefit the whole island (less than 10% of the land mass is within a municipality). As the Commission on Land and Local Governance pointed out in 2009,

> "*There is no provincial land use policy to guide decision-making at the local level, and there is no indication that any serious attempt has been made by government recently to remedy the situation...there is no framework to allow for public engagement in the development of provincial land use policy...some developments have been approved despite the apparent likelihood that they would precipitate premature development or unnecessary public expenditure...* "
> (Thompson, 2009. p. 24).

The future of land use and municipal regulation has been of issue and concern to many islanders, for decades, and this has resulted in four major reports having been commissioned on the subject since 1973. These efforts included the Royal Commission of 1973, the Royal Commission of 1990, the Round Table Report of 1997 and most recently, the report of the Commission on Land and Local Governance was released in late2009. A recurring theme of these exhaustive reviews of PEI land use and governance has been the reiteration of the publicly perceived and publicly voiced need for to create municipal land use authorities across the whole island landscape .

One of the consequences of failing to implement municipal agreements across the island is that the provincial government acts as the *defacto* municipal government in the void that is created. Generally speaking, the province allocates to itself, a percentage of federal grants to

municipalities for its own use, funds that would otherwise be shared amongst municipalities (Canada, 2005). The re-allocation of federal funds by the province is deemed to be for municipal expenditures and improvements in unincorporated areas. The adoption of an ICSP for the entire island province would ensure that island citizens are included in the development of equitable economic development plans that integrate local concerns into long term development plans. Although technically a requirement of major federal funding agreement, the completion of ICSP's for Prince Edward Island is still elusive goal.

Ecosystem Restoration

Habitat restoration opportunities present an immediate opportunity to improve the value of our environment for present and future generations with investment in the near term. The net present value of forest cover and buffer zone enhancements would indicate that investment returns will be realized quickly as a result of action in this sector. "S*alvage immediately the world's hotspots...cease all logging of old-growth forests everywhere... ...and concentrate on the lakes and river systems"* (Wilson, 2002 p. 161).

Biodiversity protection in the working landscape is seen as a necessary first step for the island; it is possible on a regional scale and needs to be instituted in order to avoid continued reductions in biodiversity. High value habitat must be connected by wildlife corridors in order to maintain genetic diversity and increase resilience in the ecosystem (Michael Soule, 1997).

Forestry values and ecosystem service provision can both be improved by increased management for biodiversity (Aneilski & Wilson, 2005; Boyd, 2003; I.P.C.C., 2007; NRTEE, 2003). The consensus surrounding the science of ecosystem preservation is strong; common

goals are defined in terms of preservation of threatened species and the re-introduction of extirpated species in forest ecosystems.

The re-introduction of extirpated species in the wider landscape and on islands is a specific action that can be taken to create a working landscape that maintains biodiversity while at the same time allowing economic activity for the production of goods. The absence of top predators appears to lead inexorably to ecosystem simplification accompanied by a rush of extinctions (Terborgh et al., 2001). Consideration should be given to habitat restoration for martin, lynx, and other 'trophic' species which serve as indicators of ecosystem health in the science of conservation biology. Old growth Acadian forests act as a reservoir of genetic diversity in the landscape, this is a particularly important function for rare and declining species and forest tree types. Old growth forests are rare in the Acadian Forest region and are virtually non-existent on Prince Edward Island; the Canadian Forest Service estimates that less than 1% of the forest cover on the island is older than 100 years, in contrast, long lived native tree types can survive up to 300 years (Mosseler, 2007).

The stock of long-lived, shade-tolerant trees in our natural capital inventory is very important; forests containing trees such as native sugar maple, red oak, yellow birch, red spruce and eastern hemlock provide essential habitat for indicator species like owls, bats, woodpeckers, and martins. Our forests provide much more than an inventory of trees for commercial harvest in the future, they are important contributors to water purification services, severe weather event buffering and storm water retention.

Reforestation and buffer zone restoration protocol necessitates that planning for economic development must take place within the context of the whole landscape planning; large scale concepts of landscape and biodiversity preservation ensure that natural capital values are

formally factored into long term economic production models to increase the wealth of the whole community. "*Protected areas must be large enough to support groups that can maintain genetic variability to avoid inbreeding depression and resist local population fluctuations... species thrive in the absence of habitat, ...* " (Soule, 1997, p. 21).

Particularly important to Prince Edward Island is that practical conservation strategies should give rural and Aboriginal communities a say in management decisions, and compensate them for undertaking stewardship duties - if and when they forego some short-term economic development opportunities. This conclusion is supported by consensus agreement in the Canadian context provided by research and widespread consultation throughout the country carried out by the NRTEE during 2002 and 2003, published in their report *Securing Canada's Natural Capital* (NRTEE, 2003).

Protected Area Land Assembly

Protected area land assembly is of continuing importance on the PEI. The preservation of 12% of the landscape is a benchmark established by Gro Brundtland and used by Canadian and provincial governments as a measure of success. The identification and preservation of lands which serve as the core of a protected area land use plan will provide 'biodiversity hotspots', an important first step for any island to preserve biodiversity.

To date, over 16,680 hectares of natural areas has been protected on the Prince Edward Island; the achievement of the 12% of land mass target set by Brundtland would require the acquisition of an additional 50,000 hectares of land. The financial commitment that this represents is challenging; assuming a modest price for land value of $500 per hectare, this natural capital investment could require in excess of $25 million.

The provincial government owns approximately 20,000 hectares of land which is managed by the Department of Energy, Environment and Forestry. The management regime for land used in the forest production business models is different from management regimes created for biodiversity preservation. This may present difficulties in the future as forestry management objectives are often in competition with a long term goal of preserving and restoring a portion of the biodiversity of the island's Acadian forest. The removal of forest biomass prevents the natural process of forest succession[20] which would see the gradual reintroduction and transformation of farm field volunteer spruce tree cover to longer lived varieties of hardwoods. The scattered and haphazard assembly of provincial forest lands may not immediately provide the necessary wildlife corridor and connection to areas of high ecological values.[21]

Ecological Tax Reform

Herman Daly, former Senior Economist with the World Bank outlines the four basic recommendations to assist in a change to sustainable taxation policies; (1) stop counting the consumption of natural capital as income, (2) tax labour and income less and tax resource use more, (3) maximise the productivity of natural capital in the short run and invest in increasing it's supply in the long run, and finally (4) invest in domestic production for domestic markets as the first option. Ecological tax reform suggests that shifting the tax base away from value added

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[20] Natural forest succession is a process which can take 200 years or more, this increases the importance of immediately curtailing the harvesting of any old growth forest remaining on the island.

[21] Forested land inventory assembly on the island in the past has often resulted from tax sales or mortgage foreclosures rather than from targeted purchases based on biodiversity or even forestry values.

(income earned by labor and capital), and on to "*that to which value is added*", namely the throughput flow (Daly, 2009, p. 1).

Daly goes on to suggest that ecological tax reform facilitated by the gradual change away from income taxation to broad base throughput taxation is in effect, a tax on entropy through the taxation of resource depletion and pollution creation (Daly, 2009). On Prince Edward Island this would indicate that a tax shift should occur, away from personal and corporate income tax, towards broad based consumption taxes.

Canadian and Prince Edward Island economic development patterns reveal that new incentives for natural capital conservation are necessary to counter the natural tendency of the free market to degrade the environment. Government regulation and guidance is needed to provide the incentive for change in our economy, we can change our economy through the intervention in the markets with ecological tax reforms.

For many years Paul Hawken has promoted a change in the tax system; Hawken's work in this field echoes the analysis from a broad spectrum of political and economic commentators including Herman Daly, OECD, NRTEE, C.D. Howe Institute and the David Suzuki Foundation. A consensus statement can also be made based on the recommendations of Paul Hawken to tax labour less, broadening the consumption tax base to lower overall rates of consumption taxation on economic activity without discouraging labor income (Hawken, Lovins & Lovins, 1999).

Ecological tax shifting includes recommendations for improvements in the taxation system for sustainable economic growth. This would allow for decreased personal and corporate income taxation; the predominant logic being that personal income tax reductions (or increases) will most quickly motivate action by individuals, by neither immediately encouraging or discouraging investment and labour.

The reduction of income tax for lower income brackets decreases the negative effects that a regressive tax, like consumption tax, might have by disproportionately taxing the poor. *"Taxing labor income tends to discourage employment by making labour more expensive to employers and employment less profitable for workers"* (Bernow, 1998, p. 193).

The overstatement of benefits from products derived from natural capital sources distorts the market signals that are used by market participants to make purchasing decisions; undervalued natural capital prices do not reflect the true costs and benefits of these products in the marketplace. When the market fails, as it has in the case of the extensive use of GHG emitting petroleum products for instance, the conclusion must be reached, that there is a need for regulators to step in (Stern, 2006).

Ecological tax reform is supported and encouraged by a broad spectrum of commentators, including leading Canadian economist Jack Mintz. Writing from the perspective of the C.D. Howe Institute suggests improving economic growth and competitiveness from the center of the Canadian financial and business community will be achieved with the reduction of income taxes and the broadening of the consumption tax base. Mintz suggests that economic effects of dealing with environmental costs would be neutralized by *"converting the existing fuel excise tax into broad based environmental taxes on various energy sources (natural gas, coal, electricity and nuclear) and toxins with rates varying according to environmental damage"* (Mintz, 2007, p. 23).

David Boyd, writing from the environmentalist's perspective in *Un-Natural Law* echoes these comments, *"Tax shifting begins to correct the markets failure to reflect the full cost of resource depletion and pollution, gets the market to send appropriate signals, internalizes economic externalities and encourages investment in new technology and efficiency"* (Boyd,

2005, p. 321). Tax changes can be made in a revenue neutral manner; this will spur new investment and define new economic opportunities in sustainable industries.

Carbon Markets

Cap and trade systems have been used successfully in Canada in the past, cap and trade market systems function reliably in the dairy and poultry industries as well as in governance models and pollution abatement schemes. The cap and trade approach to pollution reduction was pioneered in the past with the Acid Rain agreement signed between Canada and the US in the 1980's as well as in the multilateral Montreal Protocol to reduce CFC's in the atmosphere in the 1990's. Cap and trade systems have been credited the reduction of CFC use in consumer products worldwide.

Economist Herman Daly argues that the imposition of quotas allows a more equitable distribution of costs throughout society for a number of reasons; capping pollution emissions will at first stop increases, trading serves the goal of efficient allocation and permits can be gradually or quickly reduce, and the auction process ensures transparency (Daly, 2009). The fledgling global carbon market is presenting investment opportunities for the future; trading values vary from $3 per tonne to a potential of $85 per tonne as defined by the opportunity cost established in the Stern Review (Stern, 2006).

Concrete action can be taken integrate carbon trading schemes like the Western Climate Initiative. Several Canadian provinces have joined the WCI initiative which spans international borders and includes 13 states in the US (including California) as well as 6 Mexican provinces.[22]

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[22] British Columbia, Saskatchewan*, Manitoba, Ontario, Quebec and Nova Scotia* are full partners or observers (*) in the Western Climate Initiative (WCI).

Despite the reluctance of the Canadian and American national governments to implement actions under the Kyoto Protocol, market development is underway and trading systems are being developed and implemented that provide commercial incentives for the reduction of GHG emissions.

Many argue that the population should act individually to reduce personal carbon emissions as opposed to waiting for the bureaucracy of politics and administration to move to action. Very few Canadians believe that their government is leading the fight on climate change, in fact only 16% agree with that idea. There is however, widespread consensus supported by survey that among Canadian adults, two thirds of Canadians agree with the statement that climate change is a threat *"climate change will have a harmful impact on the world"* (harris decima, 2009, p. 2). Such widespread public support for action warrants some form of response from government.

Sea Level Rise and Climate Change Adaptation

The changes that are anticipated as a result of sea level rise and increasing frequency of extreme weather events makes it imperative that the PEI assess the vulnerability of critical public infrastructure like sewage treatment facilities, water supply infrastructure, and roads and bridges. The identification of the risks should indicate priorities for financial investment in the near term.

Some public infrastructure facilities are located in areas of high risk to damage from the changing environment like the sewage treatment plant in Charlottetown which is within five meters elevation of sea level. Plans for long term sustainability must include the development of alternate locations for the installation and future development of critical public infrastructure.

Import Replacement Schemes

One dependable method of reducing imports on the island is to curb the increase of imports by the substitution of local products, another might be the substitution of imported petrochemicals with alternative energy sources. One of the lessons learned from the study of small islands is that, as off-island remittances grow in importance, independence is diminished. Import substitution should be a top priority for the island as the provincial trade deficit has been growing at a rate of 2:1 over exports since the turn of the millennium. The resulting import leakage continues to weaken the provincial economy simply because of its magnitude.

Food imports continue to contribute to economic development challenges on an increasing basis (Jennifer Scott, 2007). Island consumers may not be aware of the impact of declining shelf space devoted to domestically produced product or may not even be aware of the extent to which the substitution of imported foods for locally produced product drains the economy of valuable local currency.

Chapter Seven

Conclusion

The underlying premise of natural capital economics is that nature is the primary engine of growth and that laws of nature determine the outcome of any activity. The economy is a subsidiary of the environment. It should be clear from the research that there are many life supporting ecosystem functions which we receive from the Earth for which there is no substitute. These life supporting services are critical to future economic and ecosystem viability globally, and on Prince Edward Island. Over the last several decades, despite our best efforts to improve the economy, stagnation continues to be a long term economic trend on Prince Edward Island. The island presents a lagging economy where unemployment continues to be high, over 11% for the last two decades, and resource based industries in fishing, farming and tourism are collapsing.

The case study reveals a declining quality and stock of natural capital present in the environment on Prince Edward Island largely because of the resource exploitation model of economic development used to sustain GDP growth in the past. The abundance of nature has been diminished most certainly since the arrival of the Europeans; and for most of those living on the island today; evidence abounds of declines within our lifetime. Species like Atlantic salmon, piping plovers, and American Eels continue to decline in population, while others, like otter, marten, and black bear have been extirpated.

The free market economy depends on individuals and corporate entities to make decisions (on the costs and benefits of products and services) based solely on individual welfare and utility. This economic engine seems to perpetuate the continuing decline in nature values and the long term economic stagnation of the Prince Edward Island economy, this would suggest

that the present economic development paradigm (free market business models combined with government regulation) is not working to improve nature or the economy. In fact, it appears this scenario prevents the island from achieving long-term economic sustainability goals.

It is clear that free markets do not provide an incentive to preserve nature, it is also clear that we must place value on these limited resources through alternative actions. Ecological economics and natural capital asset values illustrate financial metrics which inform market mechanisms to function and internalize these values in closed loop production systems. The tax base, and therefore the economy, is wholly defined by the federal and provincial governments in the statements of financial flows of goods and services that make up GDP. Prince Edward Island has the jurisdictional capacity to act within the existing economic and governance framework of the Canadian Federation to incorporate measures, independently of the federal government, which act to preserve the environment and long term sustainability of the province. This logic path would conclude with affirmative actions, based on knowledge of the island's governance capacity and the desire of the citizens to enable change.

Tax rates often diverge in Canada for a number of reasons, provincial governments use different rules, definitions and investment classes for depreciation, inventory costs, and other business related expenditures. Provinces may have different economic development strategies based on ideology, political history, cultural differences, natural resource inventories, election timing issues, and differences in the level of dependency on federal government transfers. The definition of what matters in the island economy, Prince Edward Island's, is within our jurisdictional capacity and although well established international protocols based on GDP templates and measurement standards must be followed, changes can, and should be made.

Through the history of development on small islands, islanders come to know that economic activities must not transcend the ecological functions and physical limits found in the island ecosystem. The development of natural capital economic production theory necessitates the creation of business models which follow the laws of science as found in nature. The most efficient use of thermodynamic and entropic energy creates innovative business models which benefit the community as a whole.

Ecological economics would suggest options are available to build closed loop *economies of islandness* that are incorporated into local economic production models. Business models which incorporate laws of science are by definition more resilient than models that do not. Increased efficiency from the use of thermodynamic and entropic energy in the production and distribution of goods and services will have long term economic benefits. Island economies are uniquely positioned to take advantage of production innovations in natural capital because of the limited natural resource base which underpins the local economy and, the strong personal link to and understanding of the environment and limits imposed there-on.

Prince Edward Island's insular tendencies provide a key building block for greater economic independence and resiliency, it is because of the insular tendencies that islanders are in a good position to define and agree on fundamentals. The small size of the island market presents an opportunity to use carbon as a proxy for nature values and other externalized production costs, carbon markets which are created from 'cap and trade' systems of valuation work to decentralize the burden of decision making throughout the economy through consumption based expenditures. Local markets, once established through carbon tax price adjustments, afford domestic products with lower carbon footprints than imports, with a competitive advantage in the island market. These changes affect long term change as locally

accepted taxes are non-countervailable under international trade rules set out in the GATT and the WTO.

The overall burden of taxation should not be increased, but the tax burden should be shifted towards products that are not desirable in the island economy (carbon emissions or other pollutants). Carbon emissions are a direct or indirect byproduct of almost all human activity, and the application of the measurement metrics is conceivable in the local market place. There is broad based agreement that carbon markets and prices will become more established in the near future, this presents an opportunity to use the insular nature of the island to create local market incentives for sustainability.

Clearly, the social and cultural agenda for economic development will require that business models and theory include values which stem from non-monetary or non-marketed social preferences and values.

> "*Ultimately macroeconomics is required to express the value of ecological systems and species in monetary terms. That is, all things that appear in national and international accounts appear with a monetary value or as index that reflects monetary values*" (Fenech, 2003, p. 16).

The environmental and economic imperative for improved natural capital preservation Prince Edward Island could not be much stronger. The nationhood rationale is the citizenship's reason for action; Prince Edward Islanders, by being part of the federation, ought to have access to certain key Canadian environmental rights such clean air and clean water as defined by our constitution, parliamentary law, and international treaty. Since some of these rights fall under

share federal provincial jurisdiction, it is imperative that the island province have adequate funds to act within its jurisdictional capacity. The federal rationale for supporting the improvement of natural capital preservation in Prince Edward Island is basic. In order for the federal government to full fill its responsibilities to Canadian citizens, Prince Edward Island needs the financial capacity to act in areas of shared jurisdiction.

Appendix A

Prince Edward Island species at risk, threatened or endangered (IUCN. 2009).

Marine species:

Harbour Porpoise (Phocoena phocoena)

Fin Whale (Balaenoptera physalus)

Leather Back Turtle (Dermochelys coriacea)

Striped Bass (Morone saxatilis)

American Eel (Anguilla rostrata)

Winter Skate (Physeter macrocephalus)

Atlantic Cod (Boreogadus saida)

Terrestrial species:

Bobolink (Dolichonyx oryzivorus)

Piping Plover (Charadrius melodus)

Barrow's Goldeneye (Bucephala islandica)

Harlequin Duck (Histrionicus histronicus)

Gulf of St. Lawrence Aster (Symphyotridum laurentianum)

Extirpated Species; no longer present on Prince Edward Island

Black Bear (Ursus americanus)

Marten (Martes americana)

River Otter (Lontra Canadensis)

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