
Business Ecosystem Services Review: A Nova Scotia Case Study

Submitted in fulfillment for the requirements for the
Honours Conversion Bachelor of Environmental Science Degree

Dalhousie University
Halifax, Nova Scotia
April 2011

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Abstract

Recent efforts to assess the state and value of ecosystems on a global level have been increasing, within this research, ecosystem services and their relation to businesses has also been expanding. Although there are gaps in the existing literature on the accuracy and applicability of measuring and valuating ecosystem services, jurisdictions are beginning to recognize that ecosystems provide essential services to the economy. In Nova Scotia Canada, the Environmental Goals and Sustainable Prosperity Act recognizes this interrelation. This thesis discusses why ecosystem services should be given higher priority by businesses by demonstrating the applicability of the Corporate Ecosystem Services Review using a local company, Acadian Seaplants Limited, as a case example. This thesis focuses on the state of the coastal zone, the results show that Nova Scotia is experiencing threats to ecosystem health and this is resulting in economic losses. The discussion investigates the incorporation of environment and economy and explains that there is a business case for recognizing ecosystem services as limited resources that are essential to business operation and human well being. The findings could be useful for business leaders, academics, students, organizations, and government.

Acknowledgements

Completion of this thesis could not have been possible without the consistent support of my supervisor Raymond Côté. His expertise, vast knowledge, and ability to patiently guide and mentor me through this writing process provided an enriching learning experience. Special appreciation to my greatest friend Nikki Carter. Though she resides several provinces away, she was always accessible for advice, editing, and support throughout the writing of this thesis. Thank you Jen, Dave, Sally and the staff at Brigadoon for allowing me to fulfill my passion in a work setting while always being respectful of my academic commitments and facilitating the ability to somehow juggle both. Lastly to my Mom, thank you for challenging me to consider the idea of writing a thesis in the first place and always having faith that I would complete it.

Abbreviations

MA- Millennium Ecosystem Assessment

TEEB- The Economics of Ecosystems and Biodiversity

ESR- Corporate Ecosystem Services Review

WBCSD- World Business Council for Sustainable Development

ASL- Acadian Seaplants Limited

ESV- Ecosystem Services Valuation

EGSPA- Environmental Goals and Sustainable Prosperity Act

Introduction

1.0 Background

Research concerning the linkage of ecosystems and business has been expanding. Current and ongoing studies such as the Millennium Ecosystem Assessment (MA) and The Economics of Ecosystems and Biodiversity (TEEB) demonstrate that ecosystem services, or “the benefits from nature to households, communities and economies” are relevant to business decisions (Boyd and Banzhaf, 2007, p.616). This is suggested for two reasons: companies affect ecosystems and ecosystem services, and they depend on natural resources (Hanson, Ranganathan, Iceland, Finisdore, 2008). In this context, it is important for companies to acknowledge the benefits or possible drawbacks that ecosystem services provide so that managers can make well-informed business decisions that maximize opportunity and mitigate risk. In order to maximize business opportunity, firms make decisions that are attractive to the bottom line. Goldman (2010) argues that, in the same way that consumers want to buy as inexpensively as possible, companies wish to produce goods as inexpensively as possible. When businesses operate in this fashion, there is concern that the services provided by nature are overlooked, and largely ignored with regard to businesses’ decision-making criteria.

In order to better understand the gap between nature’s contributions to business and ensure that ecosystem services are considered part of the business decision making process, the World Business Council for Sustainable Development (WBCSD) has recently recommended that a thorough review of ecosystem services be undertaken. The process, which was developed by WBCSD and its partners, World Resources Institute (WRI) and the Meridian Institute, is known as the Corporate Ecosystem Services Review

(ESR). An ESR is a specific methodology that addresses and examines how businesses impact the environment on the one hand, and depend on ecological resources on the other. Hanson et al. (2008) argue that an ESR can advance existing business strategies by emphasizing potential opportunities and future risk. While there are no specific examples of this assessment in Nova Scotia, the WBCSD document on corporate ecosystems services reporting includes a number of case examples. Hanson et al. (2008) states that these companies are “facing unexpected risks or novel opportunities arising from their dependence and impact on ecosystems” (pg.1).

The companies highlighted in the report are from a variety of business sectors and industries. One of these involves an ecological disaster with which we are very familiar with in this part of the world. The specific company, Unilever, faced major financial repercussions when stocks of Cod—the main fish used in its products—rapidly declined. As a result of the decline in supply, the price of cod dramatically increased and caused a reduction in margins on Cod related products by 30 percent (Hanson et al., 2008). Unilever failed to recognize the economic contributions of oceanic ecosystems to their business, and the result was an unforeseen decrease in profits. The Millennium Ecosystem Assessment has documented losses in ecosystem functions and services across the planet. These losses appear to be increasing and have the potential to negatively influence the viability of many other industries. The Corporate Ecosystem Services Review addresses these issues and also helps users create strategies that avoid financial risks and ecological disruption. This thesis aims to show how the ESR approach could address the interrelationship between ecosystem services and the bottom line for business, using an example from Nova Scotia.

1.1 Research Topic

Traditionally, ecosystem services have been considered to be within the purview of environmental management, agencies of government and functions of corporations, often having a marginal impact on core business functions and government decisions (R. Côté, personal communication, February 1, 2011). Costanza (2008) addresses this disconnect when he notes that the overall challenge is to prompt business decision makers to recognize the value of ecosystem services and natural capital. Additionally, De Groot, Wilson, and Boumas (2002) suggest that there has been an increase in reports that discuss the value of ecosystem contributions to human society (see for example, the Millennium Ecosystem Assessment 2005, Costanza et al., 1997, Folke 1999, Pimentel and Wilson 1997). These publications illustrate how measuring the value of ecosystems is becoming increasingly pertinent to societies and the enterprises that operate within them. Costanza (2008) explains that identification and measurement of ecosystem service values can be an effective way to evaluate tradeoffs and avoid economic loss. However, this is not a new concept, society is starting to see examples of efforts to measure and recognize ecosystems more prevalently in the corporate realm.

For example, Dow, a multi-national chemical technology company with sales of \$45 billion and 52 000 employees, recently announced a unique ten million dollar collaboration with the Nature Conservancy (Dow Chemical, 2011). Through the Dow funded research initiative, efforts will be made to recognize ecosystem services and protect nature's role in business. The results of the research and assessments will be peer-reviewed, and the academic publications will be made available for other companies to consult (Dow Chemical, 2011). Dow is beginning to recognize and explore the value of ecosystem services; however this example illustrates that some leading corporations

recognize an increasingly important connection between business activities, their bottom line and the ecosystem services on which they depend (R. Côté, personal communication, February 1, 2011). The Economics of Ecosystems and Biodiversity mentioned earlier, is another large project aimed at understanding how the value of ecosystems and their services should be incorporated into decision-making.

This thesis will explore the following topics i) why and how the consideration of ecosystem services should be given more consideration by companies in Nova Scotia, ii) assess the use of ESR methodology and demonstrate how it might be applied in a Nova Scotia case study, and iii) demonstrate the practical integration of the environment and the economy by business as envisioned by the Environmental Goals and Sustainable Prosperity Act (EGSPA).

1.2 Case Example

A Nova Scotian company that has been recognized for their effort and innovation in environmental practices is Acadian Seaplants Limited (ASL). ASL manufactures seaweed-based products such as agricultural feed, fertilizers, food, and health and beauty products (Acadian Seaplants, 2010). The Eco-Efficiency Centre at Dalhousie University (2006) notes that ASL has implemented a sustainable resource management program that preserves coastal ecology and supports the long-term sustainability of seaweed resources. ASL has accomplished this by harvesting seaweed under controlled licenses, which are tightly monitored by experienced resource managers. They have successfully been able to maximize their production however they only exploit 35 to 45 percent of the seaweed's annual re growth rate, this is a precautionary approach that is far below the total possible

harvest (Acadian Seaplants, 2010). Acadian Seaplants also closely monitors their by-catch onboard the fishing boats, they investigate the type and proportion of organisms being caught as bycatch by harvesters (Acadian Seaplants). Additionally, ASL's processing facility in Cornwallis Nova Scotia has made considerable operational enhancements to reduce water and energy consumption and recycle waste. The Eco-efficiency Centre (2006) estimates that this program has resulted in "an estimated cost savings of \$64 000 per year for the company, with a pay back period ranging from 2.5 to 5 years" (pg.1). Acadian Seaplants has also been recognized for their efforts to preserve the marine environment; they have received The Nova Scotia Export Achievement Award, awards from The National Sciences and Engineering Research Council of Canada, and they have been acknowledged by The North American Agricultural Marketing Officials (Acadian Seaplants, 2010). Acadian Seaplants has effectively recognized the value of coastal ecosystems and resources by experimenting with new ways to manufacture and harvest their products. The results have been positive environmental improvements and cost-efficiency, both of these successes are critical components of an ecosystem services review.

Companies that depend extensively on ecosystem services in Nova Scotia include those in the agricultural, forestry, fisheries, and tourism sectors. This thesis will focus on a particular ecosystem, the coastal zone, throughout the paper to provide a Nova Scotian context. This thesis could provide a company that operates in the fisheries sector such as Acadian Seaplants Limited examples of ecosystem services that they depend on, and strategies to incorporate the value of risks or opportunities derived from ecosystem services into their business decisions. As Nova Scotia moves closer to the targets and

intents of the provinces governing environmental legislation; The Environmental Goals and Sustainable Prosperities Act (EGSPA), applying the ESR method could help link ecological dependence to business decision-making. This thesis aims to explore the critical business information gap between the services that nature provides and business functions. At a minimum this thesis will attempt to provide an example and review of relevant literature for companies operating in the natural resources sector which depend extensively on ecosystem services.

2.0 Review of Literature

2.1 Context

Global Perspective

2.1.1 The Millennium Ecosystem Assessment (MA)

After four years of scientific review, the Millennium Ecosystem Assessment report provides evidence of ecosystem change that will affect human well-being (Millennium Ecosystem Assessment, 2005). Included in the report are findings that have a definite connection to businesses and industries. The Millennium Ecosystem Assessment (2005) states that businesses interact with ecosystems and ecosystems services by using and altering them. As a result, the report suggests there are three ways that businesses will be affected by ecosystem change: i) current ecosystem services will not be available in the future; if they are, they will be at a price that is too costly, ii) as ecosystem services are lost, operations within businesses will change. Loss will affect consumer preferences, policy, regulatory practices, or accessibility of finance, and; iii) as the availability of ecosystem services changes, the potential for new business opportunity will grow; new

markets will be more efficient in how they use resources (Millennium Ecosystem Assessment, 2005).

These findings are relevant to businesses operating in Nova Scotia, in part due to its geographical location. Like many areas in Canada, Nova Scotia is rich in natural resources (forestry, lakes, minerals). The availability of these resources and good ecosystem health plays a vital role in business success. There are actions that businesses can take to reduce impact on ecosystems and improve their bottom line (Millennium Ecosystem Assessment, 2005). These actions include: i) technologies to improve operations, this improves the efficiency of ecosystem service use, ii) identifying and valuing the essential ecosystem services that businesses rely on and affect, and then make changes in business strategy to reduce these effects, iii) creating partnerships with other organizations to information share, this facilitates corporate learning about ecosystems and how ecosystem services are used (Millennium Ecosystem Assessment, 2005). The ESR methodology attempts to address both the actions that a business should take, as well as the effects of widespread change to ecosystems. The MA provides evidence and resources to help successfully complete an ecosystem services review, making it a useful tool for businesses in Nova Scotia to adapt the ESR framework.

2.1.2 The Economics of Ecosystems and Biodiversity (TEEB)

The TEEB report provides economic rationale for considering ecosystems and biodiversity. More specifically, TEEB focuses on “the global economic benefit of biological diversity, the costs of loss of biodiversity and the failure to take protective measures versus the costs of effective conservation” (TEEB, 2010a, pg. 1). Similar to the Millennium Ecosystem Assessment, TEEB indicates evidence for the loss of biodiversity

and ecosystems, paying particular attention to how these losses affect businesses. The TEEB executive summary outlines several aspects of the report that could be useful for conducting an ESR, including: i) linkages between business and biodiversity, emphasizing the trends of ecosystem services, ii) recent measures taken to report how businesses depend on and impact ecosystem services, iii) tools and models that companies can use to manage the business case for biodiversity and ecosystem services, and iv) current initiatives and actions (including examples) that have larger implications on communities and human well-being (TEEB, 2010a).

The TEEB report provides an in depth analysis of how business operations affect ecosystem services, while addressing methods to measure and report impacts (for example, the “SMART” approach—specific, measurable, achievable, relevant and time-bound) (TEEB, 2010a). Similar to the Millennium Ecosystem Assessment, this report stresses the importance of prioritizing the role of ecosystem services, making it a valuable source of information for conducting an ESR.

Local Perspective

2.1.3 The Environmental Goals and Sustainable Prosperity Act

In the spring of 2007 the government of Nova Scotia passed The Environmental Goals and Sustainable Prosperity Act (EGSPA). This act recognizes the critical link between the environment and the economy. It contains 21 aggressive goals and five economic building components: human, social, built, financial, and natural capitals (Annual Progress report, 2010). There are several key components that integrate the environment and the economy including:

- i) sustainable economic growth that recognizes the long term value of the Province’s environmental assets, ii) creating long term approaches to planning

and decision making that balance the Province's goals of economic prosperity and environmental sustainability, iii) managing the environment and economy in a way that benefits present and future generations (EGSPA, 2007, np)

Nova Scotia appears to have embraced the value of its natural resources and ecosystems and recognized that sustainable prosperity depends on those resources and services.

Private sector businesses play an essential role in ensuring the sustainable consumption of these resources, the integration of the environment and economy, and the prosperity of the province. The analysis section will show how businesses in Nova Scotia could use the corporate ecosystem services review methodology to meet these objectives and adhere to the goals of this act.

2.1.4 The Genuine Progress Index (GPI)

Nova Scotia has been a leading jurisdiction in the study of the application of the Genuine Progress Index (GPI). The Genuine Progress Index a full cost accounting method of measuring well-being and sustainable economic development. Full cost accounting is used to measure items that are not traditionally considered when evaluating GDP.

Examples include the value of civic and voluntary work, ecological footprint, and income and its distribution (GPIAtlantic, 2008). A local Maritime research organization,

GPIAtlantic, utilizes the index to report on specific issues relevant to the Atlantic region.

One particular report, The GPI Fisheries Account, states that what are economically measured is an indication of what we as societies value (Charles and Lavers, 1999).

More specifically,

[t]raditional measures, such as fishery revenues, exports, and employment rates are clearly relevant, but preoccupation of these measures has misled us in the past. By failing to include factors such as ecosystem health, fishery resilience, and resource

depreciation in traditional measurement, strict economic accounting has given these vital factors an implicit value of zero. (Charles and Lavers, 1999, pg. 6)

Charles and Lavers suggest that progress should be measured in a way that is economically viable; however, they also promote the importance of using natural resources and ecosystem services in a sustainable manner. Business in Nova Scotia have the capacity to accomplish both of these objectives, one way is by incorporating the value of ecosystem services.

2.1.5 Relevant GPI Atlantic Studies

Genuine Progress Index Atlantic has completed a number of studies that attempt to include the ecological costs and benefits associated with coastal ecosystems in Nova Scotia, two that have particular relevance to this thesis are entitled:

- 1) Fisheries and the marine environment in Nova Scotia: Searching for sustainability and resilience, and;
- 2) The GPI water quality accounts case study: The cost and benefits of sewage treatment and source control for Halifax harbour

These reports could be useful to a company that utilizes coastal ecosystem services, these reports provide explain the benefits and drawbacks of ecosystem services and link ecological benefits to the Nova Scotian economy.

In the first report, Charles et al. (2009) address the need for increased understanding of marine environments in Nova Scotia, in particular the; “ecological, socioeconomic, and institutional components and interactions between them” (pg. 3). The study focuses on the provision of food from coastal ecosystems, addressing the state of Nova Scotia’s capture fisheries. There are three ecological costs or impacts occurring

in Nova Scotia's fisheries. Firstly, fish stock indicators from the Genuine Progress Index display instability in biomass, natural capital, and fish condition (Charles et al., 2009). Secondly, there are threats to ecological resilience (the ability for a fishery or marine ecosystem to rebound from shocks back to its healthy state) occurring in Nova Scotia due to the method of "fishing down the food chain". Thirdly, several marine species *Salmo salar* (Atlantic Salmon), *Gadus morhua* (Atlantic Cod), *Eubalaena glacialis* (North Atlantic Right Whale) are at risk of being extirpated or extinct (Charles et al.). The report also concludes that fishery GDP is increasing, however, employment rates are decreasing. According to Charles et al. this indicates that fewer Nova Scotians are sharing the rising monetary output from the fishery sector. In relation to this thesis, these findings address unknown business dependencies on coastal ecosystem services. For example, a seafood company that relies on coastal ecosystems to provide an environment for Atlantic salmon could see a decrease in profits as Salmon stocks decline.

In the second report, several environmental and economic drawbacks are noted with respect to the coastal environment of the Halifax Harbour. There is extensive bacterial contamination and poor water quality in the Halifax and Dartmouth waterfronts; specifically in harbour beaches and shorelines. Contamination is a major concern to the marine environment because marine ecosystems provide essential nutrient cycling services such as cycling of carbon, nitrogen, oxygen, phosphorus, and sulfur (Wilson, 2000). Coastal ecosystems also decompose, transform, and detoxify waste matter from human activities, providing critical services that support business, recreational, and tourism activities (Peterson & Luchenco, 1997). These beneficial services can be disrupted by wastewater or sewage discharged into marine ecosystems. Discharge often

includes solids and other particulates, which prevent sunlight from reaching plant life below the surface waters (Holmes et al., 1999). Improving overall water quality could attract marine species back into the Halifax harbour, restoring ecosystems and benefiting the surrounding coastal communities.

2.2 Ecosystem Services

Defining ecosystem services ranges from broad scale “benefits of nature to households, communities, and economies” (Boyd and Banzhaf, 2007, p.1) to more specific, as “the capacity of natural processes and components to provide goods and services that satisfy human needs, directly or indirectly” (de Groot, Wilson, and Boumans, 2002, p.395). De Groot et al. (2002) classify ecosystem functions into four primary categories noted in the table 1 below.

Table 1. Definitions and Examples of Four Main Ecosystem Service Categories (de Groot et al., 2002)

Category	Function	Example
1) Regulation	<ul style="list-style-type: none"> - The capacity of natural and semi-natural ecosystems to regulate essential ecological processes and life support systems through bio geo-chemical cycles and other biospheric processes. - In addition to maintaining ecosystem health, these regulation functions provide direct benefits to 	<ul style="list-style-type: none"> - Clean air - Clean water - Soil - Carbon Storage
2) Habitat	<ul style="list-style-type: none"> - Natural ecosystems provide refuge and reproduction habitat to plants and animal species - Contribute to the conservation of biological and genetic diversity and evolutionary processes 	<ul style="list-style-type: none"> - Biodiversity - Food
3) Production	<ul style="list-style-type: none"> - Photosynthesis and nutrient uptake by autotrophs converts energy, carbon dioxide, water, and nutrients into a wide variety of carbohydrate structures - This function provides ecosystem goods for human consumption 	<ul style="list-style-type: none"> - Raw materials - Energy resources genetic material
4) Information	<ul style="list-style-type: none"> - Natural ecosystems contribute to the maintenance of human health - Providing opportunities for reflection, spiritual enrichment, cognitive development, recreation, and aesthetic experience 	<ul style="list-style-type: none"> - Recreation - Stewardship - Education

Additionally, Daily et al. (1997, pg. 2) states that ecosystem services are “a wide range of conditions and processes which through natural ecosystems sustain human society”.

These “biological under pinnings” are essential in maintaining biodiversity and economic activity, ecosystem services support life through:

- purification of air and water
- mitigation of droughts and floods

- generation and preservation of soils and renewal of their fertility
 - detoxification and decomposition of wastes
 - pollination of crops and natural vegetation
 - dispersal of seeds
 - cycling and movement of nutrients
 - control of the vast majority of potential agricultural pests
 - maintenance of biodiversity
 - protection of coastal shores from erosion by waves
 - protection from the sun's harmful ultraviolet rays
 - partial stabilization of climate
 - moderation of weather extremes and their impacts
 - provision of aesthetic beauty and intellectual stimulation that lift the human spirit
- (Daily et al., pg.2)

Failure to recognize these services and their contributions to economic activity could result in major consequences to communities and societies around the world.

2.3 Ecosystem Valuation

A number of approaches to valuing nature and ecosystems can be applied depending on the context of the study. According to De groot et al. (2002) the objective of creating ecological value is to ensure that the use of ecosystem goods and services are restricted to sustainable levels. In doing so, ecosystem functions should theoretically be continuously available. This section will begin by describing what ecosystem service valuations is, followed by outlining the natural capital accounting and market value methods of valuation. Furthermore, I will make conclusions regarding the applicability of these approaches for this ecosystems services review, or argue why a particular method is not practical.

Farber, Costanza, & Wilson (2002) define valuation as “the process of indicating a value for a particular action or object” (pg. 376). Ecosystem service valuation (ESV) specifically represents the process of expressing a value for ecosystem goods and services (eg. pollination, erosion control) (Farber et al., 2002). Costanza and Folke (1997) further

describes ESV as the process of assessing the contributions of ecosystem services to sustainable scale, fair distribution, and efficient allocation. In order to assess ecosystem services, they can be understood under two economic classifications: market goods and services such as gas or post secondary education and non-market goods and services; goods and services that do not have market value (people are willing to pay nothing or very little for them), air or clean water are examples (Costanza and Folke, 1997). This distinction is more formal in economic terms, yet critical, as it shows how ecosystem services that are not represented in the market are not fully represented.

One application of ESV is natural capital accounting. This method compares natural capital to physical and human capital, paying close attention to their contribution to human well-being (Liu et al., 2010). Liu et al. (2010) states that the challenge of attempting to account the value of natural capital is estimating multiple ecosystem service values at one time, making it expensive and time consuming.

Another economics based approach to ESV is using market prices to reflect the valuation of goods and services. Farber and Costanza (2002) illustrate market prices of ecosystem goods and services through the example of timber. The price of a board of timber reflects what a board foot is worth to a buyer at the margin (the equilibrium between price and quantity set by the market). It does not reflect the whole value of all timber used by the buyers, because there are some buyers that are likely willing to pay more for a board foot of timber. These buyers will be netting a surplus and therefore the total value of the timber sold in the market is not reflected in the market price. Here Farber et al. (2002) recognize that “the timber only reflects a portion of the full social value of the tree, which provides a variety of services such as soil stabilization, water

storage, flood control, and habitat for many species” (pg.388). In this example, Farber et al. (2002) demonstrate that in most cases, market prices for ecological services fail to reflect their total value.

If this study were placing monetary value on ecosystem services from an economic theory perspective, the approaches suggested above could be applied. Lui et al. (2010) indicate that natural capital accounting requires overlap or additional inputs from benefit transfer, making it a costly and time-consuming approach. The market value approach would be useful in a study with a larger scope that concentrates on a specific resource with available economic data. This thesis seeks to show that there are alternative approaches to valuing ecosystem services. It will assess whether or not the corporate ecosystem services review could be performed and understood by businesses in Nova Scotia, it will show how the ESR approach is a practical way to value ecosystem services in order to align businesses with the goals of The Environmental Goals and Sustainable Prosperity Act.

2.3.1 Most Recent Approach- A Guide to Corporate Ecosystem Valuation

This paper specifically focuses on the Corporate Ecosystem Services Review, however during the writing of this thesis WBCSD and its partners released the most recent framework for valuating ecosystem services: “A Guide to Corporate Ecosystem Services Valuation (CEV)”. This report was unveiled in April 2011, three years following the release of the Corporate Ecosystem Services Review. The CEV builds on the foundations of the ESR and provides businesses with a framework to increase the value of ecosystems

in the corporate decision-making process using qualitative and quantitative approaches.

The four generic applications of the CEV framework are:

- 1) trade-off analysis, 2) total valuation, 3) distributional analysis, and, 4) sustainable financing and compensation analysis (WBSCD Guide, 2011, pg. 60)

The CEV suggests carrying out a Corporate Ecosystem Services Review as a screening tool before undergoing a full Corporate Ecosystem Valuation (WBSCD Guide, 2011).

The release of this advanced framework indicates an increase in demand for more complex methods of valuating ecosystems in relation to business. WBSCD has recognized this demand and created an additional tool for businesses to prioritize ecosystem services.

2.3.2 Challenges to Ecosystem Service Valuation

The Economics of Ecosystems and Biodiversity report (2010) states that valuing ecosystems and biodiversity poses restrictions, uncertainties, and many complexities.

These issues are a reoccurring theme in ecosystem service literature and measuring ecological services has proven to be somewhat of a challenge. Daily (1997) states that although we recognize the importance of ecosystem services for human well-being, it appears that the role of ecosystems and their services are not yet fully understood and are inadequately monitored. This is in part due to fairly limited amount information concerning the status of ecosystems and the rate of their degradation and depletion (Daily et al., 2000).

There are also challenges faced when trying to the measure the “value” humans direct toward ecosystem services. The ability to recognize and capture value in

ecosystem services, landscapes or a particular species is increasingly difficult when entire societies or communities are involved (TEEB, 2010b). This applies specifically to estimating or monetarily assessing cultural ecosystem services. Cultural value can be particularly arduous to measure, it is also not clear that placing monetary value is even an effective measure. TEEB addresses this issue using national parks as an example. National parks or protected areas have historically been established in response to a “sense of collective heritage or patrimony” (pg. 13). These areas provide inherent cultural or social value to the users and surrounding community, as such; these areas remain protected without the need to place monetary value on the cultural ecosystem services provided. In situations where ecosystem services or biodiversity are widely accepted it could be counterproductive to attempt monetary valuation, as an alternative, it may be more effective to enforce protective legislation or voluntary agreements (TEEB, 2010b). When ecosystem services are valued as cultural norms there are alternative measures to preserve or protect ecosystem services. To address this issue, Barbier and Heal (2006) found that taking an interdisciplinary approach to value ecosystem services is an effective method. In this approach, economists work with ecologists or social science experts to form an “integrated ecological-economic system” (pg.5). According to Barbier and Heal (2006) this method provides an opportunity to influence environmental decision-making. Integrating natural and social sciences provides a better understanding of ecosystem functions and ecosystem services, and the ability to measure the benefits of both.

Lastly, assessing the value of ecosystems requires valuating tradeoffs. Carpenter et al. (2009) state that measuring tradeoffs is increasingly difficult in today’s society

because resources are constrained; consumption of one ecosystem service often leads to reduction in another. Additionally, when ecosystem services and natural ecosystems are not formally traded in economic markets, their value is highly underestimated and often externalized (Daily et al., 1997). Decision makers then have no clear indication of the value of ecosystem services. For example, when a mangrove is converted into a human dominated system, such as a shrimp aquaculture operation, the ecosystem goods and services that the mangrove could have provided are lost to a more economically viable alternative. Failure to place value on the functions of nature that contribute to human sustainability jeopardizes the overall sustainability of natural ecosystems. When this value is not addressed, Daily et al. (1997) suggest that society will drastically alter the planet's remaining natural ecosystems. In order to avoid this, the challenging task of ecosystem service valuation requires a careful selection and creative application of different methodologies depending what the desired outcomes are (TEEB, 2010b). When this is accomplished, overall environmental health is maximized and decisions can be made that reflect the proper value of ecosystem services to society.

Conclusion

The review of literature has unveiled information that is currently known about ecosystem services on a global and local level. This section has also provided information about valuating ecosystem services and the challenges that are faced when attempting to do so. In summary, there are gaps in the existing literature. It seems that monetarily assessing ecosystem services limits the ability to encompass all economic, social, and environmental factors. This prompts us to question our current methods of measuring ecosystems and challenges us to explore new ways that address economic,

social, and environmental factors while avoiding bias. Bias can be avoided by including economic or environmental improvements in the literature (for example, we see that through environmental resource management plans and other environmental initiatives it is possible for businesses to have environmental and economic success). The proceeding sections will explore these issues by analyzing the Corporate Ecosystem Services Review and its applicability to businesses in the fisheries sector.

3.0 Methodology

A qualitative approach is used to explore the mentioned research objectives of the study. Qualitative research focuses on obtaining meaning from the data that has been collected, with an emphasis on words and text, compared to numbers and statistical analysis found in quantitative approaches (Hesse-Biber & Leavy, 2011). This thesis adapts the case study approach for gathering information. Yin (1984) suggests this strategy for answering questions of “how” or “why” something is done, particularly when real life circumstances such as business reliance on ecosystem services are being examined. This paper will follow the instrumental case study type. Instrumental case studies aim to “generalize or provide insight into a larger topic” (Hesse-Biber & Leavy, 2011, pg. 258). In this thesis I provide the reader (business leaders, academics, government, students, and advocates) with a case study and research insights on the broad topic of ecosystem services valuation, I also argue how these topics interrelate businesses with the intent of Nova Scotia’s environmental legislation. Key word searches could include: the corporate ecosystem services review, ecosystem valuation, sustainable business, or coastal ecosystem services.

A broad array of literature was consulted for the literature review and case study, such as the WBCSD's corporate ecosystem services review document, MA, TEEB, Nova Scotia's State of the Coast Report, Atlantic Genuine Progress Index reports, other government documents, and academic journals. The case study attempts to identify problems, sources of problems, or solutions, relevant to the goals of the paper. Because the literature surrounding this topic covers a wide range of themes, and case studies often require massive amounts of qualitative data, it was an aim to limit information to the scope and objectives of the thesis. Ideally, the case study approach will formulate ideas that could inform readers on issues of ecosystem services relevant to business operations and legislation in Nova Scotia (Hesse-Biber and Leavy, 2011).

3.1 Steps

Hesse-Biber and Leavy (2011) provide a concise approach to case study interpretation.

In their simplest form, the steps are as follows: i) collect data (from the mentioned sources), ii) perform analysis to understand what the literature is saying and how it is relevant to the research goals, iii) validate the information and present it in a comprehensive manner to the reader (Hesse-Biber and Leavy, 2011). The analysis section will contribute a focused assessment of the ESR and how it could be used by a Nova Scotian business that relies on coastal ecosystem services. The analysis will identify several coastal ecosystem services, outline threats to these services, and explain possible business implications. Lastly, the discussion section will address environment and economy in Nova Scotia, highlighting strategies that incorporate environment and economy by preserving ecosystem services.

3.2 Limitations

Due to time and resource constraints, this thesis is limited to a literature review and case study; this information is secondary research. Conclusions will be based on the analysis of existing literature. Utilizing a variety of information sources will help to fill the relevant gaps in the literature on corporate ecosystem services valuation for businesses in Nova Scotia.

3.3 Delimitations

Due to the expectations of an undergraduate thesis and the length of this study, the analysis will be limited to the three objectives of the paper. This thesis will touch on coastal ecosystems, but it is not intended to be an exhaustive account of all ecosystem services associated with coastal environments, nor does this paper aim to conduct a full corporate ecosystem services review on coastal ecosystem services. Coastal ecosystem services will simply be used to provide an example that is applicable to Nova Scotia, or to better explain an argument throughout the paper. However, this thesis does hope to provide a relative case example for natural resource companies that depend on ecosystem services in Nova Scotia.

4.0 Analysis

4.1 The Corporate Ecosystem Services Review

Overview

The World Business Council for Sustainable Development and its partners have developed an alternative approach to ecosystem services valuation for businesses. The ESR is meant to act as a guide for enterprises, its main purpose is to connect the

implications of business dependence and impact on ecosystem services. Hanson et al. (2008) state that there may be better approaches for addressing traditional issues of pollution and resource depletion but these methods typically focus on business risks instead of potential business opportunities. One additional feature that makes the ESR approach comprehensive and effective is a structured methodology and simple design, which can be tailored to specific processes (Hanson et al., 2008). As legislation and consumer purchasing patterns change, many companies of varying sizes and capacities may recognize that conducting a study that values ecosystem services could result in profitable business decisions. Fortunately, the ESR method offers managers and environmental teams within companies a comprehensive method for identifying ecosystem services that they depend on and impact, while developing business strategies to manage risks and opportunities.

The ESR provides a number of business benefits in its approach to ecosystem valuation:

(1) identifying new business risks and opportunities, as well as framing and giving added urgency to risks and opportunities, (2) anticipating new markets and influencing government policies, (3) strengthening existing approaches to environmental management, (4) improving stakeholder relationships, and (5) demonstrating leadership in corporate sustainability. (Hanson et al., 2008, pg. 8)

The ESR also provides resources to managers to assist in completing the review and ultimately recognizing the aforementioned benefits. These resources include:

- A complete list of ecosystem services, definitions, and examples
- Questionnaire and spreadsheet that assesses corporate dependence and impact on ecosystem services

- An extensive list and case examples of business risks and opportunities that might arise from trends in ecosystem services
- A framework to guide the development of strategies for addressing the risks and opportunities
- Suggested data sources and case studies
(Hanson et al., 2008, pg. 10)

Steps

Corporate Ecosystem Services Review: Summary of Methodology					
Step	1. Select the scope	2. Identify priority ecosystem services	3. Analyze trends in priority services	4. Identify business risks and opportunities	5. Develop strategies
Activity	Choose boundary within which to conduct the ESR (a specific business unit, product, market, landholdings, major customer, supplier, etc.)	Systematically evaluate degree of company's dependence and impact on more than 20 ecosystem services. Determine highest "priority" ecosystem services—those most relevant to business performance	Research and evaluate conditions and trends in the priority ecosystem services, as well as the drivers of these trends	Identify and evaluate business risks and opportunities that might arise due to the trends in priority ecosystem services	Outline and prioritize strategies for managing the risks and opportunities

Figure 0. Overview of ESR Methodology by, Hanson et al. (2008).

In the first step of the ESR, the scope of the study is identified. This sets the boundary of the study by addressing the most productive way of evaluating ecosystem services. The person conducting the study will consider the following two questions: (1) at what stage of the value chain will the study be conducted? (2) what will be studied and where will the study be conducted? (Hanson et al., 2008). In many cases, companies have multiple markets, product lines, or facilities; these questions narrow the scope to make the review more manageable.

The second step aims to identify priority ecosystem services. The ESR report suggests attempting to identify fifteen ecosystem services that the company impacts and/or depends on. The person conducting the study should then consider whether or not the ecosystem services are a source of business risk or opportunity. For example, if a

company impacts an ecosystem service by depleting it, the company's action could pose regulatory, legal, or reputational risks (Hanson et al., 2008). The following two questions are considered when evaluating a company's dependence: (1) do the ecosystem services serve as an input or do they enhance conditions for successful business performance? (2) if "yes" is answered to question one, then does this ecosystem service have cost-effective substitutes? (Hanson et al.). Once the ecosystem services are identified, they should be prioritized in terms of how influential they are to business risk and opportunity. Generally two or three priority ecosystem services are chosen and carried out for the rest of the evaluation.

The third step of the methodology is to analyze trends in the priority ecosystem services. Here, a series of questions are asked according to the matrix noted in Table 2.

Using the dependence matrix, the fourth step of the study recognizes implications for the company based on the trends in the priority ecosystem services. Possible implications include: operational, regulatory and legal, reputational, market and financial. The priority ecosystem services identified in step three are then considered under these five themes, assessing both the risks and opportunities.

In the final phase of the study business strategies are developed to address the risks and opportunities discovered in step four. The strategies should aim to minimize risk and maximize business opportunity. Strategies could include: internal changes, sector or stakeholder engagement, or policy-maker engagement (Hanson et al., 2008).

Table 2: Ecosystem Service Dependence and Impact Matrix, from WBCSD ESR Report (Hanson et al., 2008).

1		ECOSYSTEM SERVICES DEPENDENCE AND IMPACT MATRIX									
2											
3		Key									
4		• High		+ Positive impact							
5		○ Medium		- Negative impact							
6		Low		? Don't know							
7		Suppliers			Company operations				Customers		
8		Ecosystem services		Dependence	Impact	Dependence	Impact	Dependence	Impact		
9		Provisioning									
10	Crops										
11	Livestock										
12	Capture fisheries										
13	Aquaculture										
14	Wild foods										
15	Timber and other wood fibers										
16	Fibers and resins										
17	Animal skins										
18	Sand										
19	Ornamental resources										
20	Biomass fuel										
21	Freshwater										
22	Genetic resources										
23	Biochemicals, natural medicines, and pharmaceuticals										

4.2 A Preliminary Corporate Ecosystem Services Review

Oceans are geographically complex and contain a diverse and large quantity of organisms, as such; the marine environment provides an array of ecosystem services (Worm et al., 2006). Globally, a large and increasing portion of the population lives close to the coast, in Nova Scotia 70% of the population lives on 13 300 kilometers of coastline (Our Coast, 2009).

As previously mentioned, in Nova Scotia communities rely on the coast, businesses in particular depend on coastal ecosystem services for the production and manufacturing of goods as well as the disposal and assimilation of waste. It was mentioned in the introduction that companies such as Acadian Seaplants Limited have investigated the use of sustainable resource management as a



Figure 0 *Ascophyllum nodosum*

practice to reduce consumption and impact on coastal environments. The ESR method for valuating ecosystem services could offer companies like ASL a new perspective on ecosystem services and illustrate potential business risks and opportunities. The following section will demonstrate the application of the corporate ecosystem services review, showing how a company like Acadian Seaplants could benefit from the outcomes. A full ESR assessment requires specific corporate operational and financial information that will not be addressed here. However, I will attempt to reveal coastal ecosystem services, impact and dependence on these ecosystem services, and recommend potential business strategies that could be implemented to ensure that ecosystem services are considered part of the business decision making process.

Step 1: Scope

Questions to consider: What stage of the value chain? Who and where? Is the scope strategic, specific and supported?

This preliminary review will focus on the ‘company’ stage of the value chain. Acadian Seaplants has three main product lines: products for humans, plants, and animals. This review will look Acadian Seaplants Limited plant product division, in particular their Kelp Meal products. All of ASL’s plant science products are derived from, or have active compounds from, *Ascophyllum nodosum* (Rockweed). Rockweed grows in Nova Scotia’s coastal environment; growth extends from the Arctic Circle to New Jersey in a wide range of wave exposures on substrate (Ugarte and Sharp, 2001). The local processing plant for these seaweed products is located in Cornwallis, Nova Scotia. It is not known if the scope of this review is timely for specific business decisions; however,

the plant division at ASL represents a large portion of their company products so it is assumed that this study could be useful for future business decisions.

Step 2: Identifying Priority Ecosystem Services

A full ecosystem services impact and dependence matrix was completed for Acadian Seaplant’s plant derived products, see Appendix B. Below, are a summary of the results:

Table 2. Ecosystem Services Dependence and Impact Matrix, by Blok (2011).

ECOSYSTEM SERVICES DEPENDENCE AND IMPACT MATRIX			
Acadian Seaplants Limited: Plant Division Summary Analysis			
Key			
● High	+ Positive impact		
○ Medium	- Negative impact		
Low	? Don't know		
		Company Operations	
Ecosystem services		Dependence	Impact
Provisioning			
Food	Crops	●	● -
	Livestock		
	Capture fisheries	●	● +/-
	Aquaculture		● +/-
	Wild foods		
Raw materials	Timber and other wood fibers		
	Fibers and resins		
	Animal skins		
	Sand		● +/-
	Ornamental resources		
	Biomass fuel		● +
	Freshwater	●	● -
	Genetic resources	●	○ +
Regulating			
	Maintenance of air quality	●	● -
	Global climate regulation		? ?
	Regional/local climate regulation		? +/-
	Regulation of water timing and flows	●	● +/-
	Erosion control	●	● -
	Water purification and waste treatment	●	● +/-
	Disease mitigation		
	Maintenance of soil quality		
	Pest mitigation		
	Pollination		
	Natural hazard mitigation	●	● -
Cultural			
	Recreation and ecotourism	●	● +/-
	Ethical and spiritual values	●	● +/-
	Educational and inspirational values	●	○ +
Supporting			
	Habitat	●	○ +

Step 3: Analysis of Trends in Priority Ecosystem Services

Based on the assessment in step two, the following are identified as priority ecosystem services:

- *Capture fisheries:* Rockweed has an important role in the Fundy ecosystem, providing habitat for the prey of waterfowl and at least 22 species of fish several of commercial importance (Hamilton, 1997).
- *Freshwater:* required for laboratory, facility, and employee use.
- *Water purification and treatment:* coastal environments play a vital role in waste detoxification and filtration, and the decomposition of organic wastes and waste water for businesses and residents near coastal zones (Adger et al., 2005).
- *Recreation and Eco-tourism:* the coastal environment in Nova Scotia is important for the tourism and eco-tourism sectors of the economy.
- *Regulation of water timing and flows:* ASL depends on the regulation of coastal waters to harvest Rockweed.
- *Erosion Control:* poor facility operation near the coastline could impact erosion control.

Direct Drivers: Natural or man-made drivers that cause changes in an ecosystem and its ability to supply ecosystem services (Hanson et al., 2008).

The State of Nova Scotia's Coast Report (entitled "Our Coast") (2009) outlines threats toward coastal ecosystems and how water quality is affected. Examples of direct drivers that could impact operations at Acadian Seaplants include land and marine based activities.

Land based activities such as municipal discharge from wastewater treatment plants, industrial discharge, seepage pollutants from agricultural activities all impact coastal ecosystems (Our Coast, 2009). Land use such as housing developments near coastal areas also cause contamination; inadequate residential septic systems leech contaminants, sewage, and nutrients into coastal waters. Excess nutrient release can cause algal blooms in coastal waters, these blooms lower the oxygen content of the water, threatening marine organisms (Our Coast, 2009).

Marine based activities that affect coastal ecosystems and water quality include dredging and ocean dumping, wharfs and coastal structures, aquaculture and fishing, ballast water discharge from ships, shipyard activity, and activities by the off shore energy industry (Our Coast, 2009).

When conducting a full ecosystem services review indirect drivers would also be identified, additionally, ASL's contribution to direct and indirect drivers would be noted.

Step 4: Identify Business Risks and Opportunities

Table 4. Examples of Risks and Opportunities Arising from ASL Priority Ecosystem Services, by Blok (2011), adapted from Hanson et al. (2008).

Type	Risk	Opportunity
Operational	<ul style="list-style-type: none"> ▪ Impact to business operation ▪ Reduced extraction or output of Rockweed 	<ul style="list-style-type: none"> ▪ Increased efficiency- for example, investment in a cooling system could reduce freshwater consumption in Seaweed processing facilities
Regulatory and Legal	<ul style="list-style-type: none"> ▪ Possible taxes or fees imposed on for over harvesting in future (inability to meet new quota regulations or policies) ▪ Potential lawsuits ▪ Rockweed harvesting permit suspension or denial for new 	<ul style="list-style-type: none"> ▪ Ability to avoid potential taxes or fees arising from new quotas ▪ Opportunity to influence or help shape new public policies ▪ Formal license to expand

	permits	operations
Reputational	<ul style="list-style-type: none"> ▪ Damage to brand image for misuse of coastal environment or over harvesting 	<ul style="list-style-type: none"> ▪ Ability to appeal to the conscious consumer ▪ Improved brand image, possibility to win additional environmental awards
Market and Product	<ul style="list-style-type: none"> ▪ Changes in consumer preferences locally and internationally (ASL sells their plant products to consumers around the world, different locations have varying levels of environmental awareness of consideration) 	<ul style="list-style-type: none"> ▪ Potential to develop new products or services ▪ New revenue streams ▪ New certifications for existing Seaweed products
Financing	<ul style="list-style-type: none"> ▪ Higher cost of capital investment (into new technology) 	<ul style="list-style-type: none"> ▪ Appeal to investors who require corporate social responsibility

Step 5: Possible Business Strategies in Response to Risks and Opportunities

If conducting a full ecosystems services review, the manager would extensively evaluate the trends in priority ecosystem services at this phase and develop strategies to avoid economic loss from a company's impact or dependence on ecosystem services. Here I will provide several suggestions that a company like Acadian Seaplants could implement, this stage will show the final application of the ESR.

Acadian Seaplants could prepare for new government quota policies that reduce harvesting quotas. Alternatively, the company could participate in the development of new public policies that address coastal ecosystems. More specifically, a harvesting company could help develop a new policy that offers incentives to harvesters who implement improved operational practices (lowering bycatch, for example). According to Hall (1996) one of the challenges that fisheries managers face is to assess the ecological impacts of different fisheries in order to understand proposed alternatives and implement

management plans based on the alternatives. When best practice operators are rewarded (by lower taxes, subsidies, or lower fees) and the operators who fail to meet established standards are punished, the overall operation standard of the harvesting fishery is raised (Hall, 1996).

Possible outcomes of the trends in priority ecosystem services could be useful in strengthening Acadian Seaplants sustainable resource management plan. One approach in particular that reduces threats to biodiversity and ecosystems is to minimize bycatch. Bycatches, or “unwanted species or individuals caught during fishing operations” are inconvenient, reduce income, and can endanger fishers (Hall, 1996, pg. 321). Bycatch management strategies have a number of biological goals such as: avoiding species extinction and retaining the structure and function of ecosystems (Hall, 1996). Management strategies are also critical in ensuring optimal harvesting levels and the sustainable use of coastal ecosystems. When this is achieved, harvesters can operate competitively. Hall also states that when an unpopular bycatch (Cod for example) affects the marketing of a product, managers should institute programs that specifically reduce those bycatches. One way to do accomplish this is by making technological advances in fishing gear, operation procedures, and materials (Hall).

Another approach to minimizing business risk and maximizing opportunity is to increase employee training that includes aspects of ecosystem, environment, and policy awareness. This type of management is effective for three reasons; it prevents negative environmental impacts, responds to consumer demand, and improves corporate image (Morrow & Rondinelli, 2002). A company in the fisheries sector could increase their

bycatch training, Hall (1996) suggests that teaching captains and crews the correct use of harvesting devices and procedures can greatly reduce bycatch.

Land-based operations such as ASL's processing and research facility could develop new reporting methods to track the pollutants and contamination in wastewater that is discharged into coastal waters. They could also increase efforts to ensure their operations mitigate the highest amount of contaminants. This places less reliance on detoxification and purification ecosystem services.

Additionally, Acadian Seaplants could benefit from identifying stakeholders in Nova Scotia that could assist them in maintaining or enhancing ecosystem services. These might include: coastal resource users including boaters and recreational fishers, municipal planners, researchers, NGO's such as the Atlantic Coastal Action Program, and conservationists such as the Nature Trust and Nature Conservancy, as well as the federal and provincial Department of Fisheries.

Summary

The qualitative nature of the ESR methodology provides a comprehensive method for businesses to evaluate ecosystem services and create strategies to effectively manage future risks and opportunities. The analysis of the ESR methodology aimed to demonstrate the applicability and potential for a case study in Nova Scotia using Acadian Seaplants as a case example. I have highlighted coastal ecosystem services, trends in ecosystem services, risks and opportunities associated with five aspects of corporate performance, and provided potential business strategies that could improve ASL's economic and environmental performance.

It should be noted that the corporate ecosystem services review does not provide quantitative or economic measurement of a company's dependence or impact on ecosystem services (Hanson et al., 2008); in fact, the ESR strives to accomplish the opposite. Hanson et al. state that "making internal operational changes, launching new products, or working with government to develop new policies does not require economic evaluation" (pg. 10). The ESR is focused on mitigating risk and capitalizing on ecosystem service opportunities, this goal provides the critical link between environmental dependence and business success.

5.0 Discussion

5.1.1 Resource and Ecosystem Decline

In order for businesses to consider the important role that ecosystem services play in supporting the natural environment, changes in resource availability should be recognized. In Atlantic Canada, resource and ecosystem depletion is a major concern. Eaton and Eaton (2007) suggest that many Atlantic Canadians rely on the long-term sustainability of resources such as the forestry and fisheries sectors for their sources of income. For example, the collapse of the cod fishery in 1992 depicted a clear misuse of ecosystems, and the resulting effects negatively impacted businesses operating within the fisheries sector. This posed threats to both the local economy and the environment, two issues that are considered integral to Nova Scotia's development.

We are also familiar with rapid closures another sector of the fisheries industry. Shellfish, or filter feeding organisms such as oysters, mussels, and soft shell clams feed by filtering water that washes over shellfish beds, because of this feeding mechanism chemicals and bacteria can be assimilated into their tissues when their surrounding waters

are polluted (Environment Canada, 2009). When the coastal environments that support shellfish are contaminated by natural causes, land-based agriculture, or municipal run-off they are closed to harvesting (Charles et al., 2008). There were 278 shellfish closures operating on 3,314 km of the coastline in 2000 (Our Coast, 2009). Closures also directly affect the productivity of the shellfishery sector as a whole. According to Charles et al. (2008, pg. 29) the “loss of market, recreational opportunities, and subsistence harvests create serious negative impacts and costs to coastal communities and local economies”, closures are also indicate the state of marine quality.

In an effort to uphold marine quality and monitor water contamination in shellfish growing areas, Environment Canada has implemented a marine water quality program. The Canadian Shellfish Sanitation Program aims to:

[i]dentify safe shellfish, monitor water quality, identify point and non-point source pollution (municipal sewage, industrial waste, and agricultural run off) in the immediate area that would impact shellfish areas (Environment Canada, 2009, n.p.).

This program provides a critical link between marine health and the provision of shellfish as food. This link directly benefits local economies in Atlantic Canada, especially areas where shellfish harvesting provides financial benefits to coastal communities.

Businesses operating in the fisheries sector should give higher prioritization to ecosystem services in order to sustain their operation in a way that benefits both the company and the local economy. Companies that depend on natural resources and ecosystem services play an important role in a province’s development. In fact, resource

and ecosystem decline negatively affects the operation and profitability of all parties involved. If ecosystem services such as food from marine ecosystems, or clean air and oceanic water suddenly become unavailable, there could be lasting effects on business functions, local communities, and the economy.

5.1.2 The Business Case for Ecosystem Services Prioritization

Businesses are often confronted with barriers that prevent them from exploring ways to improve their negative impact on the environment. Barriers could include ignorance or refusal to address these concerns, however; for many business owners or managers, the decision to improve their environmental conduct comes down to cost efficiency. Eaton and Eaton (2007) suggest that the fear of unknown costs with regard to increasing environmental concern could be a major determinant in preventing businesses from moving towards sustainability. Cost, especially those with a relatively short payback period is a major concern for businesses; however, Young (2001) identifies additional barriers to prioritizing sustainability:

- lack of relevant information;
- additional training required;
- limited managerial expertise;
- lack of resources to build networks
- short term economic outlook;
- difficulty obtaining financing; and
- time consuming regulatory requirements
-

When businesses recognize these barriers and develop strategies to manage them they could see cost savings, additionally, their efforts will benefit the environment as well.

Not surprisingly, Eaton and Eaton (2007) state that moving towards sustainability in business has eventual financial benefits. Businesses can reduce their expenditure in energy, waste, and resources. Many have also increased their profits by capitalizing on

new or different opportunities, identifying new markets, appealing to consumer concerns, and improving their competitiveness (Eaton & Eaton, 2007).

The WBCSD Business and Biodiversity report offers seven critical business opportunities resulting from utilizing biodiversity in a sustainable way. They are summarized below in table 2:

Table 3. Opportunities for Sustainable Businesses. Source: Chennell, Elleboode-Zwaans, and Fry (2004). WBCSD Business and Biodiversity.

Business Opportunity	
1. Secures “license to operate”	<ul style="list-style-type: none"> ▪ Governments can use their leverage to increase permit costs to businesses that don’t conform to societal norms
2. Strengthen the corporate supply chain	<ul style="list-style-type: none"> ▪ Avoiding environmentally destructive procurement of raw materials improves a company’s access to reliable resources. This can increase exponentially as more firms demand that suppliers “go beyond compliance”
3. Improves stakeholder relationships	<ul style="list-style-type: none"> ▪ Biodiversity and ecosystem consideration sends a positive message to stakeholders ▪ The public and government officials will more understanding of firms who have made efforts to consider these environmental issues
4. Appeals to ethical consumers	<ul style="list-style-type: none"> ▪ Consumers demonstrate a preference for goods and services that are supplied by firms that have strong environmental considerations ▪ Benefits include: increased market share, customer loyalty, capturing a premium price over competing products
5. Ensures sustainable growth	<ul style="list-style-type: none"> ▪ Attention to conservation can lead to new resources and improved efficiency; this can lead to beneficial relations with customers, employees, and non profit organizations.
6. Attracts socially responsible investors	<ul style="list-style-type: none"> ▪ Possibility to access improved capital from investors who prefer socially responsible companies
7. Improves employee productivity	<ul style="list-style-type: none"> ▪ Employees prefer to work for firms with outstanding reputations, these employees provide the highest quality and productivity

	in their work
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Businesses face significant barriers to improving positive environmental performance and are faced with even greater challenges when valuing ecosystem services and biodiversity. However, there are potential financial rewards associated with these activities as well. As consumers increasingly purchase items based on more than just price, businesses will be forced to find innovative ways to offer products and services that are environmentally responsible and avoid impact to resources in order to stay competitive.

5.1.3 Incorporation of Environment and Economy

The Nova Scotia Environmental Goals and Sustainable Prosperity Act was designed to encompass two issues that face the province: the environment and the economy. As mentioned in the introduction, “the long-term objective of the act is to integrate environmental sustainability and economic prosperity” (Lane, 2010, pg. 1). The act includes overarching goals and targets, however what is seemingly more important than the targets is the intent of the act and how businesses play a critical role in achieving the integration of the environment and economy.

In 1995 the Environment Act was released to “reform the environmental laws of the province and to encourage and promote the protection, enhancement, and prudent use of the environment” (Environment Act, 1995, n.p.). The goals of this act promote sustainable development and the protection of ecosystems, human health, and socio-economic well being (Environment Act, 1995). A more recent example relevant to businesses in Nova Scotia occurred in April of 2010 when the province issued a bill to create a voluntary carbon offset fund. The intent is for businesses, organizations and

people to purchase emissions credits from the fund to offset their own greenhouse gas emissions (Environment Canada, 2010). Currently, the government is developing the provinces coastal management strategy to be applied within Nova Scotia's framework policies for economic and social development (Our Coast, 2009).

Altogether, EGSPA was designed, in part, to ensure the integration of environment and economy; businesses in Nova Scotia hold some responsibility in achieving this intent. Businesses can accomplish this integration by considering the costs and benefits associated with the goals and targets of these acts (Côté, 2010). The Corporate Ecosystem Services Review provides a technique to measure business dependence and impact associated with ecosystem services, this framework could be a useful tool for businesses to align themselves with the targets and intent of the Environmental Goals and Sustainable Prosperity Act.

6.0 Conclusion

This thesis has evaluated the connection between ecosystem services and how they relate to businesses. Evidence from global studies (TEEB and MA) suggests that ecosystem degradation is a concern to populations around the world. In Nova Scotia, GPI reports and the implementation of the Environmental Goals and Sustainable Prosperity Act confirm that Atlantic Canadians should consider how threats to environment, ecosystems, and ecosystem services will impact communities, businesses and the long term sustainability of natural resources. The review of literature also indicated that the process of valuing ecosystem services is challenging and ecosystem services are often misunderstood or ignored in the business decision making process.

It was an objective of this study to show that ecosystem services should be given higher priority by businesses in Nova Scotia. With respect to coastal ecosystem services, the literature revealed that Nova Scotia's coastal environment is at risk. Pollution and contamination, coastal land use, and loss of marine biodiversity all threaten the coast's ability to provide ecosystem services that Nova Scotians depend on for business functions, recreation, tourism and fishery uses. Decline of these services could result in economic losses to coastal communities, the businesses that operate in these regions, and to the province altogether. For these reasons, increased prioritization of ecosystem services in the decision making process is a preliminary yet effective approach to manage or avoid these threats.

This thesis evaluated the applicability of the Corporate Ecosystem Services Review as a method for businesses to address their dependence and impact on coastal ecosystems. Using Acadian Seaplants Limited as a case example, it was demonstrated that the ESR method provides a comprehensive tool for businesses in all sectors of the economy to evaluate the ecosystem services which they depend on, and the trends and divers of priority ecosystem services. Once these are identified, companies can then formulate business strategies to ensure that ecosystem services and resources are managed in a sustainable fashion, profitable business opportunities are not overlooked, and potential business risks are mitigated.

The application of the Corporate Ecosystem Services Review is particularly relevant in Nova Scotia due to the regions progressive vision to demonstrate the integration of environment and economy. This connection is encompassed in The Environmental Goals and Sustainable Prosperity Act, however, there is no existing

framework encouraged by the government or used by businesses that measures potential opportunities associated with the integration of environment and economy. There are even fewer frameworks that highlight the potential for monetary benefits. This thesis has attempted to demonstrate how the application of the Corporate Ecosystem Services Review could benefit businesses in Nova Scotia by evaluating ecosystem services. The results of the Acadian Seaplants case study indicate that the ESR method for integrating the environment and economy is feasible, and in many cases, profitable.

In order to solidify these suggestions, further research is needed to document ecosystem services which companies rely on. Furthermore, complete reviews should be conducted in various sectors of the economy to ensure that this technique is in fact useful in ensuring the integration of environment and economy.

Finally, this thesis has revealed that ecosystem services have been overlooked by many businesses in Nova Scotia, regardless of the fact that ecosystems provide known benefits to business operation and financial success. Though assessing the contributions of nature to businesses presents a number of complex challenges and tradeoffs, the role and value of ecosystem services should be considered fundamental in the business decision-making process. When this is achieved, Nova Scotia can progress in the integration of environment and economy and move forward in direction of sustainable prosperity.

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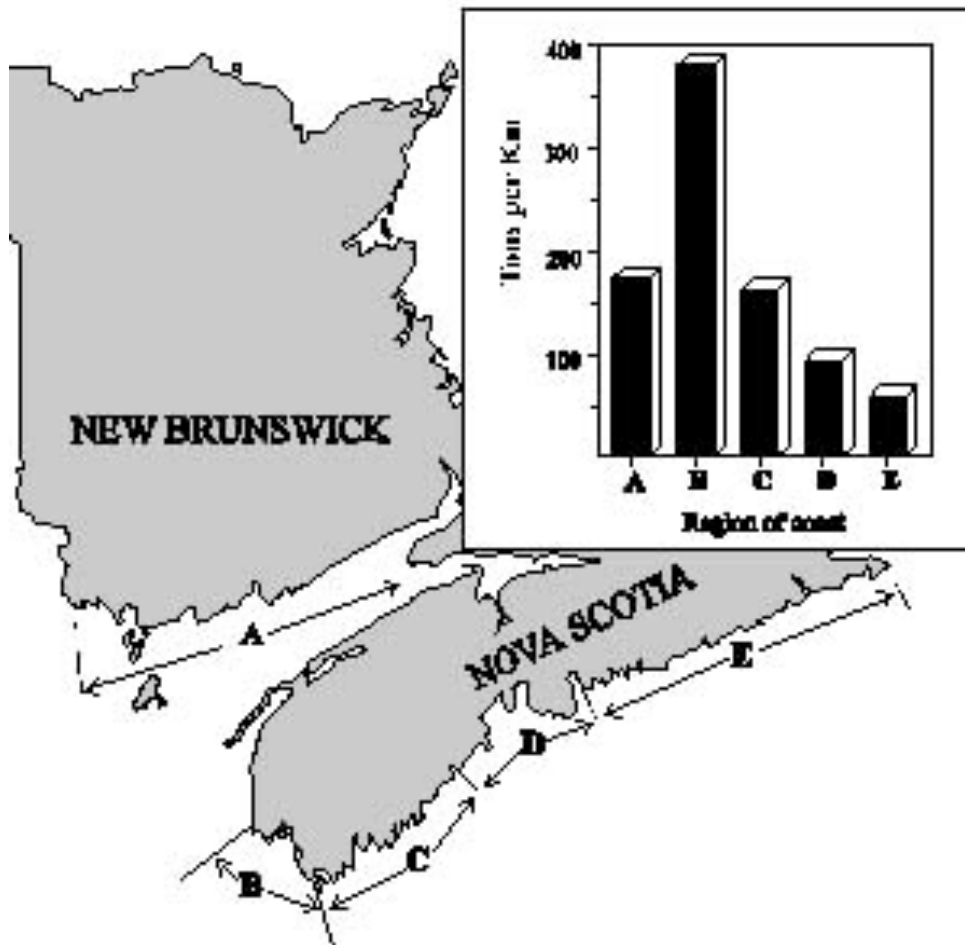
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7.0 Appendix

Appendix A: Map displaying Ascophyllum nodosum harvesting areas and amounts (tons) in Nova Scotia and New Brunswick.



Tons of rockweed growing along each kilometre of coast in different regions

Source: <http://www.bofep.org/rockweed.htm>

Appendix B. ESR Impact and Dependence Matrix for Acadian Seaplants. Plant Derived Products.