Assessment of Ecosystem Service Values in the Township of King

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Ecosystem services are critical to human survival. Yet, over the last century "…(15 out of 24) of the ecosystem services examined during the Millennium Ecosystem Assessment are being degraded or used unsustainably…"(Millennium Ecosystem Assessment [MEA],2005,p.1). This paper attempts to find the total value of ecosystem services in the Township of King by examining various data sources.

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Foreword

Finding a topic for a major paper was no easy feat. I came into this program with a passion for the environment, not quite knowing where or how to focus my energies. As much as this could have been seen as a disadvantage to me, I feel that I was really able to find my own way to what I ultimately believe to be a worthy use of my time and energy. Once I found something to focus on, it all began to flow easily and effortlessly.

Ecosystem service valuation is a rather contested concept. While having struggled with the morality of reducing nature to an economic measure, I have come to think of ecosystem service values as another way to measure the environment. We measure the environment every day in biological units. Natural capital valuation is merely an economic way of measuring the environment. It by no means should be used as justification for environmental conservation or destruction, but rather to provide the public with a new way to communicate measurements of the environment. Biological units for example may not be a useful measurement to express to most people. Economics and dollar values are something that most people in North America can understand, perhaps easier than some arbitrary biological measure. That begin said my understanding of value is the biggest thing I struggled with on my journey through this program.

I ask myself, 'Why do we value nature?' And the answer to this question has led me to struggle and juggle many different ideas. I think this concept of natural capital valuation has allowed me to explore all my interests adequately. I hope that this paper will help raise awareness of natural capital valuation and spur more valuation exercise in the future.

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Abstract

The concept of ecosystem services is becoming a commonplace term amongst environmental professionals. The Township of King contains ecologically significant land such as the Happy forest, the Oak ridges moraine, and the Dufferin and Holland Marsh. No systematic attempt to assign economic value to the land within the Township of King has yet to be undertaken. This paper attempts to address this gap and highlight the importance of natural capital in the study area. This paper explores the concepts of natural capital valuation. Conventional economics does not consider the value of natural capital. This paper shows the dangers of overlooking this value and illustrates the benefits that can be experienced when taking the value of natural capital and ecosystem services into account.

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1.1 Introduction

Human life depends on nature. We are all essentially dependent on the natural environment for our own well-being and survival but the natural environment is generally neglected in economic decision making. Environmental considerations have been entirely ignored and profits have been made the primary concern. For instance "… (15 out of 24) of the ecosystem services examined during the Millennium Ecosystem Assessment are being degraded or used unsustainably…" (MEA, 2005, p.1). Nature is often considered a separate entity from the economy, when in reality the economy is embedded in the environment, and indeed the economy is dependent on the natural environment.

Conventional economics makes an ecologically devastating assumption; that natural capital is valueless. The true costs of business are not reflected in market prices. These are known as externalities and can be thought of as the effects of an economic transaction on a third party. For example, factory pollution, negatively affects human and animal life in that area even though they may not be part of the initial transaction. Ascribing a value to the environment could help to mediate the impact of negative externalities on the environment. Valuation of the natural environment expresses the usefulness of the natural environment in economic units. It seeks to remedy the disconnection between the environment and the economy in an attempt to make them commensurable. Ecosystem services are defined in the Millennium Assessment report as

> …the benefits people obtain from ecosystems…[such as] provisioning, regulating, supporting and cultural services…[and]…include products such as food, fuel and fibre; regulating services such as climate regulation and disease control; and nonmaterial benefits such as spiritual or aesthetic benefits,(Millennium Assessment, Ch1 conceptual framework, 26).

This definition highlights the inherent anthropocentricity of ecosystem service valuation. It is now well known that "…land in the middle of a city is much more valuable than land in a remote rural area, because there is a premium on accessibility," (Mather, 1986, p. 17). If humans do not benefit from the services that flow from natural capital, their economic value is significantly decreased. Boumans et

al.,(2002) believe that "…it is the presence of human beings as valuing agents that enables the translations of basic ecological structures and processes into value-laden entities,"(Boumans et al.,2002, p. 395). This makes clear the importance of human perception to the process of natural capital valuation. Without economic valuation natural capital is presumed to be worthless. Development is allowed to continue without taking into account full costs. Katz and Oeschsli (1993) provide a critique of anthropocentrism. They define the term "…anthropocentric to mean those values, goods, and interests that promote human welfare to the near exclusion of competing nonhuman values, goods and interests," (Katz et al., 1993, p. 50). Although valuation is a useful tool in expressing economic value of the environment, it is only valuable if it can benefit humans. As stated later in this paper, McAfee (1998) discusses that nature has to 'earn' the right to exist. Katz & Oeschsli state that "If the final goal of our policy [environmental policy] is the maximization of human satisfaction, then the preservation of nature only occurs when there is a congruence of interests between humanity and nature,"(Katz et al., 1993, p. 56). If nature cannot prove useful or valuable to humans then its conservation cannot be justified. This argument highlights the dangers in using natural capital valuation to justify environmental preservation.

1.2 Purpose of the major paper

This paper explores the topic of natural capital valuation and ecosystem service valuation and focuses on the Township of King and the ecosystem services that its stock of natural capital provides. This paper aims to make clear the relationship between the natural environment and human well-being.

The study area was selected for a few reasons. First, its geographic proximity to the Greater Toronto Area (GTA) means that many of the ecosystem services provided by the Township of King benefit the city and are of economic value to surrounding regions. In addition, many unique ecological features are in the Township of King such as the Holland Marsh, Oak Ridges Moraine and the happy valley forest. The importance of these natural features needs to be understood by the public so that

they may be effectively preserved. Expressing the value of the natural capital in the Township of King in dollar units democratizes the value of the environment so that everyone (not only biologists and environmental professionals) can have an idea of the value of the natural capital. These reasons make it a worthy cause to pursue. The values arrived at in this paper are in no way exact measurement of the value in the study area, but rather are an approximation.

The objectives of this paper are to:

- raise awareness and encourage dialogue on the topic of valuation of natural capital in King Township
- explore the concept of ecosystem services and natural capital
- to value the natural capital/ecosystem service in the Township of King
- make clear the relationship between human well-being and the natural environment
- contribute to a more holistic view of the natural capital in the Township of King when evaluating alternative land uses around the Greenbelt.

1.3 Outline of the major paper

The following section of this paper provides a discussion on the problems inherent in conventional economics and their negative impacts on the environment. Section 2.2 highlights the dangers of neglecting natural capital on the environment, economy and society. Costa Rica and Newfoundland are discussed in this section and are used as examples where valuation may have been useful.

Section 2.3 discusses natural capital as it relates to human wellbeing. Studies have shown that there are in fact many health benefits associated with access and time spent in nature such as

decreased stress. This section highlights the benefits to human health as a result of functioning natural capital and ecosystem services.

Section 2.4 and 2.5 discuss the topic of accounting for natural capital and the different types of value that exist. A critical distinction is made between use values and non-use values with respect to natural capital valuation

Section 2.6 gives a few examples of natural capital valuation at work. New York City is an example of successful valuation which aided in competent decision making.

The next chapter discusses the specifics of the Township of King. Section 3.1 discusses the significance of the ecosystem services in the King Township. Section 3.2 discusses the Greenbelt Act in the Township of King. Section 3.3 provides a demographic profile of the study area. Section 3.4 discusses land use and recreation in the Township and 3.5 outlines a few threats to natural capital in the study area which includes urban intensification and climate change.

A small section discusses natural capital valuation and how it relates to business. Natural capital valuation can be a useful tool for businesses.

Chapter 4 outlines the methods employed in this research. An overview of other valuation methodologies that could be used in primary valuation of natural capital is also provided. Limitations associated with various methodologies are identified. Section 4.3 and 4.4 discuss the different categories of land cover as identified by the Southern Ontario Land Resource Information System (SOLRIS), the spatial informatics group ecosystem service classification and possible study limitations. The next section reconciles the two studies and identifies the relevant categories.

The findings of the study are presented in section 4.7 where the total value of natural capital by land cover for King Township is approximately $676,085,021. Section 4.8 discusses the findings more thoroughly by indicating the types of ecosystem services that were valued in each land cover.

The final sections of this paper discuss appropriate uses of this information as well as some concluding remarks on the topic of natural capital valuations.

2. Chapter 2

In this chapter, I explore the neglect of the environment in conventional economics and economic decision-making. I describe some cases where this has led to disastrous environmental and ultimately economic, consequences. Consumerism has fueled environmental degradation in many cases. The price mechanism has shown to be an inaccurate measure of value. As a prelude to Chapter 3, I begin to describe how natural capital might be valued in order to better preserve the natural environment and benefit human wellbeing at the same time

2.1 Conventional Economics and the Environment

The purpose of natural capital valuation is to help give the environment an economic leg to stand on in the decision making process. This is becoming increasingly important due to dwindling natural resources. Remaining resources must be used much more efficiently than they have been in the past; in order to meet increasing demand for these resources. The concept of externalities is important when considering the value of natural capital. Negative environmental externalities represent an example of a conventional economic market failure. Pollution is an example of a negative externality. Economists define a negative externality as "…a cost of a transaction not borne by the buyer or seller," (Goodstein, 2008, p.32). This section discusses errors in conventional economic theory that have contributed significantly to environmental degradation.

Conventional economics has long abused natural capital because its use did not represent a cost for the producer. Capitalist economies are "…inherently extractive with respect to the natural resources, upon which they must depend for productivity…" (Ikerd, 2005, p.1). This means that natural capital is the fuel that capitalism runs on. Even in the most strictly protected areas of the country, specie loss is a reality. That protected areas are experiencing specie loss, illustrates how alarming the state of the environment has become. Studies have shown that all national parks in western North America including Banff and Jasper are losing species (Boyd, 2003, p.177). For instance,

> Impoundment and diversions affect over 40% of the Bow river catchments within the park. Airborne organic contaminants concentrate in glaciers and increase elevation in snow banks, yielding amounts high enough to contaminate fisheries to levels that in some cases approach guidelines for human consumption (Schindler, 2007, p. 403).

This example exposes the worsening condition of the natural environment, even in protected areas. Much of this environmental degradation can be attributed to market failure whereby the cost of environmental degradation is not paid by any single person but is rather experienced by society as a whole. Market externalities like pollution "… [impose] costs on people who are 'external' to the producer and consumer of the polluting product," (Goodstein, 2008, p.32). Even those not directly involved in producing the pollution are affected.

It is clear that human activity is driving the natural environment to thresholds nearing the earths' ability to regenerate and cleanse itself. The demand for consumer goods like housing, theaters, swimming pools and golf courses increases during periods of economic prosperity. In effect, there is economic incentive to alter landscapes and ecosystems in order to provide these consumer goods. There is thus a direct relationship between increased market activity and environmental degradation.

For instance,

> Look at LA: twenty million people where there ought to be maybe a few thousand. How do they accomplish this? Well, for one thing, they have diverted the entire Colorado River from its natural purposes. They are siphoning off the Columbia River and Piping it south…Whole regions of our ecosphere are being destabilized in the process, (Churchill, 2002, p. 395).

This example illustrates the extent to which natural environments are being altered to serve consumer demands. Companies want to sell as much of their product as possible to consumers using two main methods: built in obsolescence and perceived obsolescence. The first term refers to products being designed to last only for a limited time span. That later term refers to the product still being usable but the consumer being dissatisfied with the product. This is widely seen with fashion. For instance, despite the usefulness of clothing products, its old style renders it unusable to the consumer. There is a plethora of market activities where the pursuit of profit has directly led to environmental degradation. A notable case in Canada is the cod fishery in Newfoundland where the exploitation of the fishery for economic gain eventually collapsed the ecosystem. Examples such as this one illustrate the failure of the market system to effectively allocate resources in a sustainable manner. This example is discussed further in the following section of this paper.

The conventional market model encourages the degradation of the environment because it does not allocate a cost to resource depletion. Therefore, the market price of a consumer good does not reflect the full cost of its production. Raj Patel (2009) discusses externalities in his book 'The Value of Nothing'. He discusses how McDonald's externalizes environmental costs onto society. For instance,

> If McDonald's is able to cause the emission of pollutants like CO_2 without having to pay for it, then the costs of the firm are not the same as the broader social cost…These are the costs that somehow slip through the net of prices,(Patel, 2009 ,p.43).

In this case, the effects of McDonald's CO_2 emissions are mediated by valuable ecosystem services (CO_2 sequestration) provided by the stock of natural capital (trees and oceans). These ecosystem services are

currently valued at zero, yet they play an important role in human well-being. True costs are not reflected in the price of goods and demand is artificially inflated. If the full cost of products and services were reflected in the market price, consumers would respond to this and demand would significantly decline. Raj Patel (2009) mentions an Indian report that found the true cost of a burger "…grown from beef raised on clear-cut forest …[to]… cost about two hundred dollars,"(Patel, 2009, p.44). Consumers would surely respond to this price increase and the demand for burgers would significantly decrease. The low price offered by fast food chains is what makes these restaurants so popular. How many consumers would be willing to pay the true cost of a hamburger?When profits are being made from beef grown on clear cut forest lands, the market is clearly signalling and encouraging the continuation of forest clear cutting. The artificially low prices therefore skew consumer demand and it becomes evident that the price mechanism is an extremely ineffective method of determining optimal resource allocation.

In addition, conventional market models advocate for liberal trade barriers around the world. This has negative implications on ecosystems because the liberalization of trade between countries makes it possible for

> …countries to live beyond their carrying capacity by importing that capacity- natural capital- from other countries and this tendency in individual countries tends to push the world economy to grow beyond its optimal scale relative to the containing ecosystem, (Daly, 1997, p.149).

This quotation illustrates how liberal trade policies supported by neo-classical market models only increases the rate of resource depletion on a global scale and again illustrates the markets ineffectiveness in securing optimal resource allocation.[1]

[1] Developing countries that do not have mature industries are enticed to sell of their natural capital as a way to raise profits. This is unsustainable over the long term, and once their resources are depleted, results in poverty. Staples trap.

The current market model is extremely short-sighted and a more ecologically sustainable approach to organizing the economy is needed. Often it seems the market is the only solution the economic problem. In reality there are a few of other ways to solve the economic problem as is discussed by authors Heilbroner and Milberg (2008). The purpose of an economic system as identified by Heilbroner and Milberg (2008) is to deal with production and allocation of scarce resources in society, (Heilbroner & Milberg, 2008, p. 4). They state, "Societies can exist- and most do exist- with badly distorted productive and distributive efforts," (Heilbroner & Milberg, 2008, p. 6). Many of the natural resources used in production processes for consumer goods are exhaustible and industrial production processes commonly used are detrimental to the environment. This fact is not taken into consideration when setting prices. As stated, the costs of resource depletion are not bore by any actor in particular and are classified as externalities. The depletion of a resource is considered an externality because this price is not paid directly by any actor. For instance, "The opportunity cost of using up a quantity of whales today is not having it ten or fifty years later," (Holesovsky, 1977, p. 178). The opportunity cost of using a resource in the present is not considered in conventional (neo-classical) market models. Due to the lack of this consideration in free market economics, the price mechanism which produces an 'equilibrium price' (and is supposed to secure optimal allocation of resources) fails.[2] According to the conventional (neo-classical) model, an equilibrium price will produce an optimal allocation of a certain resource. In general, optimality implies that each resource is allocated to where it is needed most. Since the current market distribution has shown to deplete resources and collapse ecosystems, it is possible to conclude that the market system has led to the misallocation of resources over the long term.

[2] In a free market (free from government intervention), the price mechanism is supposed to secure an optimal allocation of resources. Since the depletion of natural resources is not paid by the consumer, it is considered a 'spillover effect' by Holesovsky. "The amount of costs or benefits that exceeds the price paid by the direct buyer," (Holesovsky, 1977, p.176). The distorted price influences the behaviour of consumers by inflating demand. Goods with high negative externalities tend to be over produced while goods with high positive externalities tend to be under produced. In both cases there is a misallocation of resources.

The notion that the conventional market model is contributing to the misallocation and depletion of resources over the long term is contested. Those in favour of conventional markets argue that the competitive market place provides profit incentives for the discovery of alternatives or substitutes.[3] Conversely, because the price of environmental degradation is considerably lower than the costs of discovering substitutes, the former is likely to be the outcome. This result is evident when examining society's ongoing struggle to find economically viable alternatives for fossil fuels in a free market economy. Enormous costs must be incurred to renovate society's infrastructure away from fossil fuel dependant vehicles and modes of production. Thus has been the case, consumers and producers continue to be dependent on fossil fuel production, even as society approaches threats of peak oil. Holesovsky has identified that the

> …belief in certainty of substitution may again err on the side of overconfidence in the market mechanism and human capabilities. We just do not know for sure, (Holesovsky, 1977, p. 179).

This quotation reminds us of the markets over confidence in the discovery of substitutes for exhaustible resources. It also suggests that overconfidence in the development of substitutes leads the market to misallocate resources in the present.

As stated, conventional economics neglects to provide e accurate prices of goods and services due to externalization.When supply and demand meet, an equilibrium price is said to be achieved. According to conventional economic theory, an equilibrium price implies an optimal allocation of a resource. In general optimality implies that each resource is allocated to where it is needed most. If a market distribution can be shown to fail in this general sense, then we can conclude that the 'free market' will (under certain circumstances) lead to a misallocation of resources. From this discussion, some errors in conventional economics with respect to price, consumption and resource allocation become evident.

[3] The idea being that there will be sufficient profit motive to drive the development of alternatives or substitutes.

Focusing only on economic notions of value ignores other concepts of value. Natural capital provides ecosystem services that increase the wellbeing of those who live in the area. Natural capital and human wellbeing is discussed later in this paper. The cost of environmental degradation is not included in market prices and so ecosystem services are valueless according to the conventional market paradigm. Neglecting notions of intrinsic value can have adverse environmental impacts.

Natural capital valuations and ecosystem service valuations are valuable tools that can be used to internalize the costs of environmental destruction. These valuable services that are often critical to life are overlooked because they are provided for free. The absence of a price does not imply an absence of value, only an absence of economic value. Economic valuations of ecosystem services attempt to put a price tag on natural capital. Valuation of the environment and its services is important because it is a tool to help remedy this problem of valuation inherent in the dominant economic system.[4] This valuable tool can help solve the allocation problem of resources in contemporary society. The key challenge of the next generation is to provide for the earths increasing population with a fixed amount of natural capital that all humans must share. This is the allocation problem that the market system has failed to solve adequately.

2.2 Destroying Natural Capital: Canadian Cod Fishery/Costa Rican Carbon Neutral

This section makes use of examples to communicate the potentially negative impacts caused by externalizing the destruction of natural capital. As Prugh states "…allowing our stocks of natural capital to be over exploited or neglected is a prescription for trouble..." (Prugh, 1995, p. 35). .

In July of 1992, the once abundant cod stocks off the east coast of Newfoundland collapsed and a moratorium was placed upon fishing. This occurred mainly due to the disregard for the value of the

[4]It is important to understand that natural capital valuations are not the solution to environmental destruction caused by externalities. It attempts to remedy this problem from within the free market framework. Natural capital should be accounted for just like any other form of capital that is used by humans

cod fishery. This example illustrates how the market fails to assign a useful value to natural capital. This neglect causes the inevitable destruction of natural capital occurs.

Canadian economic history is based on natural resource exploitation. For example

> The economic history of Canada has been dominated by the discrepancy between the center and the margin of western civilization. Energy has been directed toward the exploration of staple products and the tendency has been cumulative, (Innis, 2001, p. 385).

In fact, the importance of staple products in Canada began with the fishing industry (although the fur trade was of most importance to the North American continent) (Innis, 2001, p. 401). Canada's economy is still largely driven by commodities like fish, timber and more recently oil. The Alberta Tar sands require large inputs of water and energy. Oil production "… is expected to increase from 1.31 million barrels per day in 2008 to 3 million barrels per day in 2018, keeping pace with demand…"(Albertagov, 2012). This represents increasing resource extraction. **The Canadian economy is closely tied to commodities and it is for this reason that it is particularly important for natural capital to be valued in Canada.**

At a time when natural resources were seen as inexhaustible, all resources were put towards capturing the cod fish. For instance,

> The most promising source of early trade was found in the abundance of fish, especially cod, to be caught off the Grand Banks of Newfoundland and in the territory adjacent to the Gulf of St. Lawrence. The abundance of cod led the peoples concerned to direct all their available energy to the prosecution of the fishing industry which developed extensively, (Innis, 2001, p.384).

Fisheries fall into the category of 'open access resources'. This means that the resource can be accessed by anyone and it is not possible to exclude people from the resource. Conventional markets have shown failure in their ability to manage such resources. The law of diminishing returns is a key point in conventional economic theory. It is "...an assumption of general scarcity to all sectors resulting in an upward sloping marginal cost and supply curve..." (Christensen, 1991, p. 82). Conventional economic

theory holds that when supply decreases, the price will increase and cause demand to fall as consumer's willingness to pay decreases. However in the case of open access resources demand driven commodity prices coupled with the decreasing supply, increases prices and acts to encourage the harvesting of the resource[i]. Since there is no way to exclude another person from depleting the resource, it becomes a sort of race to see who can harvest the resource (fish) the fastest. One person's consumption diminishes the amount available to others thus encouraging technology that will more quickly deplete the resource. For instance, "…technologies can also be used –and predominantly are used- simply to extract resources more efficiently and to increase total throughput," (Prugh, 1995, p. 37). Thus the competitive forces between harvesters or users of an open access resources encourages rapid depletion. The law of diminishing returns is another example of how conventional economic theory encourages open access resource depletion and thus is not a good framework to be used in the management of these resources.

The cod fish continued to be harvested despite environmental evidence that their populations were seriously in danger. Proponents of unrestricted fishing were measuring the flow of fish rather than the stock. A flow does not always represent the stock of resources and therefore is an unclear representation of fish stocks. There is a similar problem with measuring ecosystem services rather than natural capital stocks. The flows of ecosystem services are only possible when a certain stock of natural capital exists. Depleting natural capital reduces the amount of ecosystem services in the form of benefits that are delivered to people. Natural capital stocks are important, they produce a flow of materials when harvested "…but also a flow of services (photosynthesis, water purification, water absorption etc.) for which human ingenuity will probably never find comprehensive substitutes," (Prugh, 1995, p. 35). This statement stresses the importance of the ecosystem services provided to humans when natural capital exists.

Conventional economics "…is understood in terms of the mutual advantage of individuals in a market society, and is dependent on each pursuing his or her private interests," (Slater & Tonkiss, 2001, p. 57). An economic 'free rider' problem with respect to open access resources arises due to property rights not being clearly defined or enforced. "...the individual is motivated by self-interest... [and]...has an economic incentive to free ride at the expense of others in the group..." (Pasour, 1981, p.1). Furthermore, while the individual "...may recognize that similar independent behaviour on the part of everyone produces undesirable results, it is not to his own interest to enter voluntarily into an agreement since...he enjoys a 'free ride' that is, secures the benefits without contributing to the costs," (Buchanan,1968, p.83). These quotes illustrate the economic incentive created by contemporary economic theory to deplete open access resources. This provides further support for the idea the market is unable to regulate the consumption of open access resources.

In the case of the cod fishery, consumer demand for cod fish drove the annual catch in the 1970's to 800,000 tonnes, (Boyd, 2003, p.198). The cod fish suffered a biomass reduction of up to 97-99%, and 14 years after the closure of the fishery- the cod continue to show no signs of recovery (Boyd, 2003, p. 198). The economic value of the cod fish was lost. The bottom trawlers wreaked havoc upon the ocean floor and valuable natural capital and ecosystem services were ultimately lost.

Cultural value is a value that is identified in the millennium ecosystem assessment. In the case of the cod fishery cultural values were also damaged. The shutdown of the east coast cod fishery was the largest industrial closure in Canadian history (Boyd, 2003, p. 198). The closing also took four hundred years of Newfoundland culture and lifestyle down the drain with it.

Another example of natural capital value being neglected can be seen in Costa Rica. In Costa Rica, failure to understand the value of their natural capital resulted in huge losses. For example,

> Since…1970, Costa Ricans have burned off or otherwise cleared at least 30 percent of the nation's forest cover. Converted to fields and pastures and exposed to heavy rainfall, the land suffered savage erosion, losing an estimated 2.2 billion tons of soil between 1970 and 1989. In parallel, costal fishing grounds were heavily damaged by water pollution and over harvesting, (Prugh, 1995, 90).

The Costa Rican tropical science center estimates economic loses "…from 1970-1989, the accumulated depreciation in the value of [Costa Rica's] forests, soils and fisheries exceeded $4.1 billion in 1984 prices – more than the average value of one year's GDP,"(Prugh, 1995, p. 90). This is yet another example of environmental degradation that compromised the flow of ecosystem services and their benefits. Costa Rica is not the only perpetrator and has since become a leader in environmental stewardship. In fact the government has announced plans to become the first carbon neutral country by 2021, (Herro, 2007). This is a laudable goal for Costa Rica who aims to accomplish this by "…cultivating a carbon certificate market that aims to not only boost carbon capture and storage in the nation's forests, but also to help maintain their scenic beauty,"(Herro, 2007). This shows the nation has since realized the importance of natural capital and has taken important steps to rectify the situation.

The loss of the cod fishery can be measured economically by the amount of any lost revenues associated with the loss of the cod fish. It can also be measured biologically by measuring any damages associated with the loss of the cod fish. Either measurement represents a method of expressing a value of the fishery. It is evident through the use of examples how an error in conventional economic theory has led to environmental degradation.

2.3 Natural Capital and Human Well-being

This section will discuss natural capital and how it is closely related to human well-being. A healthy functioning environment is important to human well-being and should be protected for this purpose. A general assumption is made in this paper that all humans desire to be happy as opposed to sad. How this happiness and wellbeing is achieved is an area that is increasingly becoming a critically

debated topic. This section shows how natural capital can play an important role in increasing human wellbeing and perceived happiness.

Conventional economic theory assumes that consumption is closely related to welfare and should therefore be maximized. In other words, the more a person is able to consume the happier they will be. However, the environment is essentially left out of this equation and increasing consumption in pursuit of wellbeing will cause resources to be allocated sub-optimally.[5] Although there is a considerable amount of data that supports this correlation between wellbeing and income/consumption, it is an unsustainable and therefore irrational method of pursuing happiness. The work of John Lintott (1997) and others has shown that "...increases in consumption do not...lead to improvements in overall welfare," (p. 242). The effectiveness of conventional economic tools to measure the wealth of a nation has long been contested by ecological economists. Since economic growth has shown to do little to improve social and environmental welfare, it should not be a primary goal of government policy. Rather than government efforts being directed to growing the GDP (because of its supposed relation to welfare) efforts should be made to directly increase social and environmental welfare. Gross National Happiness (GNH) is an alternative tool used to measure social and economic progress in society. Rather than attempting to find correlations between income and happiness, the GNH explicitly measures happiness and well-being. A higher income gives people the freedom to purchase more consumer goods but cannot bring satisfaction with immaterial aspects of life.

Aristotle argued that making money was not the best life path to pursue. For instance, "The moneymaker's life is in a way forced on him [not chosen for itself]; and clearly wealth is not the only good we are seeking, since it is merely useful...for some other end," (Aristotle, 2000, 109). Aristotle argues that money (income) is not what humans demand, but rather are pursuing happiness through

[5] Suboptimal: in this paper, sub optimal means that resources are not allocated efficiently whereby making one person better off means making another person worse off. (Goodstein, p. 51, 2008).

consumption. In Aristotle's view, in order to be happy one had to achieve a virtuous life. This meant an individual has to be the best they can be in each of their roles in life and succeed in integrating them. This view illustrates that all aspects of life need to be considered, not only the economic realm. Rather than maximizing economic wellbeing governments ought to focus on maximizing subjective wellbeing and redefining wealth.

There is considerable debate concerning the economics of happiness. Richard Easterlin (1995) shows in his work that increased incomes do not increase human wellbeing. On the other hand, Betsey Stevenson and Justin Wolfers (2008) have argued for the existence of a correlation between increased income and human wellbeing.

Richard Easterlin developed what is called the 'Easterlin Paradox'. His research shows that wealthier people are not in fact happier than poor people. He argues that human happiness or well-being increases with consumption only up to a certain point whereby the benefits of increased consumption fall away and individuals become stuck on the 'hedonic treadmill'. This is the paradox: that increased consumption increases wellbeing but only up to a certain point. The hedonic treadmill results when "…the adaptation occurs to the point where the experience is rendered neutral in its effect on wellbeing," (Keely, 2004, p. 333). Essentially people become used to a certain level of consumption and then their perceived happiness returns to previous levels over time.

A more recent study conducted by Betsey Stevenson and Justin Wolfers of the University of -Pennsylvania argues that money doesbuy happiness. Their study made use of data like the Gallop polls and Euro barometer data. The Gallup World poll contains "...data on subjective well-being for 132 countries in 2006," (Wolfers, 2008). The results of their study showed

> ...a clear positive link between average levels of subjective well-being and GDP per capita across countries, and find no evidence of a satiation point beyond which wealthier countries have no further increases in subjective well-being, (Stevenson & Wolfers,2008, p. 1).

The results of this study are different than those conducted by researchers in the past. The notion that there is no satiation point indicates that it is *absolute income* rather than *relative income* that is most important in wellbeing. Lintott specifically argues against this and states that "once basic material needs are satisfied, it's an individuals' relative not absolute consumption that counts for his or her welfare," (Lintott, 1997, p.242). In other words, it is the process of keeping up with the jones's that satisfies humans. In previous studies scientists have been able to show that "...beyond a GDP per capita of just $15,000...money does not buy happiness. Up to that point the correlation between the two is strong, but thereafter it falls away," (Economist, 2010). What makes the findings of Stevenson et al. distinctive from others is that the data has been plotted on a logarithmic scale and has revealed alternative results. This reveals a strong and consistent correlation between happiness and wealth. This study also revealed that the United Nation Human Development Index is highly correlated with GDP per capita when plotted on a logarithmic scale. This study also found a correlation between Life Satisfaction and Real GDP per capita. The data in this study also indicates an "...incredibly high correlation between average levels of happiness and average incomes ...," (Wolfers, 2008). In general, the trends indicate that there is indeed a relationship between happiness and income. However, there was an exception. Interestingly enough, the United States did not follow this trend. Appendix 1.1 illustrates the absence of a time-series happiness-income relationship and the authors state "...the data clearly reject the view that happiness grew as predicted by the happiness income gradient estimated within the United States," (Stevenson & Wolfers, 2008, p. 58). They hypothesize that the reason for this exception is due the highly unequal distribution of 'the fruits of economic growth'. This finding does not affect their assertion that a relationship between GDP and happiness exists and state that these findings for the United States "...should be regarded as an interesting exception warranting further scrutiny,"

(Stevenson & Wolfers, 2008, p. 58). Wolfers and Stevenson make clear that consumption levels and human well-being are correlated. However, if consumption and environmental degradation are correlated and human well-being and the environment are also correlated then perhaps the argument that consumption improves human wellbeing (happiness) needs to be reconsidered.

Recently, research has been conducted that brings to light the important relationship between environmental health and human well-being. This research suggests that the environment has an important role to play in human wellbeing and is again more valuable than conventional economics is able to account. The connection between the natural environment and human wellbeing is becoming evident to societies and people are beginning to sit up and take notice. The Ontario Trillium Foundation supports initiatives to better the environment. This foundation was established to build "…healthy and vibrant communities throughout Ontario by strengthening the capacity of the voluntary sector, through investments in community-based initiatives," (Ontario Trillium Foundation [OTM], 2011). Their website boasts donations of $13 million in support of the environmental sector, $24 million in support of sports and recreation, 24 million in support of arts and culture and $45 million in support of human and social services (OTM, 2011). Many municipalities have applied for this funding in order to produce sustainability plans for their communities as the connection between healthy environment and human wellbeing becomes evident.

Access to nature encourages people to be physically active and contributes in this way to improved health. In fact there are many benefits associated with interactions with nature.
One such benefit is to people recovering from sickness. As Evans et al.,(1991) refer to in their paper, "Ulrich (1984) also showed that patients who viewed natural elements through their hospital window had a faster and more pain free recovery from surgery than patients whose view was of a brick wall,"(Evans et al.,1991,p. 7). The Millennium Ecosystem Assessment is perhaps the most well-known document with respect to ecosystem service valuation. This enlisted the support and collaboration of

the global scale in order to create a sort of baseline data indicating where the world is in terms of the state of the environment. This report acknowledges that valuation is but one tool in assessing ecosystem conditions. Human wellbeing is another indicator of ecosystem condition. When ecosystem conditions are healthy and unpolluted, human wellbeing increases and decreases as ecosystem conditions deteriorate. In some areas of the world, people's subjective wellbeing varies depending on environmental features such as living in a coastal zone or in a dry land, (in the Organization for Economic Co-operation (OECD) nations that is not the case). The Millennium Assessment states that pollution in ecosystems is characterized by low human well-being, (MEA, 2005, p. 125).

The Millennium Assessment yielded some major findings. One of these findings is that "…humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history…" (MEA, 2005, p. x). Another notable finding is that the ecosystem changes have resulted in

> …substantial net gains in human well-being and economic development, but these gains have been achieved at growing costs in the form of the degradation of many ecosystem services, increased risks of nonlinear changes, and the exacerbation of poverty for some groups of people. These problems unless addressed will substantially diminish the benefits that future generations obtain from ecosystem services, (MEA, 2005, p. x).

Although consumption to a certain extent is important for human well-being, it is necessary not to undermine it by destroying functioning ecosystems and loosing those services that are beneficial to humans.

The following is a table taken from a Credit Valley Conservation Technical report that summarizes research on key relationships between nature and physical, mental and social well-being.

Table 1

Type of Well-being	**Relationship to the Natural Environment**	**Source**
PHYSICAL	• Natural Environment places a supporting role in promoting	• Sallis et al. 1998

	physical activity • Exposure to natural improves heart rate, blood pressure, and muscle tension • Contact with nature speeds recover in hospital patients • Elderly people recover more quickly from directed attention fatigue after resting in a garden • Exercising in a natural environment improves physical well-being more so than exercising in non-natural environments	• Ulrich et al. 1991 • Ulrich 1984 • Ottosson 2007 • Pretty et al. 2005
MENTAL	• Contact with nature influences the rehabilitation potential of people affected by crisis • Green outdoor settings reduce ADHD symptoms in children • Contact with nature improves cognitive performance and productivity • Contact with nature alleviates stress and anxiety	• Ottosson 2007 • Pretty et al. 2005 • Ottosson 2007 • Taylor et al. 2001, Kuo and Taylor 2004, Ottosson 2007 • Taylor et al. 2001 • Park et al. 2010, Maas et al. 2009b
SOCIAL	• Natural settings increase community bonds and social integration • Presence of trees and grass increases sense of safety • Natural areas are strongly correlated with more creative play in children • Greener homes, greener buildings, and greener neighborhoods produce healthier social behaviour and less social dysfunction	• Coley et al. 1997, Taylor et al. 1998, Maas et al., 2009b • Kuo et al. 1998 • Taylor et al. 1998 • Weinstein et al. 2009, Kuo 2010.

Green Metrics Ltd. Credit Valley Conservation Technical Report: The Importance of Ecosystem Services to Human Well-being in the Credit River Watershed. November 2011.

Not only should nature be preserved for ethical and economic reasons but also for potential 'emotional benefits'. (Hine et al., 2005, p.97). The growing rate of depression and emotional poverty is becoming a social issue and exposure to the natural environment should be used as a way to remedy this situation. The poor mental health of many people in society is identified by the World Health Organization who has estimated that "…depression and depression-related illness will become the greatest source of ill-health by 2020,"(Hine et al., 2005, p. 9).

Hine et al (2005), identify that

> …nature can make positive contributions to our health, help us recover from pre-existing stresses or problems, have an 'immunising' effect by protecting us from future stresses and help us to concentrate and think more clearly,(Hine et al., 2005, p.27).

The growing popularity of 'eco-therapy' to treat anything from adolescent behavioural problems to depression illustrates that there is in fact a benefit to be received from interactions with the natural environment. With an increasing amount of people living in urban areas than any other time in history, interactions between humans and nature are decreasing. Eco-therapists suggest that "…what the average person feels as stress or depression…is a longing for our natural home," (Walsh, 2009). A study conducted in England which compared the mental benefits of walking outdoors with those of walking indoors found that "Participating in a green outdoor walk…significantly reduced feelings of anger, depression and tension in comparison to the indoor walk,"(Hine et al, 2007, p.6). Figure 1.2 in the appendix shows the graphs produced in this study which visually illustrate the significant benefits associated withoutdoor exercise.). In another study, participants were asked to rate their subjective vitality after either walking in an outdoor or indoor environment (Ryan et al., 2009,p. 162). The results "…showed that indoor walk participants experienced no change in vitality over time…whereas those walking the natural path experienced an increase in vitality…"(Ryan et al, 2009, p. 162). This is another example of how the natural environment has a value on improving our health care. It is therefore critical that we do not underestimate the importance of nature in this respect. A literature review on the topic

of human well-being and the environment was conducted by Thomas Abel et al. Many of their reviews discuss the importance of walking outdoors on human well-being. Perhaps an unanticipated impact of natural landscapes on human well-being is that they "…promote people's ability to express positive feelings like joy and satisfaction more easily …more specifically, open and accessible forests are suggested to enhance positive emotions more than dense and less accessible forests…(Abel et al, 2009, p. 63).

Trees for example are useful in providing shade, fixing nitrogen, sequestering carbon dioxide etc. But what trees are less appreciated for is their effect on human well-being. Evidence suggests that trees strengthen urban communities and reduce violence. For instance

> We are finding signs of stronger communities where there are trees. In buildings with trees, people-report significantly better relations with their neighbours. In buildings without trees, people report having fewer visitors and knowing fewer people in the building. In buildings with trees, people report a stronger feeling of unity and cohesion with their neighbours; they like where they are living more and they feel safer than residents who have few trees around them,(Kuo & Sullican, 1996).

This trend is becoming evident anywhere such studies are conducted, indicating a benefit from interaction with nature anywhere in the world. In Australia, an "…association was detected between dryland salinity and depression, indicating that environmental processes may be driving the degree of psychological ill-health in these populations," (Cook et al, 2009, p. 880). What all of these studies suggest is that there is a clear connection between healthy environments and human well-being. Improved health is a benefit provided by natural capital. The debate on what makes humans happy is clear. Thus nature ought to be preserved as it can be shown that it is beneficial to human well-being in more than one aspect.

This section has shown that although there is considerable debate whether or not consumption makes humans happy, what is uniformly clear is that interaction with nature increases human well-being and decreases stress. Focusing on preserving nature and green spaces in communities has clear positive

benefits. This calls into question the common practice of placing economic goals in priority of preserving green spaces and other environmental goals.

2.4 Accounting for Natural Capital

As stated, the externalization of environmental degradation is bore by society as a whole. When faced with options, decision makers are unable to clearly see the full costs and benefits of all the options. Since human wellbeing and environmental health are closely tied together, it is critical to human well-being that environmental degradation is accounted for. Human wellbeing is considered a 'non-market value' of nature. Some natural resources are traded in the market place such as timber and fish, but many natural resources are not traded or valued in the natural environment. This is because "…markets do not provide complete information about the value people place on resources, because, by definition, markets do not capture the values of resources and uses not traded in the market place,"(Lee, 2000, p. 285). In general, the goal of decision makers is to increase societal well-being. This implies that non market values of natural capital must begin to be accounted for since human well-being and nature are tied together. Pollution for example negatively affects human well-being by contributing to poor air quality and illnesses associated with breathing 'dirty' air. In the past, conventional economics has not assigned a value to pollution, thus making mining and other polluting processes appear inexpensive. Neglecting to account for environmental costs has had adverse environmental and societal effects. Accounting for environmental degradation allows decision makers to make more informed decisions that will consider human well-being and not only the economic wellbeing of a society.

2.5 Value

It is useful for this paper to understand the various concepts of value used in natural capital valuation. The Millennium Ecosystem Assessment provides a framework for understanding ecosystem services. As stated earlier in this paper, ecosystem services are broken down into four categories,

provisioning, regulating, cultural and supporting. Different benefits and economic value are received by each of the different types of services. The following table is taken from the Millennium Ecosystem Assessment and outlines the different benefits received from the different types of ecosystem services.

Table 2 Ecosystem Benefits from each type of Ecosystem service

Provisioning	Regulating	Cultural	Supporting
❖ Food ❖ Fibre ❖ Fuel ❖ Genetic resources ❖ Biochemical, natural medicines and pharmaceuticals ❖ Ornamental resources ❖ Fresh water	❖ Air quality regulation ❖ Climate regulation ❖ Water regulation ❖ Erosion regulation ❖ Water purification, waste treatment ❖ Disease regulation ❖ Pest regulation ❖ Pollination ❖ Natural hazard regulation	❖ Cultural diversity ❖ Spiritual and religious values ❖ Knowledge systems (traditional and formal) ❖ Educational values ❖ Inspiration ❖ Aesthetic values ❖ Social relations ❖ Sense of place ❖ Cultural heritage values ❖ Recreation, ecotourism	❖ Soil formation ❖ Photosynthesis ❖ Primary production ❖ Nutrient cycling ❖ Water cycling

Source : Millennium Ecosystem Assessment 2oo5, page 5

These services are linked to different components of human wellbeing. All of them are linked to the freedom of choice and action, the opportunity to be able to achieve what an individual values doing and

being (MEA, 2005). Other categories of well-being identified in the assessment report are security, basic material for good life, health and good social relations.

The Economics of Ecosystems and Biodiversity (TEEB) attempts to bring together three realms: business, national policies, and biological sciences. As stated, understanding ecosystem services requires a multidisciplinary approach and TEEB has become really important in informing users of such information. TEEB warns that failing to incorporate the environment into decision making is a poor economic choice and rather than externalizing the environment, internalizing it will be much more beneficial to the environment and economy (TEEB,2010).

Total economic value equals the sum of option values, use values and non-use values of natural capital,(Goodstein, 2008, p. 144). The Millennium Ecosystem Assessment breaks these two categories down further. Use value is the sum of direct use, indirect use and option value. Non-use values include bequest values and existence values.

An illustration of the concept of Total Economic Value is provided below in Figure 1.

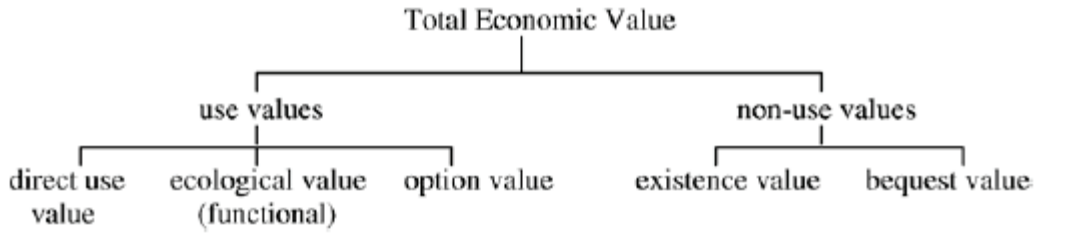


Fig. 1 – The concept of Total Economic Value of the environment.

(Plottu, 2007, p. 54).

Use Values

- Direct-use value – "The value of the use of the resource, for whatever purpose. Agricultural land can produce crops, but it also can provide biomass for energy generation, perhaps forage for animals, and so on. Some of these values will be difficult to quantify,"(United Nations Environment Program [UNEP], 2008).
- Indirect-use value – "These correspond to "ecological functions" (e.g., protecting watersheds from siltation, maintaining biodiversity). Carbon sequestration was an indirect use value, until there developed a market for it—at which point sequestration became a direct value,"(UNEP, 2008).
- Option Value – "…defined as the price that individuals are willing to pay for conservation of an element in view of its possible use in the future,"(Plottu, 2007, p.53).

Non-use Values

- Bequest value – "…satisfaction that individuals derive from knowing that resource will be preserved for use by successive generations,"(Plottu, 2007,p. 53).
- Existence value- "…the satisfaction that an individual gets from knowing that an environmental element will be preserved (a site, animal, species), independently of any personal present or future use,"(Plottu, 2007, p. 53).

The values held for non-use and use values of natural capital represent a broad range. Capturing everything that is included in Total Economic Value (TEV) is a very complicated and difficult to measure and often leads to double counting. The descriptions above are a good way to highlight the breadth of value held for natural capital. Actual measurements tend to be more simplistic. Fu Bo-Jie et al.,(2010) of Japan discuss double counting in ecosystem service valuation. They identify the causes of double counting to be poor classifications of ecosystem services and a lack of understanding of the complexity of ecosystem functioning (Fu Bo-Jie et al., 2010). It is not difficult to double count ecosystem services because there is an inherent overlap in nature, one process leads to and is necessary for the next (Fu Bo-Jie et al., 2010). It is difficult to pull apart and value one service alone due to the natural interdependence of ecosystems.

Although this tool can be extremely effective in aiding the justification of conservation, there still exists some scepticism with respect to the morality in economically ascribing a value to natural capital. Many people have identified the inherent dangers of commodifying the natural environment.

Author McAfee (1998) views the process of natural capital valuation as 'green developmentalism' whereby capitalists attempt

> …to rationalize industrial and agricultural practices and cost accounting to limit ecological damage and reduce waste, to the degree that this can be done without reducing profits; in other words, so long as 'pollution prevention pays',(McAfee, 1998, p.134).

This author argues that commodifying the natural environment is just another way to spread capitalism. For instance,

> By Promoting commoditization as the key both to conservation and to the equitable sharing' of the benefits of nature, the global environmental-economic paradigm enlists environmentalisms in the service of the worldwide expansion of capitalism,(McAfee, 1998, p. 134).

Nature is infinitely valuable and it is almost impossible currently to accurately ascribe a true value to a natural resource. In fact, since natural capital is critical to human life and wellbeing one can say that it is infinitely valuable since without it humans cannot continue to exist. Natural capital should not only be protected for economic purposes but for moral and aesthetic reasons as well. The author expresses such concerns in her paper. Despite such valid concerns, it is important to understand the alternative seems to be continuing to neglect the value of nature. The business as usual approach will continue to neglect the natural environment. Costanza et al., address these concerns and state that

> …while ecosystem valuation is certainly difficult and fraught with uncertainties, one choice we do not have is whether or not to do it. Rather, the decisions we make as a society about ecosystems imply valuations (although not necessarily exchange values expressed in money terms). We can choose to make these valuations explicit or not; we can undertake them using the best available ecological science and understanding or not; we can do them with an explicit acknowledgement of the huge uncertainties involved or not; but as long as we are forced to make choices, we are doing valuation,(Costanza et al., 1997, p. 256).

This quotation represents the authors' view that the uncertainties in undertaking such valuation must be explicit. This paper aims to value the natural capital of the Township of King while fully understanding the moral and scientific uncertainties associated with this undertaking. If the alternative is not to conduct valuation, the surely society cannot afford to any longer sit idle while the value of the environment continues to be neglected by conventional economic accounts.

When ecosystem services are destroyed, society must replace those with human made services. Natural capital can be valued at the cost of replacement, rightly called 'replacement cost' valuation. This can represent a significant cost for a government or business having to replace the 'free' services of nature with an economic activity. Natural capital valuation can lead to the more efficient allocation of funds by recognizing the true economic value of natural capital and the services it provide. Substitution of an ecosystem service with a human made service is sometimes possible but not always. Even so, nature can usually provide an ecosystem service cheaper than man made substitutions. An example of this can be seen in the case of New York City and the Catskill Watershed.

This section has outlined the various concepts of value enlisted in natural capital valuation and has also briefly presented some of the debates concerning the economic valuation of the natural environment.

2.6 New York City and the Catskill Watershed

New York City is a wonderful example of how ecosystem service valuation can be used to have a positive impact on the environment, economy and society. Natural capital valuation when used appropriately is able to effectively inform policy. Essentially, the city was faced with a dilemma: to build a water treatment plant and secure drinking water for residents or to restore and halt development on the surrounding Catskill watershed. It was found through an ecosystem service valuation (replacement cost method)[6] that conserving and protecting the watershed would be a more economical method of providing clean water to residents. The main component of their watershed restoration and management plan was land acquisition. This land was acquired by "…the city in fee, simple title or through conservation easements," (Barten et al, 2000, p.15). The concern of the residents was that there would be a loss in tax revenue because the city would hold so much of this land. This example illustrates the difficulty in appeasing all stakeholders. The city agreed to pay taxes on land under

[6] See section 4.1 for further explanation of the replacement cost method.

conservation easements (Barten et al, 2000, p. 15). This example has been discussed by many people and has become the poster case for natural capital valuation. It shows that despite difficulties in obtaining precise values of nature, such tools can be useful for informing policy decisions and can promote conservation. Protecting watersheds from pollutants is critical to healthy drinking water. Not only is it useful for clean water but even if New York City decides in the future to use a filtration system "…pollution control through watershed management [is] indispensable to the cost effectiveness of filtration," (Barten et al,2000, p. 19). Ecosystem services are thus an indispensable factor that must not be overlooked by decision makers in order to make the best decisions.

Another less well known example of ecosystem service valuation took place in the Mississippi River Valley. Rather than evaluating the benefits of flood prevention, the value of the ecosystem services provided by the river were estimated using costs. In 1993 as a result of the destruction of natural flood protection services, an enormous flood "…resulted in property damages estimated a twelve billion dollars partially from the inability of the Alley to lessen the impacts of the high volumes of water,"(ESA, 2000). More recent efforts to prevent such disasters from reoccurring include vast reforestation of this region. Only about 2.8 million hectares of hardwood forests still exist in the lower Mississippi river valley of an estimated 10 million, and over the last 10 years approximately 77, 698 hectares have been reforested, (Keeland, 1999, p.348). These efforts are attempts to restore ecosystem services like flood protection and wildlife habitat. It is typical that ecosystem services are not appreciated until they are no longer functioning.

The two examples provided in this section illustrate the benefits to human wellbeing provided by ecosystem services. In the first case, clean drinking water is provided to New York City without the large capital costs of water treatment plants. In this case an ecosystem service is providing a direct service that citizens are able to consume. In the later example, the service 'flood protection' is more of

a regulating service that people are more likely to destroy because they do not always notice the direct benefit they are receiving.

3. Chapter 3

In this chapter I provide some specific information about the study area (King Township). I outline some of the census and other data about the study area, the Township of King, and the broader significance of ecosystem services and natural capital to an area like the Township of King.

3.1 Ecosystem Services and their significance

The natural capital in Southern Ontario is most greatly threatened by "…runoff from urban areas, agricultural and sewage plants; soil erosion and sedimentation, and loss of wetlands and riparian habitat to development," (Austin, 2009, p. 4). The Township of King contains many significant landforms that are able to provide flows of ecosystem services. It is thus important that they are effectively valued to prevent their destruction. Their preservation is not only significant to the Township's flourishing, but to the entire Province of Ontario. The Oak Ridges Moraine (ORM) is probably the most popular ecological feature in the Township of King. Less well known amongst the public are the Holland Marsh, the Happy Valley Forest and the manmade Dufferin Marsh. These land features provide valuable services to the Township of King residents and to residents in surrounding areas. The Township falls into Eco region 7E which is the mixed wood plains eco zone also known as the Carolinian forest eco region (Ministry of Natural Resources [MNR], 2007). This eco region has the greatest diversity of species in Canada and also "…the provinces most developed ecological region, with 78% and 7% of the land area converted to agriculture and sub/urban land-uses, respectively,"(MNR, 2007). Approximately 60% of the Holland Marsh is located within the Township Boundaries and is known as the provinces' vegetable basket due to the fertility of the soil, (The Corporation of the Township of King [CorpTwpKing, 2012, p.2). The ORM is a large formation spanning about 160 kilometres and is unique to southern Ontario (ORMLT, 2012). The ORM provides critical ecosystem services in terms of water filtration and provides

water for many streams and rivers. It is known as 'Ontario's Rain barrel' by many. Natural Resources Canada describes the formation of the Moraine.

> About 13,000 years ago, as the Laurentide Ice Sheet melted, glacial meltwater became ponded between the ice sheet and the Niagara Escarpment. This formed a lake basin in which gravel and sand were deposited from ice-bound tunnels. As the ice sheet melted, the ponded lake water drained, leaving the moraine high above the surrounding landscape (Natural Resources Canada [NRC], 2008).

This formation allows for precipitation to soak into and replenish the groundwater systems "…that supply drinking water for over 200,000 people," (NRC, 2008). This formation is quite permeable so water can drain into the sand and gravel and it actually stays there rather than running out over the surface land. It is critical to drinking water and the flourishing of flora and fauna in the area. Appendix 1.3 shows an image of the moraine's formation that is useful for understanding its function.

The Happy Valley Forest plays an important role in preserving biodiversity. This forest also known as King Forest is situated within the boundaries of the Township. It is "…one of the largest remaining intact hardwood forests on the Oak Ridges Moraine," (King.ca, 2011). This forest provides habitat to many bird species including "…threatened hooded Warbler and endangered Acadian Flycatcher and Cerulean Warbler…" (Nature Conservancy Canada [NCC], 2011). This old growth forest provides "…important functions…from fostering complex relationships and dependencies with wildlife, to carbon sequestration and stream projection," (NCC, 2011). It is clear that there are valuable ecosystem services within the Township of King and valuing these may further support the preservation of areas such as the Happy Valley Forest. Currently, approximately 113 hectares of the Happy Valley Forest are protected by the Nature Conservancy of Canada and the long-term goal is to raise enough money to preserve 202 hectares (NCC, 2011).

Since the Township is geographically located near Toronto, land values have increased. Many people desire the suburban natural setting while remaining close to the Toronto core. New companies have located their head offices in the Township of King in order to take advantage of the lower property

taxes while still remaining close to Toronto. The total number of businesses has been increasing in the Township of King. For instance, in 1998 in King City there were approximately 970 people working in 50 firms and in 2009 that number grew to 1350 people working in approximately 95 firms (CorpTwpKing, 2012). This represents an increase in people working in King Township of approximately 39% and an increase in firms located in the Township of King of approximately 90%. This shows that the area in King has become quite desirable and illustrates the threats that the land could be under as population increases.

3.2 The Green Belt Act in the Township of King

The Greenbelt Act was created in February of 2005 and protects 1.8 million acres of valuable agricultural and environmentally significant land around the urban area known as the Greater Golden Horseshoe. The Greenbelt act is a response to the fast rate of urban sprawl occurring in the Greater Toronto and Hamilton Area. The plan aims to curb urban sprawl and intensify development where it is currently located. The ORM is also provincially protected. This policy is to be reviewed every 10 years and so the first review is slated to occur in 2015 while reviewing the Oak Ridges Moraine Conservation Plan and the Niagara Escarpment Plan. Each municipality is to comply with the provincial *Places to Grow Act 2005* (PGA). This act designates certain areas as growth areas and official plans are to be amended to meet urban intensification targets.

The Township of King developed a vision statement in November of 1995 which states:

> The Township of King strives to be a prosperous, vibrant community, proud of its rural traditions and committed to balancing the benefits of accessibility with the values of its natural environment (CorpTwpKing, 2012).

This statement shows that the Township is dedicated to preserving the natural environment and that it is an important part of the Townships' future. This report may be able to identify more environmentally valuable lands to be added under greenbelt protection. In order for the Township of King to grow its

greenbelt area it must submit a formal request to the Ministry of Municipal Affairs and housing. In order for the ministry to consider such requests, the following six criteria must be met:

1) "The request is from a regional, county or single-tier municipal government and is supported by a council resolution…
2) The Request identifies a proposed expansion area that is adjacent to the Greenbelt or demonstrates a clear functional relationship to the Greenbelt area and how the Greenbelt policies will apply…
3) The request demonstrates how the proposed expansion area meets the intent of the vision and one or more of the goals of the Greenbelt Plan…
4) One or more of the Greenbelt systems (Natural Heritage System, Agricultural System and Water Resource System) is identified and included in the proposed expansion area and their functional relationship to the existing Greenbelt system is demonstrated…
5) The municipality must demonstrate how the expansion area supports the goals, objectives and targets of both the Greenbelt Plan and the Growth Plan…
6) The request has to demonstrate that the proposed expansion area will not undermine provincial interests, or the planning or implementation of complementary provincial initiatives… (Countryman, 2008, pp. 4-10).

In order to preserve valuable land areas that could be sensitive to development in the future, the Township could add ecologically important land to the Greenbelt area.

3.3 Demographic profile of King Township

The primary source of the information presented in this section is the 2011 Census data available through Statistics Canada.

3.3.1 Population

According to Statistic Canada's Census 2006 boundary, the Township of King has a land area of 333.30 square kilometers. The population density of the Township is 59.7 persons per square kilometer, compared to the Ontario average of 14.1 persons per square kilometer.

The Population bar graph (Figure 1) provides a visual representation of the distribution of population by age and sex. As illustrated in the bar graph, the Township of King primarily consists of people aged 40 to 80 years. The median age of the population is 41.1 years old. The aging of the baby-boomers may affect

the Township in terms of service provisions. More senior-oriented services may be needed in the future. There is a considerably smaller percentage of the Township's population that falls within the age range of 25 to 35 years.

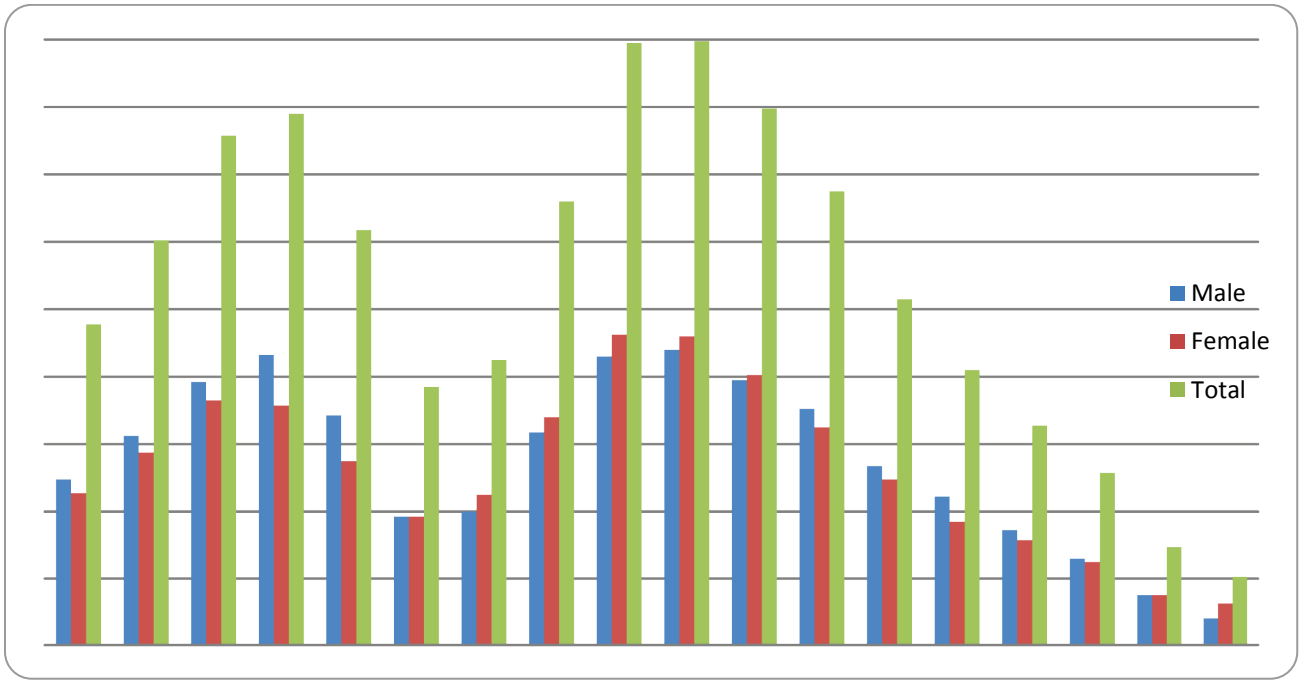


Figure 2: Population bar Graph for the Township of King, 2006, Statistics Canada

The majority of the population (93%) in the Township of King reported English as their mother tongue, while 2% reported French and 5% reported other languages. 6% of the population reported that they spoke something other than French or English regularly in their home.

3.3.2 Population Growth

According to the 2006 Census, the Township of King's reported total population was 19,487, representing a population growth of 5.148% (954 persons) since 2001. This was below the Ontario average of 6.6% and the national average of 5.4%.

3.3.3 Households and Dwellings

The Township of King has a total of 6576 private dwellings, 6395 of which are occupied by usual residents. This means that 97% of dwellings are occupied by usual residents.

In the 2006 Census, households (including married or common-law) with children represented the greatest proportion of all private households with 2725 (43%), followed by households containing a couple (including married or common-law) without children with 2130 (33%). One person households accounted for 860 of the total (13%). Couple households with children accounted for 220 of the total (22%). On average, households have 3 persons in King Township.

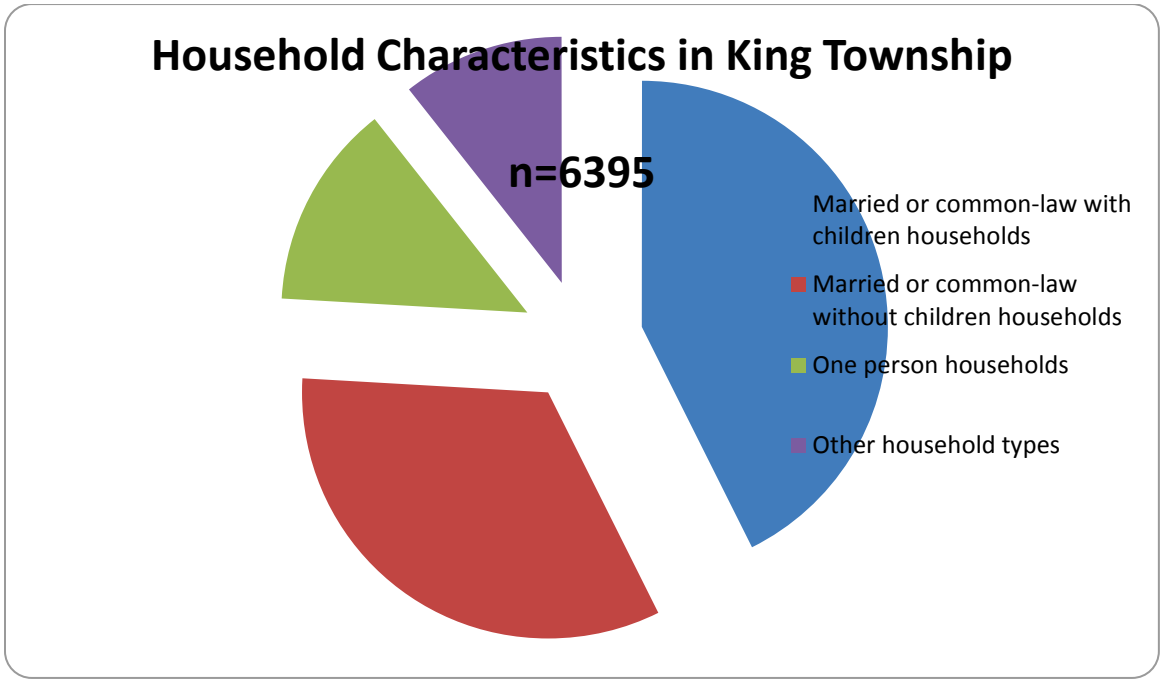


Figure 3: Types of Households in the Township of King, 2006
(Statistics Canada, 2006 Census)

The income characteristics in the Township of King for 2005, according to the 2006 Census, are as follows:

Table 3: Household Income Characteristics in the Township of King, 2005
(Statistics Canada, 2006 Census)

Median Income (2005)	**In 2005 dollars**
All private households	91,762
Couple households with children	122,548

Median Income (2005)	**In 2005 dollars**
Couple households without children	88,349
One-person households	36,256
Other household types	77,449
Median After-Tax Income (2005)	
All private households	76,158
Couple households with children	99,447
Couple households without children	74,196
One-person households	30,181
Other household types	63,692
Median monthly payments for rented dwellings	951
Median monthly payments for owner-occupied dwellings	1,158

Table 4: Dwelling Characteristics in the Township of King, 2006
(Statistics Canada, 2006 Census)

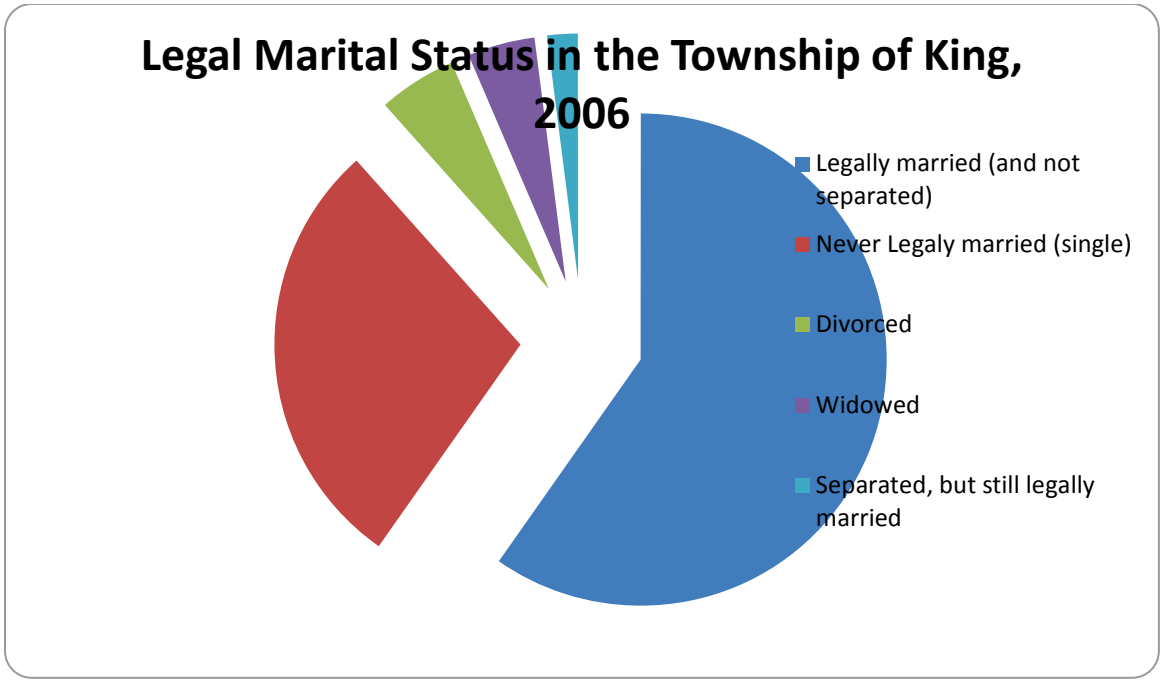
Housing Characteristics		
Number of owned dwellings	5,620	88%
Number of rented dwellings	780	12%
Total private dwellings occupied by usual residents	6395	(100%)
Dwellings requiring major repair - as a % of total occupied private dwellings	6.5	
Average number of rooms per dwelling	8.5	
Dwellings with more than one person per room - as a % of total occupied private dwellings	0.4	
Average value of owned dwelling ($)	$623,223	

Housing Characteristics		
Number of dwellings constructed before 1986	4,640	(73%)
Number of dwellings constructed between 1986 and 2006	1755	(27%)
Total number of dwellings	6395	(100%)

3.3.4 Marital Status

The majority of the population 15 years and over in the Township is legally married (60%) while the next largest percentage are single and have never been legally married (29%). Divorcees and widows make up the next largest group with 9% total, or 5% and 4% respectively. A small percentage of the population (1%) is separated, but still legally married. Of the widowed population, 520 are female and 180 are male. Of the divorced population, 405 are male and 405 are female.

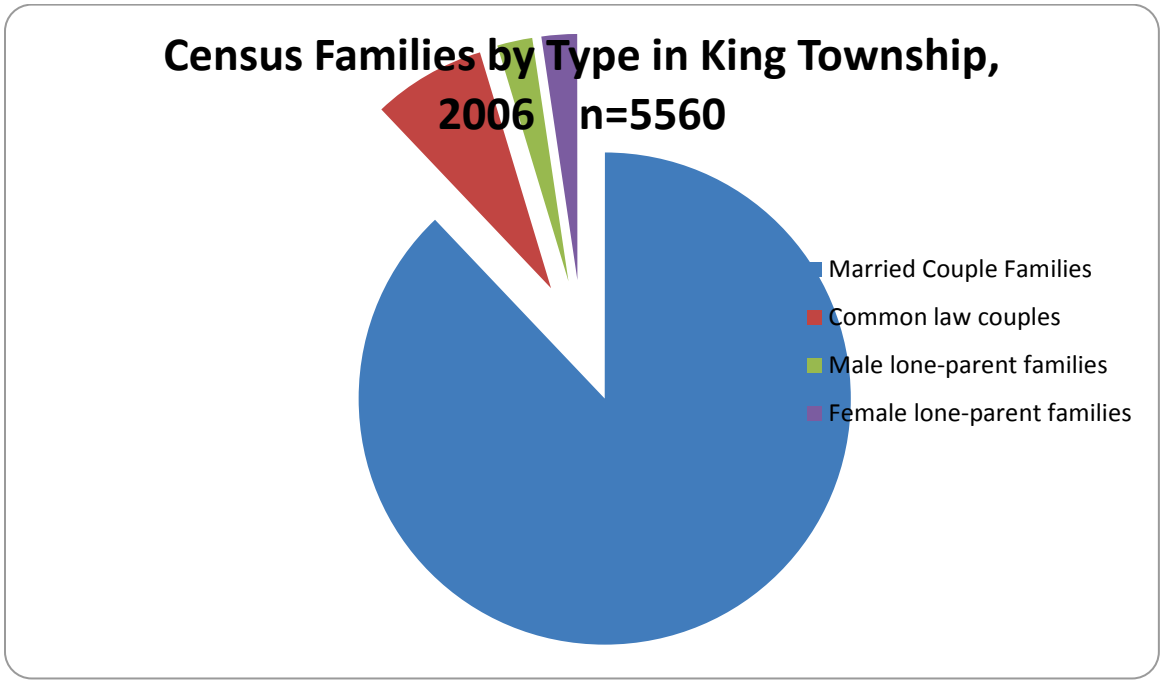
Figure 4: Legal Marital Status in the Township of King, 2006
(Statistics Canada, 2006 Census)



3.3.5 Families

The Township primarily consists of married-couple families with 4,680 families, while there are 396 common-law families and 485 lone-parent families. The average number of persons in all census families is 3.2. Married-couple families have an average of 3.3 persons, common-law couple families have an average of 2.5 and lone-parent families have 2.6. The median 2005 income for all census families was $ 99,630. Married-couple families made more than common-law couple families with a median of $107,211 compared to $75,263. Lone-parent families made considerably less with a medium income of $57,696 in 2005.

Figure5: Census Families by Type in the Township of King, 2006
(Statistics Canada, 2006)



3.3.6 Aboriginal Peoples& Visible Minorities

1.1% of the total population in the Township of King self-identified as Aboriginal in the 2006 Census. Visible minorities make up a small percentage of the Township's population; only 5% self-identified as a visible minority. This compares to a provincial average of 22.8% self-identifying as a visible minority.

3.3.7 Education Levels

About a fifth of the Township's population over the age of 15 (18%) have not earned a certificate, diploma or degree. Females slightly outperform males in terms of acquiring a high school certificate or equivalent. The largest number of post-secondary educational attainment in the Township after a high school certificate or equivalent is represented by attainment of a university certificate, diploma or degree.

Figure 6: Educational Attainment by Gender in the Township of King of the total population 15 years and over, 2006
(Statistics Canada, 2006 Census)

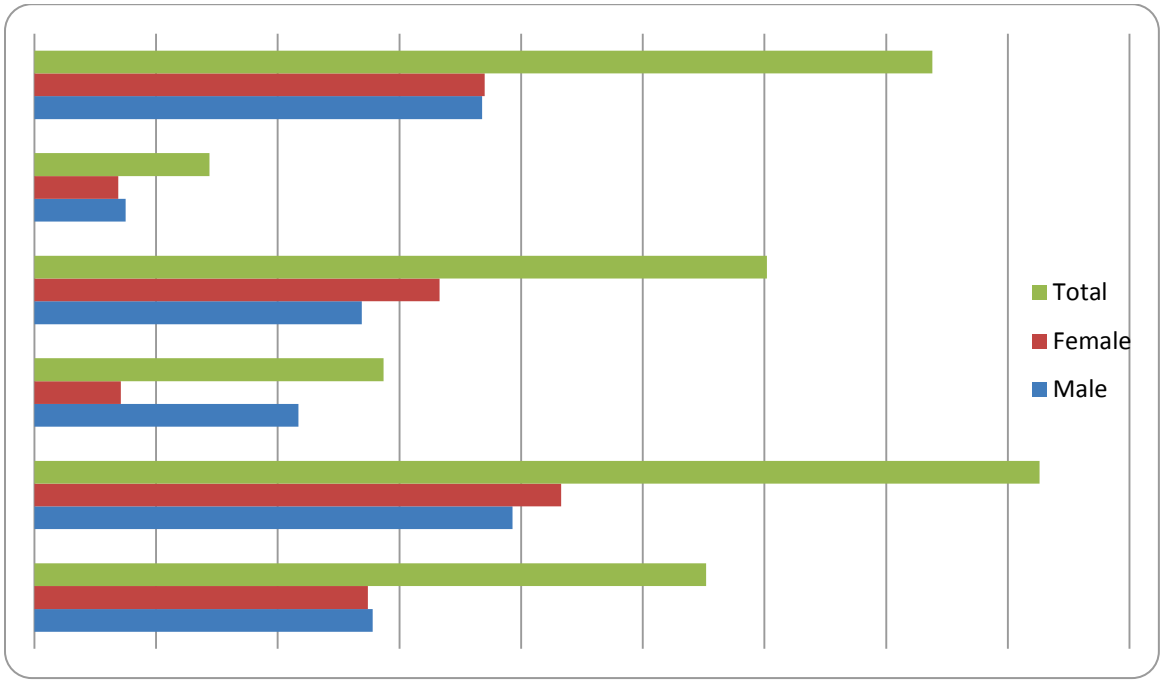
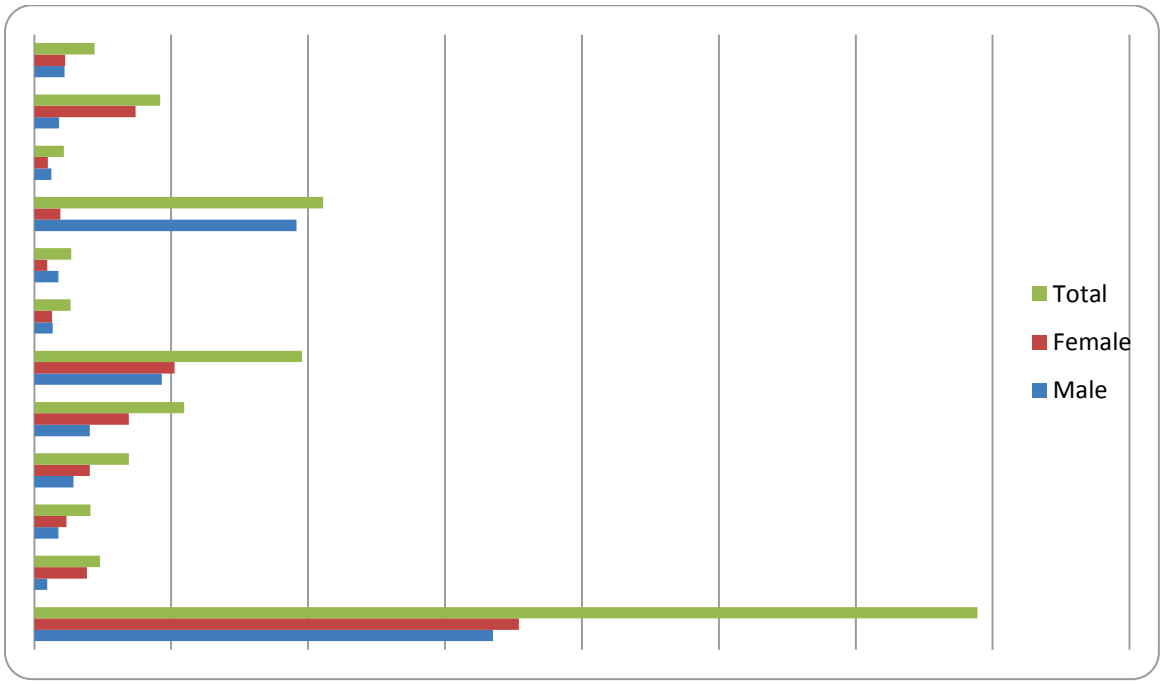


Figure 7: Major Field of Study in Post-Secondary School by Gender in the Township of King, 2006
(Statistics Canada, 2006 Census)



3.3.8 Employment

The percentage of the total population 15 years and over in the Township of King that is in the labour force is 73%, 95% of which are employed. The labour force employment rate is 73% and the average unemployment rate is 4.5% (4.4% for males and 4.8% for females). The following is a summary of the persons employed in each occupation by gender. The occupations with the highest employment levels are business, finance and administration occupations followed by management occupations and sales and service occupations.

Table 5: Occupation by Gender in the Township of King, 2006
(Statistics Canada, 2006 Census)

Occupation	Male	Female	Total
Trades; transport and equipment operators and related occupations	1460	75	1535

Sales and service occupations	1,015	1,095	2,104
Management occupations	1,495	620	2,115
Business; finance and administration occupations	600	1,655	2,255
Occupations unique to processing; manufacturing and utilities	155	95	250
Natural and applied sciences and related occupations	510	140	650
Health occupations	110	370	480
Occupations in social science; education; government service and religion	245	535	785
Occupations unique to primary industry	525	230	755
Occupations in art; culture; recreation and sport	130	285	420
Total experienced labour force 15 years and over	**6,255**	**5,105**	**11,360**

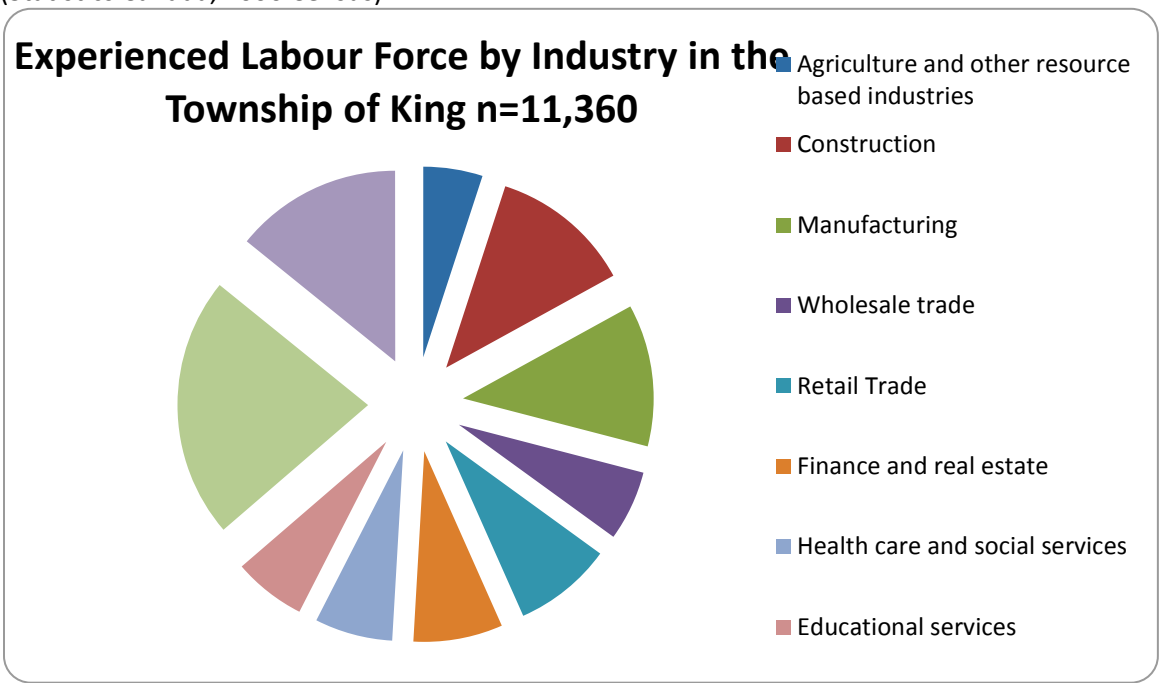
Of the total employed labour force (15 years and over) in the Township, 13% work from home and 74% work at a usual place, with 1080 people (13%) working within the Township, 3170 people (39%) working outside of the Township but within York Region, 3835 people (47%) working outside of York Region and 25 people (0.3%) working in a different province. This trend illustrates that King Township residents that work at a usual place are commuting outside of the Township.

Table 1: Unpaid Work in the Township of King, 2006 (Statistics Canada, 2006 Census)

Unpaid Work by the Numbers	**Male**	**Female**	**Total**
Population 15 years and over reporting hours of unpaid work	7,195	7,320	14,515
Population 15 years and over reporting hours of unpaid housework	7,080	7,265	14,345
Population 15 years and over reporting hours looking after children without pay	2,845	3,410	6,255
Population 15 years and over reporting hours of unpaid care or assistance to seniors	1,370	1,850	3,215

Figure 7 below identifies the number of experienced labourers by industry in the Township of King in 2006. Among the largest number of identifiable industries are business services (2,515), Construction (1,360) and manufacturing (1,370).

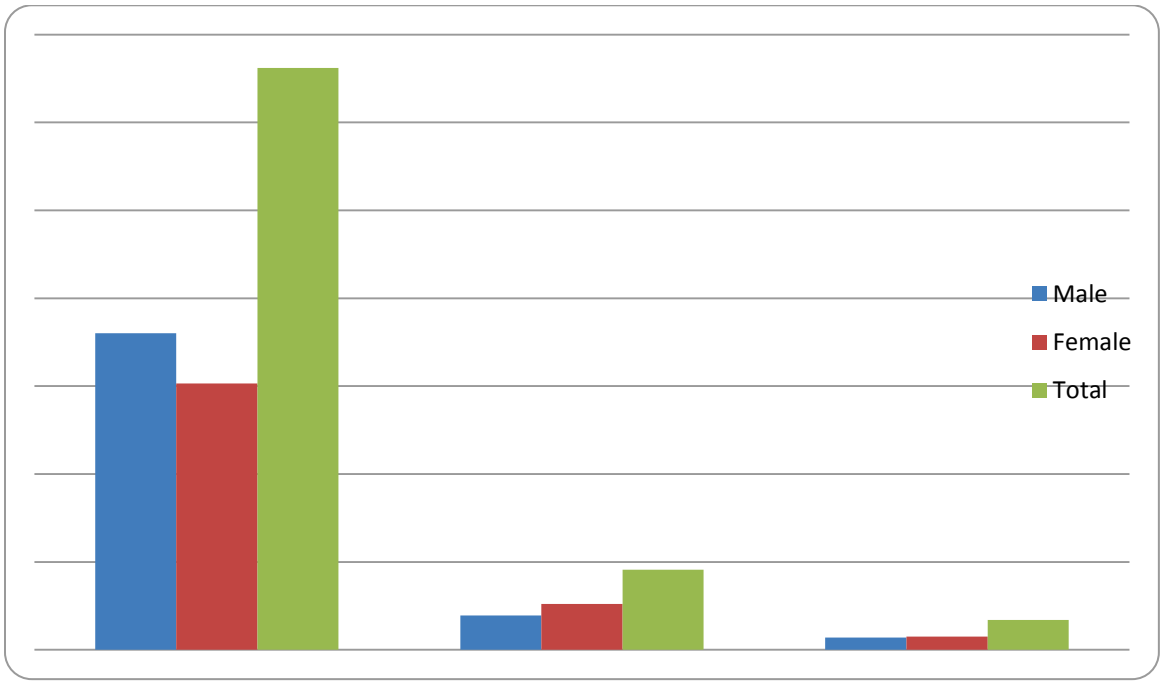
Figure 8: Experienced Labour Force by Industry in the Township of King, 2006
(Statistics Canada, 2006 Census)



3.3.9 Immigration, Citizenship and Generation Status

Immigrants account for 20% of the Township's total population. ***Figure 7*** illustrates the distribution of that 20% (3,915 persons) by period of immigration.

Figure 9: Immigration by Period in the Township of King, 2006
(Statistics Canada, 2006 Census)



Only 3% of the populations in the Township are not Canadian Citizens. A small majority of citizens (43%) in the Township are 3rd generation or more, while 32% are 2nd generation citizens and 25% are 1st generation.

3.3.10 Income

According to the 2006 Census, the median income for all persons 15 years and over in the Township of King was $34,122 while the median income for females was $27,725 and $40,825 for males. Looking at the composition of total income, earnings accounted for 79, 7% of the total, while government transfers and other money sources contributed to 4.4 and 15.8 percent respectively. This represents a considerable difference from the provincial average of 77.4% earnings, 9.8% government transfers and 12.9% other money sources of total income. Also, of all persons in private households in the Township, 5.4 % of people fall into the low-income category before taxes, while 4.0% are considered low-income persons after tax. These percentages are considerably lower than the national averages of 14.7% before tax and 11.1% after tax.

Table 7: Income Characteristics in the Township of King, 2005 Income
(Statistics Canada, 2006 Census)

Income Characteristic	Male	Female	Total
Persons 15 years and over with income (counts)	6,505	5,525	12,030
Median income - Persons 15 years and over	$40,825	$27,725	$34,122
Median income after tax - Persons 15 years and over	$34,784	$24,814	$29,703
Composition of total income			
Earnings - As a % of total income	82.1	74.6	79.7
Government transfers - As a % of total income	3.0	7.3	4.4
Other money - As a % of total income	14.8	18.1	15.8
Total	100%	100%	100%
Income status of all persons in private households (counts)	9,855	9,490	19,345
% in low income before tax - All persons	5.0	5.8	5.4
% in low income after tax - All persons	3.9	4.2	4.0
% in low income before tax - Persons less than 18 years of age	5.3	6.3	5.8
% in low income after tax - Persons less than 18 years of age	4.8	4.3	4.5

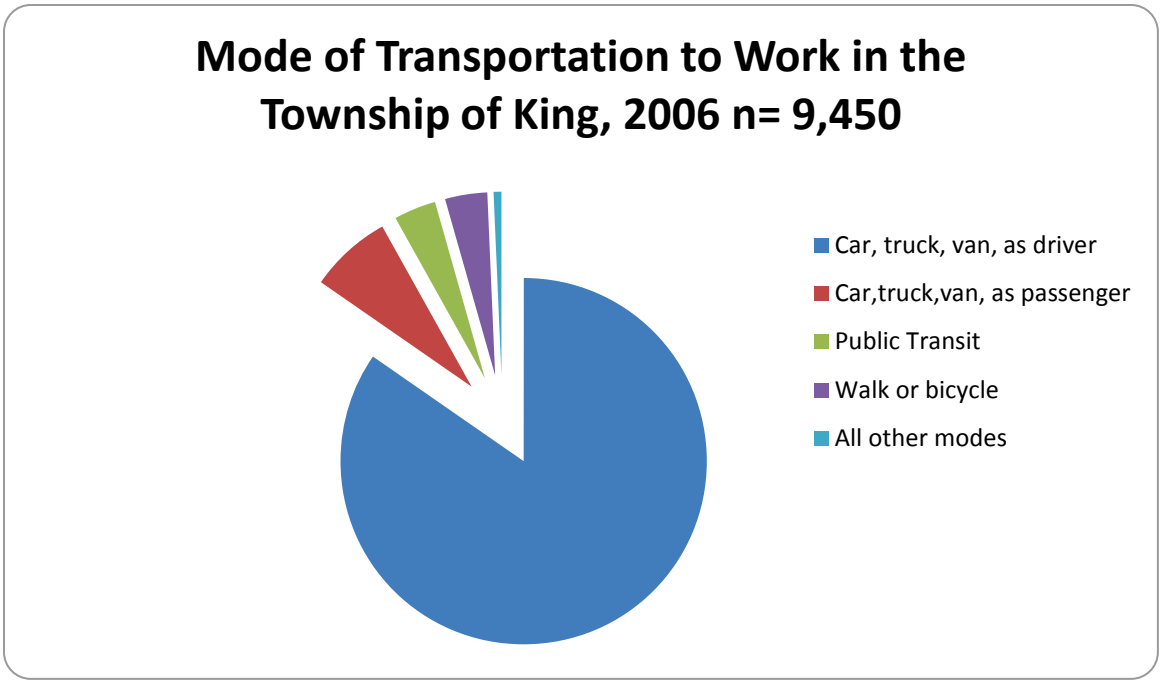
3.3.11 Mobility and Migration

The Township remained rather settled between the 2001 and 2006. Over 71% of the Township's population lived at the same address in 2006 as they did 5 years before. Similarly, 93% of residents lived at the same address one year before the 2006 Census. For the most part, people migrated from other municipalities within the province to the Township. A smaller number of people moved within the Township to another address.

3.3.12 Mode of Transportation to Work

the personal automobile is the primary mode of transportation for the employed labour force in the Township of King; 7,995 people (85%) drive to their regular place of work and 685 (7%) commute as a passenger, accounting for a total of 92%. Meanwhile, 350 (4%) people use public transit, 350 (4%) people walk or bicycle to work and 65 (2%) people use other modes of transportation such as taxi services.

Figure 10: Mode of Transportation to Work in the Township of King, 2006
(Statistics Canada, 2006 Census)



Source: *Statistics Canada. 2007. 2006 Community Profiles. 2006 Census.Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Released March 13 2007.http://www12.statcan.ca/census-recensement/2006/dp-pd/prof/92-591/index.cfm?Lang=E*

3.4 Land use and Recreation in the Township of King

The Township of King has many recreational opportunities available for visitors and residents. The more popular recreational activities according to responses of a community group survey are as follows: Figure Skating Club, Curling Club, Basketball Association, tennis Club, Theater Arts/Drama, Scouts, Lions club, Historical society, Caledon Hill Bruce Trail Club and the King City Bridge Club. These are of course organized recreational activities. An issue identified in the Parks and Recreation Master plan is that the youth is more frequently looking to drugs, alcohol, gangs and vandalism for amusement,(RethinkGroup, 2004, p.1-2). This sort of trouble is seen increasingly around the country and can be combated with increased opportunities for outdoor recreational activities. Appendix 1.2 illustrates a map of the parks and recreation master plan existing parks and open spaces. According the Parks and Recreation Master Plan, the main suppliers of

> "…publicly accessible open space include:
>
> - Township of King (Parks and recreation/nature oriented municipal open spaces that have not been classified as parkland)
> - York Region District School board
> - York Catholic District School Board
> - Seneca College – King Campus
> - Toronto and Region Conservation Authority
> - Lake Simcoe Region Conservation Authority
> - Region of York
> - The commercial recreation/tourism sector and
> - Others (non-profit, other education, other institutional (Rethinkgroup, 2004, p.2-10).

The Toronto Region Conservation Authority owns 440.24 hectares of land in King Township. The cold Creek Conservation Area and Humber trails Conservation Area "…have been named and the Authority encourages public use of these sites," (RethinkGroup, 2004, p.2-13). The Lake Simcoe Region

Conservation Authority owns 232.27 hectares of land that comprises about nine areas mainly in the north part of the township (RethinkGroup, 2004, p.2-13). Seneca College owns a 282 hectare area that includes "…wooded areas, lakes and fields, and comprises the second largest institutional open space site in the Township (after Mary Lake Monastery…)," (RethinkGroup, 2004, p.2-13). The college offers a range of sports and self-improvement programming that is not only available to the students at the school but to the community at large, (RethinkGroup, 2004, p.2-13). There are also areas as stated owned by private commercial and tourist interests.

3.5 Threats to Natural capital in the study area

The Millennium Ecosystem Assessment identifies both direct and indirect drivers of ecosystem changes. For instance, "The MA categories of indirect drivers of change are demographic, economic, sociopolitical, scientific and technological, and cultural and religions," (MEA, 2005, p. 74). The following is a list of some drivers of ecosystem change experienced in the study area.

Urban intensification

The demand to build both residential and commercial buildings has increased. Part of the reason for this demand is "…more white collar jobs [are] relocating out of the center of the GTA and into the deep end of 905,"(Raymaker, 2007). As jobs relocate out of the center of the GTA so too do employees. Workers tend to move closer to their place of employment because this implies less commuting and is generally more convenient. In this way, demand is created for housing while businesses move out of the GTA. Additionally, the aesthetics of the land adds substantial value for homeowners. For instance, "York Region still has…peaceful scenery, woodlands and vast open spaces with close proximity to an array of 400 series highways,"(Raymaker, 2007). This shows why developers are eager to tap into the consumer demand for the natural environment. Developers use images of the natural setting to market the new communities being built in the undeveloped areas. In the same way, businesses like salons and

spas use the natural setting of the moraine to market their services. For instance, the "…rustic setting just an hour north of the city atop the ORM,"(Chow, 2007). This exemplifies how land developers and businesses alike have begun to commodify the natural setting. The natural setting adds value to the land for development because if an area is believed to poses "…better amenities in terms of natural features (lakes, views from heights…this land will have substantially higher value," (Muller,1976, p.125). From this discussion it is clear both the natural environment and the close proximity to the GTA adds a great deal of value to the land and thus increases the development pressures in this area.

Global climate change

Climate change is a global environmental issue, of which many people around the world are becoming aware. It is perhaps the biggest issue that has caused this increased consciousness of our personal and environmental health. Climate change has shown us that our actions have consequences and the earth has limits. We should no longer simply continue to take resources from the earth as if they were unlimited. Those who emitted the most greenhouse gasses or those who have consumed the most trees and reduced the earths' capacity to sequester oxygen have not paid for their use of these services monetarily. The cost of this is simply *externalized* and bore by society as a whole. With respect to climate change, the global North has caused much of these environmental problems and has benefitted economically. The global South must deal with these issues despite the fact that they were not responsible for the destruction.

Waste and pollution

The Holland marsh is heavily polluting the watershed and ultimately Lake Simcoe, due to all the agricultural fertilizers currently in use. As stated in a paper published by the Friends of the Greenbelt Foundation the "…Holland marsh is foremost a Marshland, its drainage for agricultural use has left it with a number of severe environmental issues,"(Bartram et al, 2007, p. 13). The organic black soil that is

characteristic of the Marsh, has a highly absorptive property. This ends up polluting the watershed in the area because all the chemical fertilizers soak into this soil. As the soil degrades, there are declining agricultural yields. Currently "…the Marsh produces over $1 billion of revenue annually from its various crops, making it a critical part to Ontario's agriculture,"(Bartram, 2007, p. 4). The environmental properties that have made this land so economically valuable to the agricultural sector are being depleted. This makes it difficult to know if production could be sustained into the future. Also the maintenance of the canal system has been maintained very poorly making the farmers very susceptible to natural disasters. For instance,

> …a 100 year storm could cause up to $84 million in damage to local farmers and businesses alone, increasing to as much as $200 million when associated food processors, transportation companies and a rise in province-wide vegetable costs are taken into account. If the soil was saturated during a sever rainstorm the canals could easily be overwhelmed, inundating the dykes again flooding the 7,000 acres of farmland, (Bartram et al., 2007, p. 4).

Since the Marsh represents such an economically productive part of the agricultural economy in Ontario and because these ecological services are provisionally important to Ontario it is important to practice sustainable farming methods to ensure the long term viability of the Holland marsh.

3.6 Natural capital valuations and Businesses

Small and large businesses alike play a large role in contemporary society. Many aim to increase their profits without any regard for the natural environment. In the book 'Getting to Scale: Growing your Business without selling out' (2009) Jill Bamburg gives countless examples of businesses that have been able to help the natural environment while producing a profit at the same time. Bamburg gives good examples of companies that have managed to balance both objectives (profit and environment). American Apparel is an example of a clothing company that moved its operations to America where most people thought it was impossible to compete. The Vice President of operations "…came to the conclusions that if somebody had the right business model, they could be very successful [as a domestic

manufacturer]- in some cases, just cleaning up what everybody else has screwed up,"(Bamburg, 2006, p. 92). Moving operations to a domestic market is more socially responsible in the sense that everyone is getting paid fair wages. It is also more environmentally conscious because the distance clothing is travelling to market is significantly reduced.

Ecosystem service valuation can be a tool used by values driven businesses to conduct cost benefit analysis and be able to make more informed responsible decisions. In recent times, there has been a shift for companies to become more socially and environmentally responsible. This demand has come out of the increasing public knowledge of dwindling environmental resources and a general higher level environmental consciousness. As a result, businesses have had to respond with 'greener' products with smaller eco-footprints. Sustainability is not an absolute term. This means that there are different levels of sustainability and that one organization can be more sustainable than the other. 'Green washing' presents a major obstacle to identifying sustainable organizations. Its very nature is to fool consumers, investors etc. into believing that the organization is dedicated to a certain level of environmental protection when in fact it is pursuing economic gain from capitalizing on certain consumer markets. Green washing is slowing down environmental progress because it is resulting in consumer backlash. Consumers are beginning to lose faith in marketing and sometimes opt for regular products since they are weary of green claims. Five consumer groups have been identified: True-blue greens, greenback greens, sprouts, grousers and basic browns,(Baumann et al, 2007,p.569). Of these consumer groups listed above, the true-blue greens are those that are most dedicated to the environment and the basic browns are those who are unconcerned about the environment. The Greenback greens are concerned about the environment and tend to usually be young parents. They will pay more for green products or green packaging. This group is targeted heavily by organizations with green washing. Organizations are able to capitalize on this groups desire to contribute positively to the environment by marketing products as 'green' when in fact they are similar if not identical to

conventional products. The characteristics of the most likely to engage in green consumer behaviour appear to be "…females, young people and people with a relatively high education and income…"(Baumann, 2007, p. 569). Natural capital valuation and ecosystem service valuation is a tool that can not only be used by governments but by businesses to help mediate the potential impacts of their operations.

In some areas, natural amenities like lakes have important economic implications for an area. Protecting the integrity of a natural amenity can be economically important. A 2010 study determines the economic impact of beaches on the Lake Huron Shoreline. This study surveyed over 500 people onsite of Huron Beaches. Respondents filled out a check-box questionnaire. The study showed that the "…health of the beach was a key factor in their satisfaction,"(Dodds,2010, p. 5), and also has a positive economic impact on the community. It is economically beneficial for Huron (and similar areas) to preserve the natural amenities that attract tourists to their jurisdiction. The majority of local spending was for lodging and food and beverage. The main purpose of visitors' trips was centered on the beach. Lake Huron could weigh the positive economic impact of a healthy beach against alternative uses. In this way, natural capital valuation can be a worthwhile undertaking.

This section has shown that businesses can also make money when the environment is being conserved. Values driven businesses can use natural capital valuation and present this information to appeal to environmentally conscious consumers. Small towns and businesses can economically benefit more than initially thought as has been shown in the study conducted in Huron. Using natural capital valuation as a tool to inform businesses and townships can result in increased economic activity that can also help the environment. In this way, businesses need not necessarily harm the environment while pursing profits.

4. Chapter 4

This chapter discusses the possible approaches that can be used when undertaking the task of environmental valuation. It also provides some critiques of certain valuation methodologies. I specifically discuss the methodology that I used to value the study area. The different land type classifications that were used are discussed. Also indicated are the ecosystem services valued in each category of land cover. The results of the valuation in the Township of King are provided in this chapter.

4.1 Value transfer or benefits transfer method and natural capital valuation methodologies

There are many methods of valuating natural capital and depending on the situation certain methods are more or less appropriate. Valuing natural capital is easy when something has a direct market value. The difficulty arises in natural capital valuation due to the fact that so much natural capital does not have a market price. The following tools outlined in this section have been developed to value all types of natural capital with or without a market value. No primary valuation research has been undertaken for King Township. All the data has been transferred from other similar regions. The SOLRIS data provides a large 'undefined' area. This paper uses the value transfer or benefit transfer method. This method relies on other studies with a similar geographic and socio-economic context. This is quite common for Canada since very little primary valuation studies have been completed with the best studied ecosystems being wetlands. The values used in this paper have been transferred from the study *Estimating Ecosystem Services in Southern Ontario* by the Spatial Informatics Group. This method allows the user to utilize information already generated and thus requires less work and funding than that required by primary valuation studies.

Primary valuation requires a great deal of both time and money. Primary valuation methodologies consist of contingent valuation, hedonic pricing, travel cost method, factor income method and the replacement cost method. The article 'Pricing Nature' warns that "replacement cost

and avoided cost methods should be used with care, as they tend to overestimate ecosystem service values," (Barbier, 2011, p. 349). Boumans et al. (2002) identify that there is a relationship between which ecosystem function is being valued and the preferred method that is being used. For instance, regulating functions would use indirect valuation techniques like avoided cost and replacement cost methods. Habitat ecosystem functions and provisioning services would use direct market pricing valuation methodologies. Finally the authors state that information ecosystem functions would use the contingent valuation method (Boumans et al., 2002). The importance of knowing and understanding the functions of an ecosystem before it is possible to analyze the value of the goods and services is evident. Contingent valuation is a method where respondents are asked how much they would be willing to pay for ecosystem services and natural capital. The hedonic pricing method estimates "…economic values for ecosystem or environmental services that directly affect market prices," (King et al, 2000). An example of hedonic pricing can be seen in the pricing of a car. The price of a car depends on its characteristics by "…looking at how the price people are willing to pay for it changes when the characteristics change," (King et al, 2000). The travel cost method of valuation is used "…to estimate economic use values associated with ecosystems or sites that are used for recreation."(King et al., 2000). The basic idea of this method is that "…the time and travel cost expenses that people incur to visit a site represent the 'price' of access to the site. A person's willingness to pay to visit the site can be estimated based on the number of trips that they make at different travel costs."(King et al., 2000).[7] The amount of money a person is willing to pay to visit a natural resource represents "…the 'income' the person is foregoing as a result of not working," (Lee, 2000, p. 308).The factor income method uses the market prices of a product where natural resources are used in the production process. This method "…can be used if the injured resource is an input to a product that has a well-defined market price. If the injury to the resource adds an additional step to the production process, the cost of this step would be equal to

[7] This method was used in the economic valuation of the Huron Lake shore and more information regarding the practical application of this method can be obtained from that study.

the compensable value," (Lee,2000, p.307). Replacement cost is a cost method that estimates how much it would cost to reproduce the ecosystem service. Sustainability for the water filtration services provided by wetlands would be valued using the replacement method by comparing the costs of restoring a wetland to building and operating a water filtration treatment plant. The data that was used in this report relies on the value transfer or benefits transfer method whereby "…valuation information generated from related research for sites which are similar in context to the policy site was applied," (Bagstad, 2009, p. 1).

Author Kathleen McAfee (1998) criticizes valuation methodologies. For instance, she does not believe the willingness to pay method to be a good representation of value. She states,

> It is simply not meaningful to weigh the amount that a professional earning $60,000 a year is 'willing to pay' for the continued existence of a tropical ecosystem against the 'willingness to accept compensation' for the loss of his or her ancestral homeland of a resident tin that same ecosystem who has little or no cash income and a vastly different world view, (McAfee, 1998, p. 139).

This quotation illustrates how there can be conceptual differences in peoples understanding of value. Willingness to pay is often not a useful estimation of value. The Millennium Ecosystem Assessment suffered from data inaccuracies. They acknowledge that the data and accuracy of information for this project was distributed unevenly throughout different geographic regions. This is because information on cultural and regulating services is not usually measured in parts of the world which makes this data increasingly susceptible to the downfalls associated with data extrapolation.

4.2 Study Approach

In order to value the natural capital in the Township of King, the land cover in the study are must be ecologically classified. This paper values ecosystem services by ecological land cover type. Geographic information systems and SOLRIS data were used to determine the land cover classification of the Township.

The ecosystem services and natural capital valuations in the Township of King have been estimated using the benefit transfer approach. The study area has been confined to the municipal boundaries of the Township of King. It is important to understand that ecosystem services and their benefits are not usually (if ever) bound to a geographic location and are dependent on the interdependent systems around arbitrary municipal boundaries. The values of natural capital used in this study cannot be assumed to be valid in perpetuity. As land is developed in the Township, natural capital becomes increasingly scarce and thus becomes more economically valuable. The natural capital value of King Township should be reassessed as land uses in the Township change. When considerable land composition changes in and around the Township valuation should be reattempted.

4.3 Land cover classes and use in this analysis

The Southern Ontario Land Resource Information System (SOLRIS) was used in this report in conjunction with the land cover values determined by the Spatial Informatics Group 2009 for the Ministry of Natural Resources.

Table 8 Each land type in the Township of King is listed below in the SOLRIS KEY CODE

27	Forest
28	Coniferous Forest
29	Mixed Forest
30	Deciduous Forest
36	Plantations – Tree Cultiv
37	Hedge Rows
42	Transportation
43	Extraction
44	Built-up area Pervious
45	Build-up Area Impervious
50	Swamp

55	Fen
59	Bog
63	Marsh
66	Open Water
99	Undifferentiated

Table 9 Land cover typology utilized by the Spatial Informatics Group

Code	Class Name	Class Description
11	Agriculture	Areas suitable for row crops outside of designated urban areas
12	Grassland/pasture/hayfield	Likely areas for pasture or hayfields, or identified native grasslands outside of urban areas
21	Forest:non-urban	Area of tree cover located outside of designated urban, suburban, riparian or hedgerow areas
22	Forest: urban	Areas of tree cover located in designated urban areas
23	Forest: suburban	Areas of forest cover located in designated suburban areas
24	Forest:adjacent to stream	Areas of forest cover located within 30 meters of the banks of 2nd order or greater streams, excluding urban/suburban areas
27	Forest: Hedgerow	Forested belts located along the margins of agricultural fields
31	Urban Herbaceous greenspace	Herbaceous open space in designated urban areas
41	Open water: river	Areas of open water within the banks of 4th order or greater rivers
42	Open water: urban/suburban river	Areas of open water within the banks of 4th order or greater rivers and streams that are also located in designated urban or suburban areas

43	Open water: inland lake	Perennial inland lakes and reservoirs, not including the Great Lakes or Lake St.Claire
44	Open water: great lake nearshore	Nearshore zones of lakes Erie, Ontario and Huron to the international border, in addition to all of Lake St.Clair to the international border
45	Open water:estuary/tidal bay	Areas of Great Lakes forming significant embayments, estuaries or coves
51	Wetlands: non-urban, noncoastal	Wetlands, bogs, marshes, swamps and fens excluding those urban/suburban areas and those considered coastal
52	Wetlands: urban/suburban	Wetlands, bogs, marshes, swamps and fens in urban/suburban areas, including those considered coastal
53	Wetlands: Great Lakes coastal	Wetlands, bogs, marshes, and fens designated by the client as coastal but not located in urban/suburban areas
61	Beach	Open and treed sand barrens/dunes located within 1km of the coast.
62	Beach near structure	Sandy beach along the shore of a great lake, with approximately 200 meters of structures
63	Beach not near structure	Sandy beach along the shore of a great lake, not within 200 meters of a structure
197	Undifferentiated: poor agricultural potential	Land undifferentiated by SOLRIS with no known agricultural potential
198	Other unvalued terrestrial	All remaining types of land for which no valuation exists
199	Unvalued aquatic	All remaining types of surface water for which no valuation exists

4.4 Study Limitations

In general, a lack of understanding of how ecosystems function (due to their intricate interdependencies) severely impairs the accuracy of any natural capital valuation (including this one).

There is also a threshold of natural capital required for an ecosystem to exist. This issue is discussed by Josh Farley (2008) an associate professor at the University of Vermont. As the natural environment degrades and approaches the critical threshold for its survival, the value of the land approaches infinity. He gives the example of a tropical rainforest where studies suggest that if "…as little as 30 percent of the total forest cover is lost, enough water will be drained from the system that it will no longer be capable of spontaneously regenerating itself,"(Farley,2008, p. 2). This illustrates the difficulty of valuing this ecosystem by hectare. What if the removal of one more hectare flips the ecosystem? How can it be known which hectare will cause the system to flip. This hectare would surely be more valuable than the hectare removed before it. He asks "…when marginal activities may cause non marginal outcomes, how do we apply marginal valuation?"(Farley, 2008, p.2). This really calls into question the way that natural capital is being valued. Since, this threshold is frequently unknown decision makers ought to carefully consider this fact when embarking upon land use decisions. A suggestion for how the environment can be regulated by the economy is to set caps within a limit of usage rather than allowing the free market to dictate resource usage. Farley states "…rather than using prices (economic signals) to determine the appropriate level of resource use, it would be much simpler and more compatible with free markets to fix supply based on ecological factors (set up a cap) and allow supply to determine a price,"(Farley,2008,p. 4) rather than the other way around. The values offered in this study should be considered minimum values for the following reasons:

- the limitations of the undefined data
- the critical thresholds of all ecosystems are unknown, and
- nature has an infinite value to humans as it supports all life.

It is also possible to note that due to the complexity of the natural world, it is not possible to fully value and account for every ecosystem service that exists because they are not always known and relationships between services and capital are not always clear to researchers.

4.5 Value of Natural capital in the Township of King

This section provides the results of the valuation exercise performed for this major research paper.

Land cover classification comparison

MNR Report Land Cover Categories	**SOLRIS Land Cover Categories**	**Application of Values to the Study Area (King Township)**
Agriculture -290.99 Grassland/pasture – 353.36	Undifferentiated 21,101	Agriculture values were applied to SOLRIS aggregated area
Forest: non-urban 4,443.49 Forest: urban 25,842.77 Forest: suburban 14,766.65	Forest-344 Coniferous Forest-544 Mixed Forest-2234 Deciduous Forest-1876	Average value of forest: non-urban, urban, suburban (weighted by area) applied to SOLRIS aggregate area.
Forest: hedgerow 1,023.02	Hedge Rows-472	Forest: Hedgerow values were applied to SOLRIS hedge row area
Urban herbaceous greenspace 43,787.77	Built-up Area Pervious-632	Urban herbaceous greenspace values applied to SOLRIS built-up pervious area
Unvalued aquatic-0 Open water: river-55,553.16 urban/suburban river- 236,391.78 inland lake-5,049.90 great lake nearshore- 794.52	Open Water-260	Average value of open water: river, urban/suburban, inland lake, unvalued aquatic were applied to SOLRIS open water area
Wetlands: non-urban non coastal, 15,171.44 urban/suburban (161,420.22)	Swamp- 2410 Fen-24 Bog-2 Marsh-331 Total Hectares = 2767	Average value of wetlands: non-urban/non-coastal, urban/suburban were applied to SOLRIS aggregated area (swamp, fen bog, marsh).
Other Unvalued Terrestrial – 0	Built up Area- Impervious-1234 Transportation-1037 Extraction-42	Average Value of Unvalued Terrestrial were applied to SOLRIS aggregate area (by weight)

A few MNR categories were not included in this table as they were not relevant to the Township of King study area. Some categories were combined into a general category as can be seen in the table. Wetlands for example aggregated swamps, fen bogs and marshes into a general wetland category.

4.6 Findings of the research paper

Natural capital value estimates by land cover for the Township of King

Land Cover	**Area (in Hectares)**	**Total Value Estimate(CAD $ per Year)**
Agriculture	21,101	6,799,214
Forest	4998	75,058,114
Hedge Row	472	482,865
Urban Herbaceous	632	27,673,870
Open Water	260	77,425,233
Wetlands	2767	488,645,725
Unvalued Terrestrial	2313	0
Total		**676,085,021**

Wetlands, open water and forests account for the highest natural capital values as they provide most of the ecosystem services. The information for Wetlands is also the most complete since more studies have focused on this type of land cover and ecosystem and it is perhaps for this reason that it typically represents the highest value in similar papers.

4.7 Ecosystem service by natural capital

The following indicates the types of ecosystem services that were valued in each category of land cover. This is not necessarily exhaustive and that is why the estimates of this paper represent the lower end of

possible value. The following information has been obtained from the MNR report 'Estimating Ecosystem Services in Southern Ontario, 2009'.

Agriculture

- Gas regulation
- Recreation
- Other cultural
- Pollinations and Seeding

Forest Hedgerow

- Gas Regulation
- Other cultural
- Pollinations and seeding

Urban Herbaceous

- Aesthetic and amenity
- Other cultural

Forest

- Gas regulation
- Nutrient regulation
- Water supply
- Recreation
- Pollination and seeding
- Other cultural

Open Water

- Nutrient regulation
- Water supply
- Recreation
- Aesthetic and amenity
- Habitat refugium

Wetlands

- Gas regulation
- Nutrient cycling
- Recreation
- Aesthetic amenity
- Habitat refugium
- Other cultural

5. Chapter 5

The final chapter reviews the appropriate uses of this information and a few concluding remarks on the topic of natural capital valuation and how it relates to the study area.

5.1 Appropriate Uses of this information

The information presented in this paper provides an estimate of the value of the Township of King's natural capital. It suggests that contrary to the conventional economic paradigm, ecosystem services have an economic value and are not 'priceless'. If there is a market for natural capital and ecosystem services, then certainly there can be a price for them. This paper does not advocate for the creation of markets where the rights to nature can be bought and sold. It is meant simply as an exercise to illustrate the importance of ecosystem services and also to point out to what extent the natural environment has been externalized from market prices of goods and services. The value of the natural capital within the Township of King is much more than the price this paper suggests. This valuation is more of an estimate and should be used to preserve nature and not to justify its destruction.

The truth about ecosystem services is that they are valuable beyond measure. Caution should be taken so not to reduce ecosystem services to a mere commodity expanding capitalisms' reach in what Karl Polanyi would call a 'great transformation'(1957). Ecosystem services will join the ranks of fictitious commodities along with land and labour. Expanding markets into the natural environment requires nature to 'earn its own right to exist' because of its economic value (McAfee, 1998). Allowing

markets to determine the value of natural capital could eventually lead to its destruction and as we have seen, markets cannot be relied upon to provide the best allocation of resources.

As stated, Kathryn McAfee (1998) of San Francisco State University refers to the attempt to commodify natural resources as 'green developmentalism'. Criticisms are centered on the incorporation of the environment into the economy and subjecting it to free market principles. Free market capitalism has already shown that it cannot optimally allocate resources amongst members of society. There is the risk of the eco-apartheid. For instance, "…if the international distribution of biodiversity benefit is determined by the market then the world's economic elites will continue receiving the overwhelming share," (McAfee, 1998, p. 139). A price for nature cannot accurately match its value and so all valuation methodologies are inherently flawed. In order to sell something in the market place it is necessary to see it as a thing. Markets for slaves where people could be effectively bought and sold existed in recent history. This is because slaves were not viewed as people with rights, but as objects. Today, most major markets for slavery have been abolished and this idea is no longer accepted in the Western world. Creating markets for ecosystem services and valuing them implies that they are not viewed as subjects but as objects.

Conversely, if ecosystem services are not given any value or weighting in policy decisions then the assumption is being made that natural capital and the services they provide are valueless.

In order to compare different things they must be measured in similar units. Valuing the environment monetarily helps to measure natural capital so that it can be compared in the same units. For instance,"…twenty tonnes of forest biomass cannot be aggregated in a meaningful way with 20 hectares of wetlands or 100 litres of water purification provided by the wetland,"(Olweiler, 2004, p.6). It is clear that natural capital valuation has a few important uses and is a worthwhile tool.

Valuation should be used as a tool to help inform and gather information on a study area so to examine all the benefits natural capital provides. It can help make more informed decisions as in the case of New York City or it can help to prevent floods. Simply gathering information on ecosystem services is critical to understanding their value. Value driven businesses can also use this tool to help make more socially and environmentally conscious decisions. Currently, there is a global scale recession. The environment is usually sacrificed as the first area to be cut by government expenditures. For instance, Environment Canada's 2011-2012 budget includes a "Reduction of $222.2 million from last year's total planned spending," (Lui, 2012). Papers like this one can show the public that the natural environment does in fact have market value. There are ways to conserve the natural environment while saving money for municipalities and businesses alike. Each situation is different, so doing this requires some out of the box thinking at times. Every problem is not the same, so a cookie cutter solution does not exist. Valuation is a good way to raise awareness of the market value of functioning ecosystems and policy instruments like incentives should be explored by all levels of governments so that they have a whole arsenal of tools to use when confronted with difficult problems.

5.2 Conclusion

This paper illustrates the value of natural capital in the Township of King. Careful consideration should be taken when considering the expansion of development in the area. The close proximity of the GTA to the study area illustrates how valuable natural capital can be when it is located so close to urban populations. The value of natural capital presented in this paper is wrought with uncertainty, the $676 million per year estimated value provides a sense of just how important the natural capital in the Township of King is and this value should not be dismissed.

Natural capital and ecosystem service valuation remains an important tool. This paper has shown how valuation can be used to conserve the natural environment. This paper has shown the value

of the Township of King, which is important in communicating the importance of natural areas to the public. Since the Township of King contains so many valuable natural features, this paper has achieved its' purpose in communicating this value and discussing natural capital and the ideas behind valuation methodologies. That being said, by the end of this research paper, it has become increasingly evident that nature needs not earn the right to exist by being valuable. When this is further analyzed it is clear that the economy views nature as a commodity and not as intrinsically valuable and important for human well-being and survival. The view that nature needs to earn the right to exist, alienates humans from their connection with the earth far more than any other period in history.

I hope that in the future economic valuation of the natural environment does not strip nature of its intrinsic value. Until that time, natural capital valuation provides some concept of value to aid in conservation.

> *Only after the last tree has been cut down, only after the last river has been poisoned, only after the last fish has been caught, only then will you find that money cannot be eaten" –Cree Indian Proverb*
>
> *Not everything that can be counted counts, and not everything that counts can be counted - Albert Einstein*

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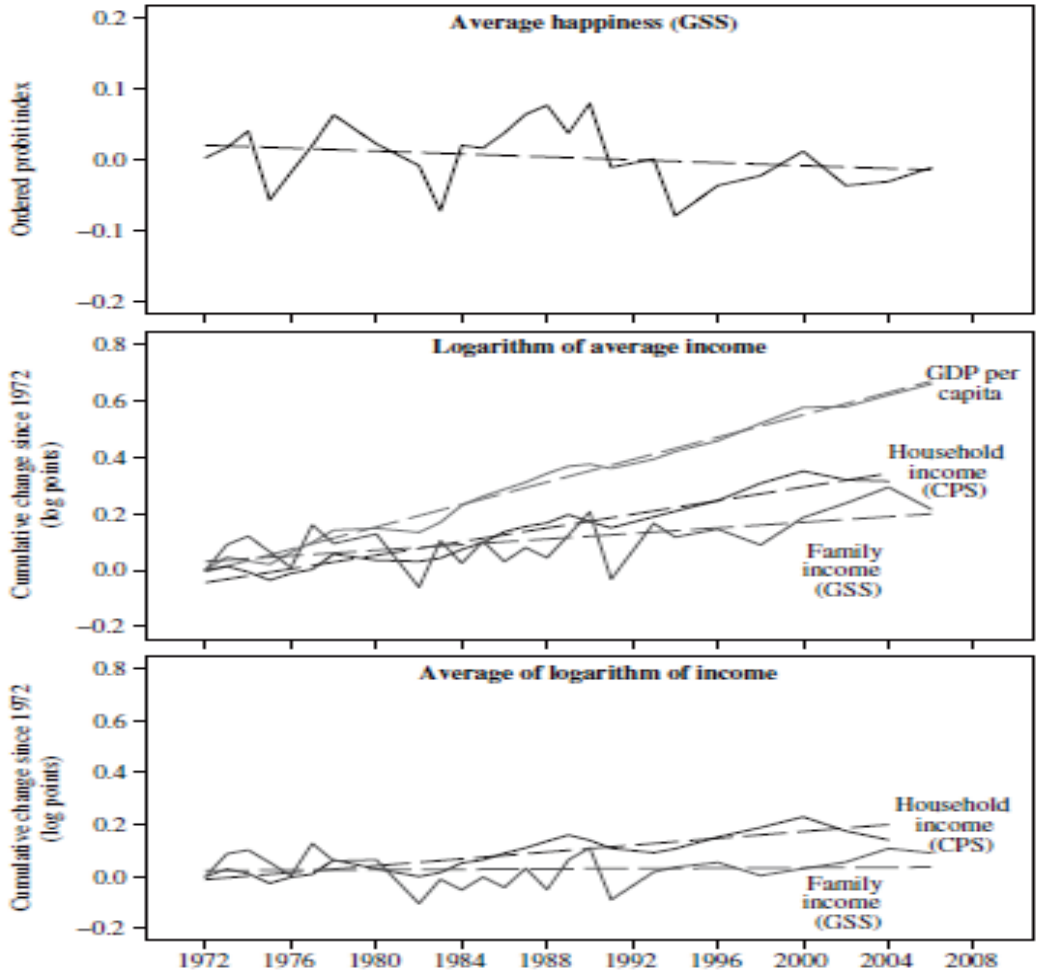
Appendix

Figure 1.1

Figure 20. Happiness and Income over Time in the United States[a]



Sources: General Social Survey; Current Population Survey; Bureau of Economic Analysis.
a. Happiness index is described in figure 13.

This figure illustrates the exception to the correlation between happiness and income in the United States even when using a logarithmic scale.

“These data suggest a...declining happiness trend through this period...which suggests that our happiness index declined by about 0.035 points...The middle panel shows that log real GDP per capita rose by 0.66 over the same period, and the juxtaposition of this income growth with a roughly flat happiness trend appears to provide useful support for the Easterlin paradox,”(Stevenson et al., 2008, 58).

Figure 1.2

This map illustrates the recreational land use in the Township of King. The Yellow lines are the Oak Ridges Moraine Trail. Most of the features can be identified by the legend to the right of the map.

This was obtained from the Parks and Recreation Master Plan, Township of King, 2004.

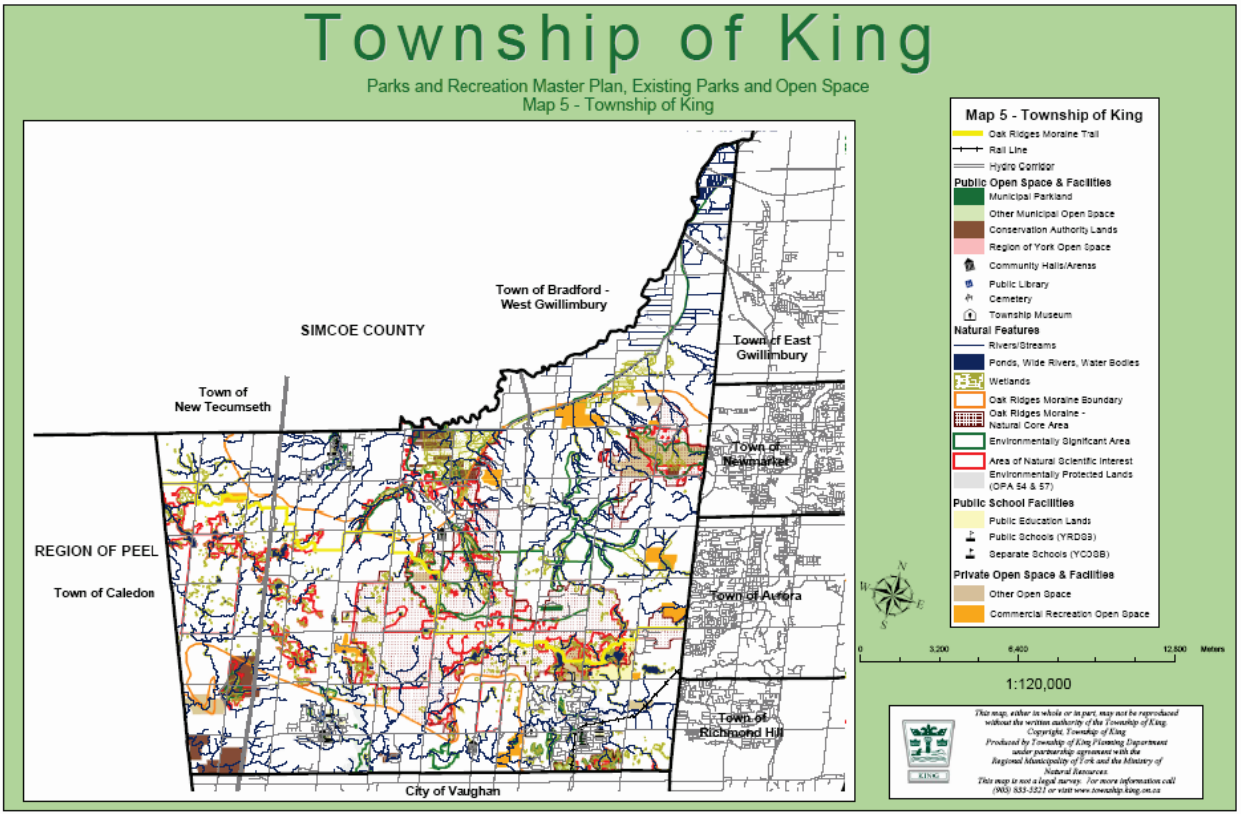
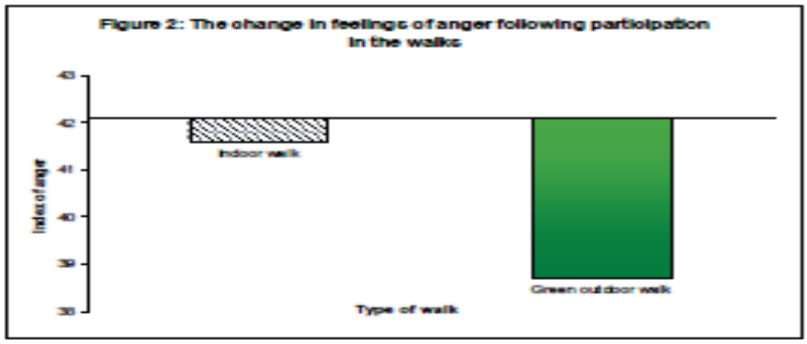
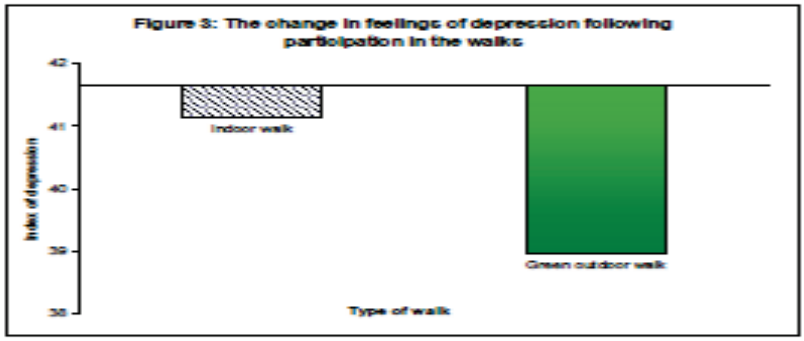


Figure 1.2
Got the blues then Find some Greenspace Pretty et al, 2009.
This visually illustrates how much more beneficial a walk in the outdoors can be on human well being measured in feelings of anger, tension and feelings of depression. All three were significantly decreased after walking in an outdoor greenspace as opposed to only walking indoors. This suggests that there are benefits associated with exercise, but combining exercise with the outdoors provides much more benefits.





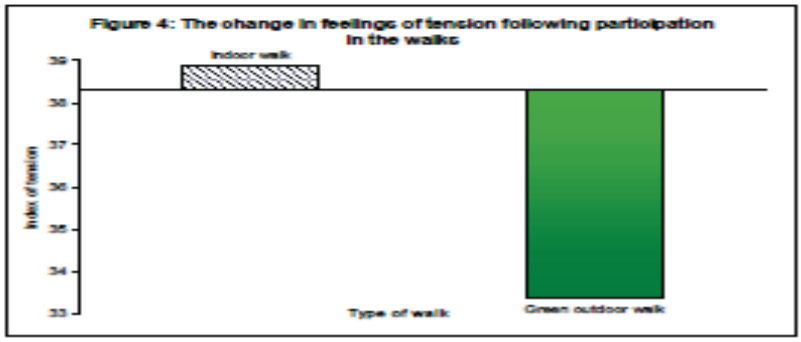
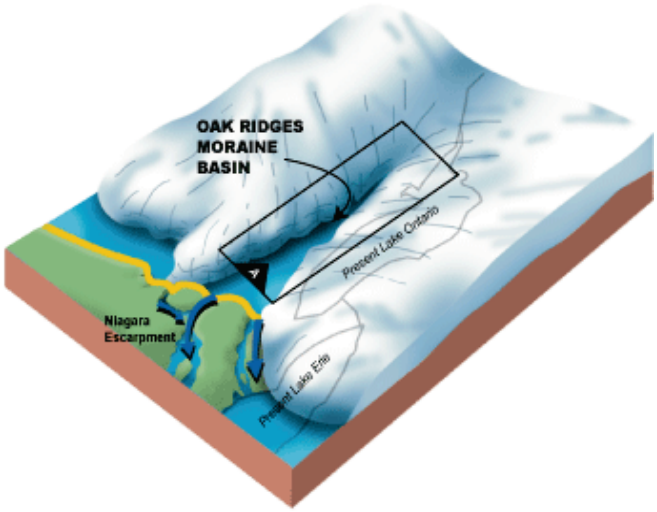


Figure 1.3 The Oak Ridges Moraine Formation. "It rises up to 300 meters above Lake Ontario and contains deposits of sand and gravel up to 200 meters thick,"(NRC,2008).



[i] It is worth noting that the price of a natural resource can still be low despite scarcity. True scarcity is only revealed at the very end due to imperfect information. There is a difference between physical scarcity and economic scarcity. In an economic sense it may not seem that there is any resource scarcity. Resource costs may decline even in times of scarcity because extraction becomes less labour intensive over time due to technological advances. Price is thus a good indicator of scarcity to an economist but not to and environmental economist