Learning from Places to Grow: Instituting a Notion of Limits in the Growth Plan for the Greater Golden Horseshoe

by

Hilary Evans Best

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Department of Geography
McGill University
Montréal (Québec) Canada

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ABSTRACT

Informed by the ecological economics concept of appropriate scale, this paper critiques Ontario's Growth Plan for the Greater Golden Horseshoe, 2006. Using an adapted version of Ehrlich and Holdren's (1971) IPAT equation as a discursive tool, I examine the population, affluence, technology, ethical specifications and overall impact of the legislation. Demonstrating that the Plan pushes the region past several key biocentric and anthropocentric thresholds, I discuss an alternative plan informed by ecological economics.

CHAPTER 1: INTRODUCTION

The call to economic growth is all around us. From the individual firm to the nation's economy, decision makers at all levels are guided by this central objective. Increasingly, however, a growing chorus (Daly, 1994; Victor, 2008; Brown, 2008) is calling into question the long-term viability of economic growth on a finite planet and the desirability of growth as a policy goal.

This paper focuses in on the Greater Golden Horseshoe Region of Ontario, which is wrestling with these issues on a local scale. The region has been the growth centre of the Canadian economy for decades. Along with increased economic activity, the region saw its population grow by 1,280,000 between 1991 and 2001. Recognizing that such growth requires careful planning in order to maximize benefits and minimize growing pains, the Ontario government has brought in several new pieces of legislation to help guide growth in the region over the coming decades. In this paper, I examine one such document, the Growth Plan for the Greater Golden Horseshoe, 2006.

Despite policy makers' good intentions, the Growth Plan has some fatal flaws which, as I will argue, render it ecologically incoherent. Winfield notes "the Growth Plan has evolved from its original bold vision for stopping sprawl, improving air quality, reducing greenhouse gas emissions, protecting natural areas and prime agricultural lands, and safeguarding sources of drinking water towards being an affirmation of "business as usual" development" (Winfield, 2006: 1). Rooted in a neoclassical macroeconomic conception of the region, Ontario's Growth Plan for the Greater Golden Horseshoe (GGH) legislates population and economic growth without consideration of appropriate scale. In this respect, the Plan is symptomatic of a narrow worldview which systematically ignores the intrinsic value of non-human life and our dependence on the biotic community.

In Chapter 2, I review the long history of planning in the region and introduce the Growth Plan itself. In Chapter 3, I present the analytical framework in which the Growth Plan is rooted, neoclassical macroeconomics, as well as the alternative framework I use to critique the Plan, ecological economics. In Chapter 4, I introduce an adapted version of Ehrlich and Holdren's (1971) IPAT relation and discuss the usefulness of each of the variables as discursive tools for deconstructing the impact of the Growth Plan. This analysis is presented in Chapter 5. Chapter 6 offers an alternative policy framework guided by the principles of ecological economics. Finally, I offer some concluding thoughts in Chapter 7.

CHAPTER 2: The Growth Plan in Context

2.1 Introduction

While the Places to Grow Act, 2005 was heralded as a landmark piece of legislation for the Ontario government, the Act does not come without precedent. In this chapter, I offer a brief overview of the background and contents of its most significant product to date: Ontario's Growth Plan for the Greater Golden Horseshoe, 2006.

2.2 Smart Growth? : Regional Planning in Ontario

Ontario's Growth Plan for the Greater Golden Horseshoe is the latest in a series of regional plans for the Greater Toronto Area which date back to the 1940s. While the Places to Grow Act, 2005, was the first to officially recognize the GGH as a planning unit, Taylor (2008) notes that it was already one of the most heavily planned areas in North America.

The concept of the Greater Golden Horseshoe as a region first emerged in the mid-1950s ("Hamilton's Past", 2007). Its industrializing municipalities had coalesced into a large and integrated economic and population base, with the cities of Toronto and Hamilton serving as catalysts for growth elsewhere in the region. Thus, the boundaries of the region were very much defined by socio-economic considerations rather than ecological characteristics.

In an early draft of the Growth Plan for the GGH, Minister of Public Infrastructure Renewal David Caplan alludes to the province's "strong track record of planning for growth in a way that contributes to our overall quality of life"(Ontario MPIR, 2004: i). Beginning in 1943, the province has released a plan for the Toronto region nearly every decade. These plans attempt to remedy the ills of urban life, "sprawl, pollution, lack of community, poor transportation, inefficient use of infrastructure and economic underperformance" (White, 2007: 45), by modernizing urban form and rejuvenating decaying neighbourhoods. White

(2007) notes that each of these plans has focused on roughly the same geographical area, confirming the importance of the Greater Golden Horseshoe as a regional unit for planners and policy makers.

In the context of the myriad regional plans for southern Ontario, the Growth Plan for the Greater Golden Horseshoe represents an important turning point. Under the period of Conservative provincial governments from 1995-2003, officials endorsed the principles of Smart Growth. Looking to their neighbours to the south, the Conservatives borrowed this approach from the American planning movement's reaction to urban sprawl. By channeling growth away from the urban fringe and into the city centre, the doctrine seeks to revitalize the inner city and preserve green lands. Smart Growth planning tries to create livable communities – with areas for employment, residence and education all within walking distance (Burchell et al., 2000). While facilitating increasing population density and public transit use "[Smart Growth proponents] accept that growth is both good and desirable, and that planning controls should not be applied in such a way that they seriously impede growth." (White, 2007: 42)

In addition to these principles, governments implementing the Smart Growth approach tend to favour stakeholder-engagement in the planning process; southern Ontario was no different. The now Liberal provincial government solicited public input using the panel discussion model of their predecessors to draft major planning initiatives including the Greenbelt Act, 2005 and the Places to Grow Act, 2005 under whose mandate the Growth Plan for the Greater Golden Horseshoe, 2006 was released.

In spite of the democratic aspirations which underlie these Smart Growth initiatives, Downs argues that "*most pressures to adopt Smart Growth policies do not come from the citizenry at large but from* [nongovernment environmentalists, urban planners and other local public officials,

innovative private real estate developers] *special interest groups"* (original emphasis) (2005: 368). In the case of the Growth Plan for the Greater Golden Horseshoe, these groups also played an important role in the plan drafting process. The Ontario Growth Secretariat, a body revitalized following the assent of the Places to Grow Act, 2005, carried out extensive panel discussions targeting these groups. Such discussions were essential to facilitate policy 'buy-in' during the implementation stage of the Growth Plan (Ryan, personal communication). These panels demonstrated a consensus-building approach in their final reports. For instance, the Central Ontario Smart Growth Panel Report, which would later form the basis of the draft Growth Plan, emphasized the need to "[m]anag[e] growth in a way that balances the goals of economic prosperity, environmental sustainability and social equity" (Ontario Smart Growth, 2003: 10). The emphasis on balancing the needs of competing interests is a reoccurring theme in the documents of the final Growth Plan.

2.3 Growth Plan for the Greater Golden Horseshoe, 2006

After several years of consulting with stakeholders, the Ministry of Public Infrastructure and Renewal (MPIR) released the Growth Plan for the Greater Golden Horseshoe in 2006. Grappling with the tensions between urban growth, regional economic competitiveness and the preservation of agricultural and natural heritage, policy makers attempted to address these challenges through the following policy objectives:

- Direct growth to built-up areas where the capacity exists to best accommodate the expected population and employment growth, while providing strict criteria for settlement area boundary expansions
- Promote transit-supportive densities and a healthy mix of residential and employment land uses
- Preserve employment areas for future economic opportunities
- Identify and support a transportation network that links urban growth centres through an extensive multi-modal system anchored by efficient public transit, together with highway systems for moving people and goods
- Plan for community infrastructure to support growth

- Ensure sustainable water and wastewater services are available to support future growth
- Identify natural systems and prime agricultural areas, and enhance the conservation of these valuable resources
- Support the protection and conservation of water, energy, air and cultural heritage, as well as integrated approaches to waste management. (Ontario MPIR, 2006: 9)

Towards these ends, the Plan mandates population growth targets for towns and cities in the GGH, sets plan boundary areas and tries to encourage transportation, housing and employment infrastructures to support this growth.

The Plan endorses transit-supportive[1] "complete communities"[2] built at set population and employment densities. This development will be limited by a settlement area boundary, preventing growth in rural areas. Instead, this growth will be channeled to urban growth centres through mandated densities and infrastructure investment. Multi-modal[3] transportation corridors will facilitate the movement of people and goods between these centres. The Plan promotes a culture of conservation – encouraging the preservation of water, energy and cultural heritage as well as waste minimization. Finally, the Plan encourages local planners to recognize, enhance and protect natural systems and prime agricultural lands within their jurisdiction.

[1] "Makes transit viable and improves the quality of the experience of using transit. When used in reference to development, it often refers to compact, mixed-use development that has a high level of employment and residential densities to support frequent transit service." (Ontario MPIR, 2006: 47)

[2] "Complete communities meet people's needs for daily living throughout an entire lifetime by providing convenient access to an appropriate mix of jobs, local services, a full range of housing, and community infrastructure including affordable housing, schools, recreation and open space for their residents. Convenient access to public transportation and options for safe, non-motorized travel is also provided." (Ontario MPIR, 2006: 41)

[3] "The availability or use of more than one form of transportation, such as automobiles, walking, cycling, buses, rapid transit, rail (such as commuter and freight), trucks, air and marine." (Ontario MPIR, 2006: 44)

CHAPTER 3: Presentation of the Analytic Frameworks

3.1 Introduction

All policy analysis occurs within a framework of values and judgments.

> "[T]he judgment in question contains norms, or objectives for individual and/or collective behaviour that are thought to be appropriate and right; …what is involved is a judgment …a proposition that can be supported by reasons." (Brown, 1976: 327).

An understanding of values in policy making and analysis is particularly important in this context where the Growth Plan has been created on the assumption that Ontario citizens share a common set of values, including, but not limited to, continued population and economic growth.

> "Values in policy and planning are generally multiple, fluid and controversial; and different values will make different dependent variables pertinent. If analysts behave as if some uncontroversial goal set does exist, then they will typically adopt that set as given by the political or bureaucratic power that be or impose one of their own choosing. In the former case, they are complicit in the instrumental or technocratic rationalization of society… In the latter, they risk irrelevance to the concerns of anyone in the potential audience of analysis. " (Dryzek, 1993: 218)

I root my own analysis of the implications of the Growth Plan for the Greater Golden Horseshoe within the framework of ecological economics. Therefore, I take the opportunity in this chapter to outline the basic concepts and normative judgments that form the basis of the analytic framework of the Growth Plan, neoclassical macroeconomics, and contrast it with the one I will use here, ecological economics.

3.2 Neoclassical Macroeconomics

Macroeconomics is the study of the economy in its aggregate. "With the aggregation of all goods into one good comes the aggregation of all individuals into the one 'individual' of the economy"' (McCandless, 1991: 44-45). This has troubling consequences for the diversity of perspectives held by those individuals and indeed, those species not represented in the

aggregate. I will present the following key concepts for contrast with the ecological economics approach:

Consumption as Welfare

Standard texts of neoclassical economics define consumption as "spending by domestic households on final goods and services" (Abel et al., 2006: 4). In Canada, consumption represents approximately 60% of total national spending (Abel et al., 2006). By this definition, it would appear that consumption is a rather benign property. However, in neoclassical analysis consumption is usually treated as a positive contribution to individual and collective well-being. Common et al. (2005) affirm that consumption is the purpose of economic activity, as it is the primary mechanism for the satisfaction of wants and needs. In this light, consumption is often used, controversially, as a measure of welfare:

> "[W]ell-being is derived from the consumption of good and services. The standard theoretical paradigm describes consumers as 'rational' agents who choose the combination of goods that maximizes welfare (i.e., utility) subject to the constraint of limited financial resources. Well-being is a function of the quantities consumed so that, in this framework, it is at least theoretically possible to infer the level of welfare from the observed quantities of the goods consumed." (Slesnick, 2001: 8-9)

As Daly outlines, this understanding of consumption is problematic as it values the use of resources without consideration of the associated costs and their distribution. This is reflected in key macroeconomic measures like Gross Domestic Product, which counts the consumption of natural capital as income (Daly, 1994). Even Alfred Marshall, a forefather of neoclassical economics, understood this inconsistency: "[man's consumption of material products] is nothing more than a disarrangement of matter which destroys its utilities" (Marshall, 1961: 63-64). This disarrangement of matter has significant detrimental implications for the environment (Daly, 1994).

Economic Growth

As evidenced in the aftermath of the economic freefall of 2008, policymakers are keen to stimulate consumption in order to maintain economic growth. Growth is defined as "the expansion of the national income—the total production of goods and services of a country over a given period." (Statistics Canada, 2007). Through fiscal and monetary policy, governments attempt to stabilize business cycles and grow the economy to absorb the labour force while creating new opportunities for wealth generation.

The standard neoclassical growth model developed by Solow in 1956 posits that human and physical capital are infinitely substitutable with labour and increases in productivity. All combinations of these factors of production will eventually yield diminishing returns to scale (Ayres et al., 1996). Growth in an economy is thus determined exogenously by technological innovation. Notably absent from Solow's theory is a consideration of the role of natural capital in the production function. Economies will use more natural capital as they grow but the neoclassical paradigm assumes that these resources can be substituted for less expensive factors of production as they grow scarce.

Economic growth has several serious limitations as a policy objective. Besides the fact that economic growth may not improve quality of life for a population (Max-Neef, 1995), infinite growth of the economic system is a physical impossibility. By ignoring the dependence of the economy on the natural capital of the biosphere, Daly argues "standard growth economics ignores finitude, entropy and ecological interdependence…" (1994: 33). In other words, our macroeconomic system currently functions without acknowledging its dependence on natural systems or its limitations as a subsystem of a finite planet.

While microeconomics seeks an optimum scale for economic transactions, the equilibrium point between marginal costs and marginal benefits for a rational individual,

macroeconomics abandons this understanding in favour of infinite growth (Daly, 1994). In this way, neoclassical macroeconomic theory lacks a connection to the realities of this planet.

3.3 Ecological Economics

In contrast to the neoclassical macroeconomic framework, I present the alternative paradigm which forms the basis of my critique of the Growth Plan: ecological economics. "The major difference between [this approach] and neoclassical economics is an overall systems view in contrast to marginal analysis." (Hubacek et al., 2006: 20). Indeed, ecological economists widen the extent of their analysis beyond the narrow self-interests of participants in the economy to include considerations of the wider system, the biosphere. With this understanding of the location of the economy in mind, I will present the key concepts of this paradigm:

The economy as a subsystem of the biosphere

Most importantly, ecological economics locates the economy as a subsystem of the biosphere. As such, it is subject to the natural laws which govern the larger system, i.e., the laws of thermodynamics. Given that all available energy is derived from the sun, ecological economists would suggest that we must re-scale our economy to a level supportable by this resource.

Natural Capital

According to Daly, "*natural capital* is the stock that yields the flow of natural resources… both renewable and non-renewable" (1994: 80). In contrast to neoclassical growth models, which treat natural capital as infinitely substitutable, ecological economics adopts the view that natural capital is a complement to other forms of capital (Daly, 1994). Rather than counting its depletion as income, natural capital must be maintained over the long term. This is achieved through natural capital investment- limiting consumption of the

resource. "More generally, this means increasing the efficiency with which capital, both natural and manmade is used to provide life-support and life-enhancing services." (Daly, 1994: 83)

Optimal Scale

Taken together, these concepts lead ecological economists to the idea of optimal scale. "Optimal scale," writes Daly, "like distributive justice, full employment, or price level stability, is a macroeconomic goal… Scale has a maximum limit defined either by the regenerative or absorptive capacity of the ecosystem, whichever is less. However, the maximum scale is not likely to be the optimum scale." (1994: 51). Indeed, Daly argues "adjustment in the service of growth has pushed us beyond a sustainable scale." (1994: 166)

Daly defines optimal scale in two different ways: the anthropocentric optimum and the biocentric optimum. The choice between the two optima hinges upon one's ethical perspective.

The anthropocentric optimum is "the point at which the marginal benefit to human beings of additional man-made physical capital is just equal to the marginal cost to human beings of sacrificed natural capital. All non-human species and their habitats are valued only instrumentally according to their capacity to satisfy human wants. Their intrinsic value (capacity to enjoy their own lives) is assumed to be zero." (Daly, 1994: 51-2).

The biocentric optimum, on the other hand, requires natural capital preservation "beyond the point necessary to avoid ecological collapse or cumulative decline, and beyond the point of maximum instrumental convenience" (Daly, 1994: 52). Scaling down human activities is done "out of recognition that other species have intrinsic value independent of their instrumental value to human beings." (Daly, 1994: 52)

Daly suggests "the best index of scale of the human economy as a part of the

biosphere is the percentage of human appropriation of the total world product of photosynthesis" (Daly, 1994: 57). Ecological economists seek to re-scale the economy to these optima.

Economic Growth

Ecological economists view economic growth in different terms than their neoclassical colleagues. According to Daly, "the physical growth of the subsystem is the transformation of natural capital into manmade capital… The size or scale of the economic subsystem is best thought of as per capita resource consumption times population." (1994: 67). Thus, growth entails an increase in material throughput. He adds that rather than a wholly positive aim, economic growth has associated costs with respect to the services of natural capital that must be sacrificed (Daly, 1994).

3.4 Conclusion

Examining the key concepts of these doctrines reveal the tacit judgments which underlie their analysis. Neoclassical macroeconomics is situated in a theoretical sphere which affords little consideration to the fundamental limitations of life on a finite planet. Ecological economics, in contrast, opens up room for macroeconomic analysis with the capacity to consider the economy as a dependent sub-system.

CHAPTER 4: Methodology

4.1 Introduction

This investigation of the Growth Plan for the GGH's respect for biocentric and anthropocentric optima has been conducted through an extensive review of the available academic and policy literature. Analysis of these documents is framed through Ehrlich and Holdren (1971)'s IPAT relation. While the original equation has been modified by others for empirical use (see York et al.'s (2003) STIRPAT equation), I use a modified IPAT relation here as a heuristic tool for deconstructing the implications and impacts of the Growth Plan for the GGH. I take this opportunity to discuss the IPAT relation and justify its use as a discursive tool for analysis.

The IPAT relation is widely used in environmental impact literature.

> "[The relation's] main strengths are that it is a parsimonious specification of key driving forces behind environmental change and, further, it identifies precisely the relationship between those driving forces and impacts. The specification makes clear that all of the driving forces [population, affluence and technology] do not influence impacts independently of one another…[N]o one factor can be held singularly responsible for environmental impacts." (York et al., 2003: 352)

While the relation may not be well suited to empirical accounting, particularly at the regional scale (Lambin et al., 2001), it does offer a useful heuristic for analyzing a complex policy environment such as the GGH. Originally developed to identify drivers of environmental impact, interactions between these factors and avenues for improvement (Chertow, 2001), the IPAT relation has been used primarily on the global scale. Variants of the relation, such as ecological footprint, have been used more frequently on regional and local scales (Rees et al., 1996). IPAT is used here because it opens up more avenues for deconstructing policy choices than the ecological footprint metric, while offering elegance and clarity.

I will briefly discuss each of IPAT's variables and their associated indicators. As will hopefully become clear in Chapter 5, each variable offers potential avenues for reducing human impact in the GGH.

4.2 Population

As the population of a given area increases, total environmental impact will also increase. Ehrlich and Holdren (1971) contend that this impact is more than proportional to increases in population due to the synergistic effects of this growth. For example, they emphasize the non-linear increase in the costs and challenges of environmental remediation for an increasing population due to the diminishing returns of each additional unit of pollution control and the various biotic thresholds which characterize an ecosystem. In surpassing the absorptive capacity of a nearby river, for instance, a growing population will require increasingly more expensive technologies to mitigate the impacts of additional sewage effluent. Moreover, if total treated sewage output exceeds the river's absorptive capacity, a population may surpass the ecosystem threshold where existing technologies can repair the inflicted damage.

In addition to the negative synergies that population growth can create with other variables, Hietel et al. (2007) add that changes in the structure of the population (age, gender etc.) may also influence its environmental impact. Raskin (1995) notes that this relationship is intricately linked to the affluence variable and cannot be easily isolated.

4.3 Affluence

The IPAT relation draws a correlation between increasing levels of affluence (or rising levels of per capita income) and increased environmental impact. As individuals acquire more disposable income, they are able to consume more and thus yield a higher ecological burden. As Mackenzie et al. conclude, "Canadians' ecological impact is not a function of their

existence on the planet, but rather is a function of their consumption. Not surprisingly, the more one consumes, the greater one's impact on the planet; and the greater one's income, the greater one's consumption." (2008: 4) In addition to consuming larger volumes, affluent individuals tend to consume more ecologically harmful goods and services (Kerkhof et al., 2009). For example, individuals with higher disposable incomes may choose to travel by carbon-intensive personal motor vehicles rather than by public transit – increasing their atmospheric impact as a result of their economic means. This relationship has been demonstrated across Canadian municipalities for housing, transportation, goods and services (Mackenzie et al., 2008).

4.4 Technology

The IPAT relation suggests that improvements in the efficiency of technology can reduce the impact of the population in question by reducing the throughput of resources required for a certain level of consumption.

In this study, I have chosen to focus on the technology of urban form as mandated by the Growth Plan. By specifying population densities, transportation choices and infrastructure plans, the Growth Plan attempts to shape human impact on the region and is, in this way, the most significant technology outlined in the policy framework. While other technologies, notably energy production and distribution are important, they are not directly addressed by the Growth Plan and are therefore omitted from this discussion.

4.5 Ethics

In addition to Ehrlich and Holdren's (1971) original variables (population, affluence, and technology), I also consider a fourth variable, ethics, in my analysis. For this reason, I will now refer to the relation as the IPATE framework.

Incorporation of ethical matters in environmental impact assessment is not new (see

Schulze, 2002; Brown et al., 2009). Nonetheless, the use of an ethical variable in the IPATE framework is not without controversy. Roca (2002) and others suggest that the ethical choices of a population are accounted for in the population, affluence and technological variables. While this may be true in an empirical sense, when using the IPATE relation as a discursive tool, as I do here, it is important to give full consideration to the ethics and culture of the population in question. By isolating ethical choices, we can identify another key driver which perpetuates environmental degradation and suggest possible avenues for improvement. Thus defined, ethics should offer moral guidance for individual and collective conduct with respect to the population, affluence and technology variables. It should help us to choose a course of action guided by a conception of the good.

4.6 Impact

The analysis of population, affluence, technology and ethics yield an indication of total impact. In this study, I use several indicators of ecological health with respect to air, land and water to determine whether current patterns of population, affluence, technology and ethics exceed biocentric and/or anthropocentric optima at the global and regional scales. Anthropocentric optima were determined using applicable human health standards, for example, Health Canada's recommended maximum concentration of ground level ozone. True anthropocentric optima would also account for the needs of ecosystems such that they may function at a level which can support a given human population. Unfortunately, due to the constraints of this study, this supportive portion of the anthropocentric optima remains unaccounted for. Biocentric optima were determined using available ecological standards regarding the maximum concentrations of pollutants, minimum required area etc., to maintain ecosystem structure and function.

Given that human populations depend on regional ecosystems, growth policy should

aim to maintain regional ecological health to at least the level of the true anthropocentric optimum. Costanza et al. assert that ecological health should be

> "a comprehensive, multiscale, dynamic, hierarchical measure of system resilience, organization and vigor. These concepts are embodied in the term 'sustainability' which implies the system's ability to maintain its structure (organization) and function (vigor) over time in the face of external stress (resilience). A healthy system must also be defined in light of both its content (the larger system of which it is part) and its components (the smaller systems that make it up) " (1998: 240).

While no single indicator offers a complete picture of ecosystem health, the suite of indicators considered here offer a rough picture of the state of the regional ecosystem and human impact on the region.

Measures of environmental impact should be used as a compass to guide planning policy towards a relationship of respect for the integrity of global and regional human and natural communities. It is on the basis of the four variables presented here that I frame our analysis of the Growth Plan for the Greater Golden Horseshoe.

CHAPTER 5: Analysis of Current Policy Implications

5.1 Introduction

This section will analyze the implications of the Growth Plan using the IPATE framework. Population, affluence, technology and ethics are each represented in the Plan and consequently offer a useful framework for deconstructing its overall impact. Following the presentation of the Plan's efforts with respect to each variable, a discussion of the ecological economics response to these policies will follow.

5.2 Population

First and foremost, the Growth Plan for the Greater Golden Horseshoe seeks to accommodate a growing population in southern Ontario.

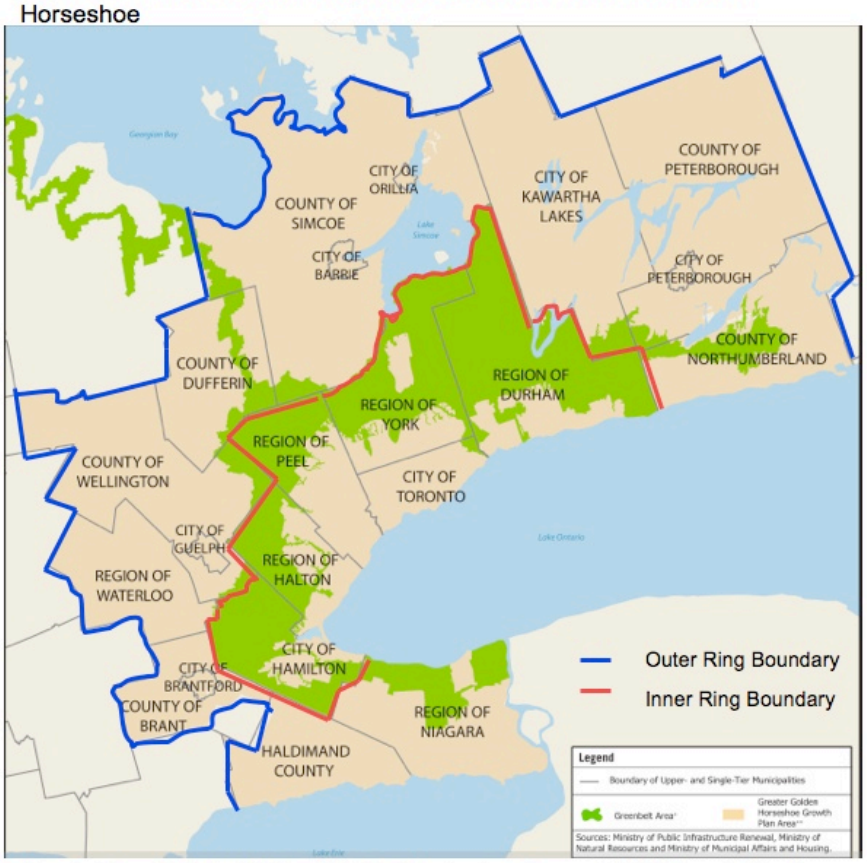
5.2.1 How Much Growth?

In addition to panel discussions and public feedback forums, the Growth Plan policy is informed by population growth forecasts. In their report, Hemson Consulting, the firm responsible for the forecasts, identifies low, reference and high growth population scenarios. According to their findings, southern Ontario can expect to accommodate between 2,960,000 and 4,620,000 additional people between 2001 and 2031. The reference growth forecast, which forms the basis of the Growth Plan targets, suggests that the population of the GGH will grow by an additional 3.7 million people between 2001 and 2031 (Ontario MPIR, 2006: 12). According to the Environmental Commissioner of Ontario, "This rate of growth is unprecedented in Ontario; the anticipated increase is equivalent to creating a mid-sized city roughly the size of Kitchener every year for the next 24 years." (2007: 15)

The bulk of this growth will occur in the counties of the Greater Toronto and Hamilton region, which will accommodate a total of 2,810,000 people by 2031. The outer ring municipalities (see Figure 1) will welcome 900,000 by 2031 (see Table 1). To manage

this additional population growth effectively, the Growth Plan legislates Ontario municipalities to "phase in and achieve intensification and the intensification targets"(Ontario MPIR, 2006: 15) (see Table 2).

Figure 1: Inner and Outer Ring Boundaries of the Greater Golden Horseshoe



Adapted from: Ontario Ministry of Public Infrastructure Renewal. 2006. Growth Plan for the Greater Golden Horseshoe. Schedule 1

Table 1: Distribution of Population and Employment for the GGH

Distribution of Population and Employment for the Greater Golden Horseshoe 2001-2031 (figures in 000s)								
	POPULATION				EMPLOYMENT			
	2001	2011	2021	2031	2001	2011	2021	2031
Region of Durham	530	660	810	960	190	260	310	350
Region of York	760	1,060	1,300	1,500	390	590	700	780
City of Toronto	2,590	2,760	2,930	3,080	1,440	1,540	1,600	1,640
Region of Peel	1,030	1,320	1,490	1,640	530	730	820	870
Region of Halton	390	520	650	780	190	280	340	390
City of Hamilton	510	540	590	660	210	230	270	300
GTAH TOTAL**	**5,810**	**6,860**	**7,770**	**8,620**	**2,950**	**3,630**	**4,040**	**4,330**
County of Northumberland	80	87	93	96	29	32	33	33
County of Peterborough*	56	58	144	149	16	17	60	60
City of Peterborough*	74	79			37	41		
City of Kawartha Lakes	72	80	91	100	20	23	25	27
County of Simcoe*	254	294	583	667	85	102	230	254
City of Barrie*	108	157			53	77		
City of Orillia*	30	33			16	17		
County of Dufferin	53	62	71	80	19	22	25	27
County of Wellington*	85	91	269	321	36	41	137	158
City of Guelph*	110	132			63	76		
Region of Waterloo	456	526	623	729	236	282	324	366
County of Brant*	35	39	157	173	16	17	67	71
City of Brantford*	94	102			39	45		
County of Haldimand	46	49	53	56	17	19	19	20
Region of Niagara	427	442	474	511	186	201	209	218
OUTER RING TOTAL**	**1,980**	**2,230**	**2,560**	**2,880**	**870**	**1,010**	**1,130**	**1,240**
TOTAL GGH**	**7,790**	**9,090**	**10,330**	**11,500**	**3,810**	**4,640**	**5,170**	**5,560**

Source: Hemson Consulting Ltd., "The Growth Outlook for the Greater Golden Horseshoe", January 2005

Note: Numbers rounded off to nearest 10,000 for GTAH municipalities, GTAH Total and Outer Ring Total, and to nearest 1,000 for outer ring municipalities.

** Separate forecasts for these municipalities for 2021 and 2031 will be determined.*

*** Totals may not add up due to rounding.*

Source: Ontario Ministry of Public Infrastructure Renewal. 2006. Growth Plan for the Greater Golden Horseshoe. Schedule 3

Table 2: Minimum Gross Density Targets for Urban Growth Centres and Greenfield Development in the Greater Golden Horseshoe by 2031

Location	Minimum Gross Density Target
Urban growth centres	400 residents and jobs combined per hectare for each of the urban growth centres in the City of Toronto 200 residents and jobs combined per hectare for each of the Downtown Brampton, Downtown Burlington, Downtown Hamilton, Downtown Milton, Markham Centre, Mississauga City Centre, Newmarket Centre, Midtown Oakville, Downtown Oshawa, Downtown Pickering, Richmond Hill/Langstaff Gateway, Vaughan Corporate Centre, Downtown Kitchener and Uptown Waterloo urban growth centres 150 residents and jobs combined per hectare for each of the Downtown Barrie, Downtown Brantford, Downtown Cambridge, Downtown Guelph, Downtown Peterborough and Downtown St. Catharines urban growth centres.
Designated greenfield area	50 residents and jobs combined per hectare

Source: Ontario Ministry of Public Infrastructure Renewal. 2006. Growth Plan for the Greater Golden Horseshoe. pg 16-17.

While the province has the jurisdiction to amend municipal plans to reflect these growth targets, some municipalities have challenged the provincial government on their assigned capacities. The City of Guelph, for instance, is working with the province to tone down its growth numbers. A report by Meridian Planning Consultants Inc. suggests that the nearby Speed River will reach total assimilative capacity of treated wastewater effluent at a maximum population of 154,000 people (Meridian, 2006), less than half of the 321,000 targeted in the Growth Plan[4]. "Even with proposed technological upgrades and realizing additional water conservation measures,… [Guelph's] wastewater treatment facilities can only handle a total population (and associated employment) of approximately 165,000 people by 2031 at this time." (Kraehling et al., 2008: 8)

The Environmental Commissioner of Ontario notes

"The GGH Plan favours the artificial extension of water and wastewater

[4] The plan's targeted population for the Guelph area does not specify the proportions to be added to the City of Guelph and surrounding Wellington County. The 321,000 target is given for the city and county in total.

> capacity in such communities, through major infrastructure projects designed to pipe water in from outside of the local watershed and, in some cases, to pipe wastewater back out…. In addition, such projects are exempt from the natural heritage protection provisions set out in the 2005 PPS [Provincial Policy Statement], the Greenbelt Plan...and the Oak Ridges Moraine Conservation Plan…, even though their construction will cause significant environmental impact." (Environmental Commissioner of Ontario, 2007: 24).

However, at a lower population, Guelph is unlikely to meet the minimum density requirements to facilitate a planned high-speed rail link ("Crossroads for growth", 2007). In short, acknowledging a limit to growth with respect to population given the local assimilative capacity for wastewater may result in a greater burden in the southern Ontario airshed as commuters revert to cars as their primary mode of transportation. Evidently, these policy choices are not easy and require forethought with respect to tradeoffs. While the province has been cooperative with municipalities seeking revisions, it is unclear why studies of the physical capacity of the region to sustain population growth were not undertaken when the Growth Plan was initially tabled.

5.2.2 Where will the people come from?

With falling natural birth rates, much of this population growth will be generated by migration. Ontario receives approximately half of all immigrants to Canada, 80% of whom settle in the Greater Toronto Area and Hamilton (Hemson, 2005). While immigration policy is formulated in response to domestic economic and demographic conditions, it is set at the national level, beyond the jurisdiction of the region or the province. As the *Immigration and Refugee Protection Act*, 2001 makes clear, immigration policy is intended to "support the development of a strong and prosperous Canadian economy, in which the benefits of immigration are shared across all regions of Canada;" (2001, 3(1)(c)). While the social, cultural and economic benefits of immigration to Canada are evident, the ecological impact

of continued population growth is not addressed in federal immigration policy.

In addition to population growth, the province anticipates qualitative changes in the demographics of the Ontario population with "enormous implications for growth and planning" (Hemson, 2005: i). As the population ages, average household sizes will decrease and the nature of housing demand will change (Hemson, 2005). Pebly notes that "[b]ecause there are substantial fixed energy, waste disposal, and other costs to running a household, the growth in the number of households implies growth in consumption." (1998: 382) Indeed, MacKellar et al. (1995) demonstrate that growth in greenhouse gas production is more closely linked to growth in the number of households than to population growth. Evidently, a growing and aging population has important implications for the environmental impact of the GGH.

5.2.3 The Role of Population Forecasts

Given that population forecasts play a very significant role in the formulation of Growth Plan policy, it is essential to consider the methodological framework of the forecasts themselves. Wachs posits,

> "Those who use forecasts, prepare them, or critique them, invariably use the language of technical objectivity. A model used for prediction is assumed to be unbiased, a tool in the hands of a forecaster who is a technical expert rather than a decision maker ... Yet, so many technical assumptions are required to make any forecast that the process can ultimately be quite subjective, while the consequences have great significance." (2001: 104)

In spite of nominal objectivity, these technical assumptions support future scenarios as envisioned by policy makers and forecasters themselves. In this way, key choices about the number of people who will inhabit a region, their character and the way they will live are embedded into policy development without public debate.

Such is the case in the GGH where the cohort-component method was used to

predict the region's future population levels, forming the basis of the Growth Plan. In their forecasting report, Hemson Consulting states:

> "Forecasts are an indication of the level of growth that might be anticipated, but due to uncertainties the forecasts are provided in ranges on the totals as well as distribution scenarios. Various aspects of the growth outlook, such as population, housing, age structure, and employment by major type are linked by a consistent set of assumptions." (Hemson, 2005: 3)

These assumptions include population growth increasingly generated by migration, an aging population, fertility and mortality rates, age-sex composition of migrants, a continued concentration of economic and population growth in the GGH, positive long term economic outlook, a mixed economy, and continued infrastructural investment (Hemson, 2005). They continue:

> "Particular results, or assumptions, cannot be taken out of this context. *Forecast results add to available information for decision-makers — but should not substitute for sound judgment*...These forecasts and scenarios should be viewed clearly as inputs to planning decisions, not the planning decisions themselves. Planning decisions, such as growth allocations and official plan targets, will be determined through subsequent decision-making processes such as Places to Grow and standard municipal official plan processes." (Emphasis added) (Hemson, 2005: 4)

By removing the population numbers from the policy debate, the Ontario government obfuscates a key dimension of the conversation of our common future.

> "…[F]ounded on population and employment projections that assume minimal change in current growth patterns. [Analysts] question the wisdom of [policy makers] entrenching what are very nearly business-as-usual growth projections in a plan that is intended to produce and encourage substantial change." (Neptis Foundation, 2006: 1)

Leaving no room to envision alternatives to the status quo, these projections serve as the foundation for a continued pattern of regional population growth with dire implications for the regional and global environment.

5.2.4 Response

The population growth assumptions to which the Growth Plan subscribes represent an unchallenged commitment to an increased scale of human activity in the region. As demonstrated in the City of Guelph, this scale may exceed biocentric and anthropocentric optima. Projections for growth in that municipality demonstrate ignorance on the part of policy makers for the provisioning and assimilative capacities of the local ecosystem.

By representing the population growth figures as objective forecasts, the Ontario government has denied public debate on the desirability, let alone feasibility, of this growth. "[T]he underlying assumption of the …"growth plans" under the proposed Places to Grow Act– is that Ontario's population should increase and that that is a sound policy choice." (Environmental Commissioner of Ontario, 2005: 46). Forecasts are a de-politicized vehicle for the provincial government to plan on the basis of established normative judgments. The Environmental Commissioner of Ontario warns

> "the fallacy of this approach to planning is that the more the Ministry of Finance predicts certain regions in Ontario will grow in population size, the more municipalities are forced to plan for these increases without being able to set limits to growth."(2005: 47)

Indeed, under the provincial Planning Act, 1990, municipalities are required to base their own local plans on the provincial growth projections. These projections leave little latitude for local challenges to future population scenarios.

In this way, the Growth Plan forecasts create an unspoken, yet legally binding, prioritization of population and economic growth over the limits of the region's ecosystems.

5.3 Affluence

In addition to planning for an increased population in the GGH, the Growth Plan is premised on the goal of "promoting economic prosperity" (Ontario MPIR, 2006: 6) in the region. The strategies it proposes are suggested with an eye to increasing economic

competitiveness. Indeed, the language of the Plan indicates that the government's attempts to create "thriving, livable and vibrant" (Ontario MPIR, 2006: 8) urban areas are motivated by a desire to attract investment and a highly skilled workforce.

Not only does the Growth Plan seek to promote economic growth, it depends on it for its success. Hemson's projections assume a continued positive economic outlook for the GGH. The report states:

> "The GTAH [Greater Toronto Area and Hamilton] and the Outer Ring are anticipated to continue to experience rates of long term economic growth sufficient to absorb the expanding labour force created through migration. Economic output is anticipated to continue to grow over the long term, with associated growth in employment and income. The GTAH is anticipated to remain the primary economic region in Ontario and continue to stimulate economic growth in its surrounding areas." (Hemson, 2005: 8)

Thus, government ministries planning for the future depend on simultaneous population and economic growth to create a favourable policy environment. As Wachs (2001) notes, the circularity of forecasting and a policy infrastructure which creates predicted outcomes prevents forecasts from being verified. In the case of the Growth Plan, forecasts of increased population and economic growth have motivated policies which both depend on and facilitate such growth.

Economic growth is promoted implicitly and explicitly as a policy objective in the Growth Plan. Indeed, the Plan emphasizes the need to "plan and manage growth to support a strong and competitive economy"(Ontario MPIR, 2006: 10) in order to create an "economic powerhouse of global significance" (Ontario MPIR, 2006: 9).

The populations in developed countries have certainly benefited from economic growth in the past with respect to improvements in quality of life and health. The GGH is no exception. However, as many scholars have noted (Victor, 2008; Daly, 1994), economic growth is also accompanied by a variety of costs which often go unmentioned. Moreover,

while economic growth may be a means to certain ideals of human development and progress, it is not an end in and of itself. Therefore, it is important to consider what the benefits of growth might be and how effective the Growth Plan will be in achieving these outcomes. Secondly, we must consider the costs of such growth to human and natural systems.

5.3.1 Why Grow?

With respect to the specific benefits of economic growth, the Plan offers only vague descriptions. Growth will bring "vibrant, diversified communities and economies; new and expanded community services; and arts, culture and recreation facilities" (Ontario MPIR, 2006: 6). However, supporting documents and neoclassical macroeconomic theory endorse other presumed benefits. These include global competitiveness, full employment, an escape from poverty and increased individual freedom.

Global Economic Competitiveness

The Plan emphasizes that "the GGH must remain competitive with other city-regions" (Ontario MPIR, 2006: 7). Towards this end, the Ontario Smart Growth strategy is advanced as a means to support regional competitiveness in the global economy. The focus of economic geographers on the importance of mega-regions as drivers of growth in the global economy has not been lost on policy makers in the GGH. Indeed, work by Richard Florida and Meric Gertler has been highly influential for the Growth Plan.

Essentially, these scholars argue that regions such as the GGH drive economic growth in the global economy and that regions must work to improve their competitive advantage in order to maintain their place in the global hierarchy.

Long run competitive success and therefore, economic growth are determined by a region's "traded industry clusters" (Gertler, 2003: 3). These pillars of the local economy

serve primarily external markets "drawing income into the region from outside, creating a propulsive force that ripples through the rest of the local economy" (Gertler, 2003: 3). "[T]o attract and retain knowledge-intensive economic activities …cities must maintain and improve the quality of place." (Gertler, 2003: 21)

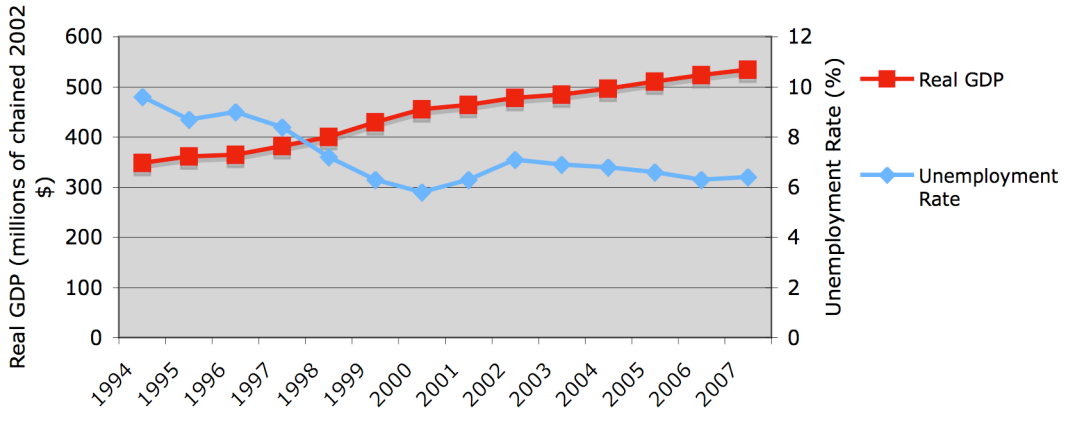
While the regional economy literature offers seemingly endless policy prescriptions for improving regional economic competitiveness, it offers little in the way of explanation for why this is a relevant policy goal. Rather than proposing improvements in the region's quality of life as ends in and of themselves, the Plan seems to justify improvements as a means to further economic growth. If regional economic competitiveness is to be endorsed as a policy objective, it requires further justification on the part of policy makers.

Full Employment

While a globally competitive region may yield economic growth, this growth will not necessarily translate into higher employment levels. Gertler (2003) notes that employment in traded industry clusters is determined by external demand rather than local labour force availability. Indeed, output in these industries has grown faster than employment since the mid-1990s (Gertler, 2000: 4).

In his thorough examination of economic growth and the Canadian economy, Victor confirms "[d]espite vigorous growth of the Canadian economy since the 1950s, the rate of unemployment has remained well above 4 per cent for most of the past half century. Economic growth has not generated full employment because of increases in the labour force and labour productivity" (2008: 156).

Figure 2: Ontario's Unemployment Rate and Economic Growth, 1997-2007



Source: Ontario Ministry of Finance (2008)

These national trends can also be seen in data for the province of Ontario (see Figure 2). While economic growth shows a negative correlation with unemployment levels, the relationship is not perfect – making economic growth a blunt tool for achieving this important policy objective alone.

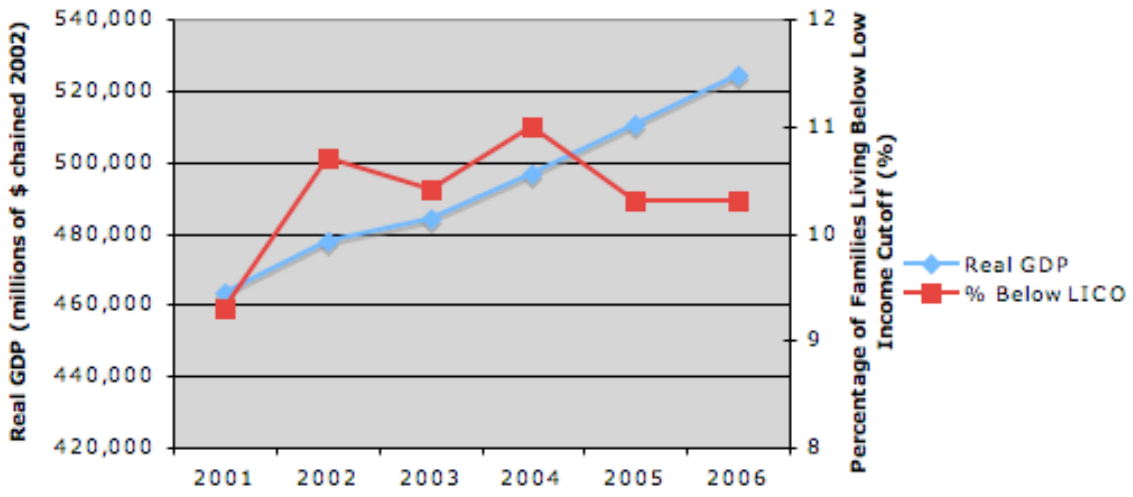
An escape from poverty

Similarly, growth has not met expectations with respect to those who would derive the greatest benefit: the poor. "Economic growth [at the national level] from 1980 onwards did little to help the poorest families, squeezed those with incomes in the middle range and gave the greatest income gains to those at the top end of the income scale" (Victor, 2008: 156).

At the provincial level, Yalnizyan (2007) notes that a legacy of economic growth in Ontario has not reduced the level of poverty in the province. Between 1981 and 2005, the province's economy grew by 310%. However, over this time period, families in the bottom 40% of income earners saw their median income fall by between 1 and 60% (Yalnizyan, 2007). As evidenced in Figure 3, this growth has done little to help families living below the

poverty line.

Figure 3: Ontario's Poverty Rate and Economic Growth, 2001-2006

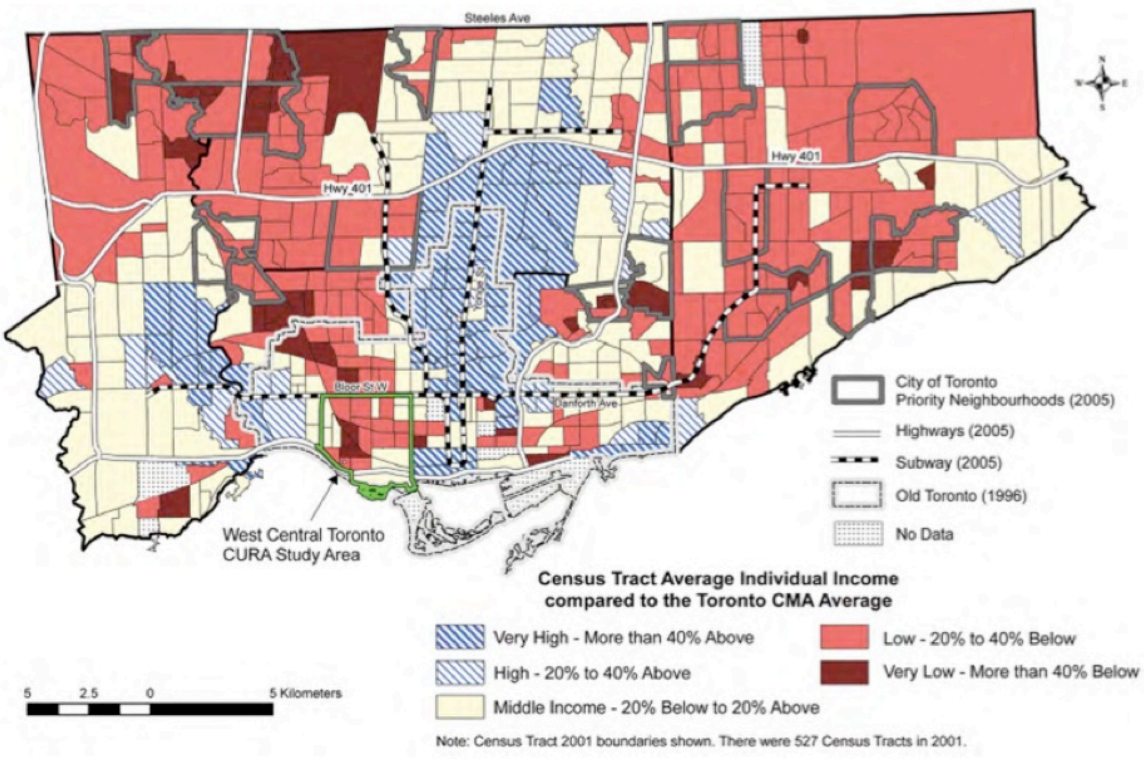


Source: Statistics Canada (2007), Ontario Ministry of Finance (2008)

Gertler asserts "even several years of general prosperity and falling unemployment have not been sufficient to reduce income inequality within the urban populace, and this polarization now appears in danger of becoming entrenched." (2001: 19)

The last two decades have been a time of tremendous change in the spatial distribution of growth in the GGH. Where the economy was once focused on the city of Toronto, businesses are increasingly dispersed in suburban areas (Gertler, 2000). Outer-suburbs and exurban areas, benefiting from their proximity to major highways, have seen extensive employment growth at the expense of the city and inner suburbs which are home to pockets of persistent unemployment (Gertler, 2000) (see Figure 4). Even economically vital areas in the GGH, such as Niagara, Durham, Halton and York regions, are also characterized by high levels of population growth and income inequality (Tomalty et al., 2007).

Figure 4: Average Individual Income in the City of Toronto, 2000



Source: Hulchanski, J. David. (2007). "The Three Cities within Toronto: Income polarization among Toronto's neighbourhoods, 1970–2000" Centre for Urban & Community Studies at the University of Toronto Research Bulletin 41. Available at: urbancentre.utoronto.ca

Increased Individual Freedom

Elsewhere in the Plan and other government documents, growth is promoted as a mechanism for widening the sphere of individual freedom while elevating the competitiveness of the region in the global economy.

> "The stated vision of the Ontario Government is to expand choices in transportation and housing, without restricting anyone's lifestyle choice. The Minister of Municipal Affairs and Housing said the Smart Growth goals were based on choice — the idea that individuals can choose where they want to live, and have the flexibility to live in the way they choose. The government calls this a "made-in-Ontario" Smart Growth strategy." (Environmental Commissioner of Ontario, 2001: 70)

While Smart Growth policy seeks to increase the range of individual choices with

respect to livelihood and urban form, the evidence that economic growth necessarily increases economic or political freedom for everyone in a society is inconclusive at best. Indeed, if economic growth continues to be as unequally distributed amongst residents of the GGH as has been the case over the past several decades, the range of choice for an individual with respect to urban form could be reduced by further growth.

The effect of Smart Growth initiatives on housing affordability are mixed and depend crucially on how such policies are implemented (Alexander et al., 2002; Litman, 2007). " If compact community policies cannot deliver greater affordability and a higher quality of life, then they are not likely to be successful in the long run." (Alexander et al., 2002: 403). For this reason, the Growth Plan needs to more seriously confront the assumption that the Plan will necessarily increase the range of choice for all members of society.

Moreover, economic growth that exceeds the anthropocentric optimum may limit the sphere of choice for human communities. If it undermines the long-term viability of natural capital, economic growth can reduce options for future generations. For example, if a farmer cultivates a field intensively to maximize short-term production values, he may push the field past ecological thresholds of nutrient availability and reduce its ability to produce a crop while maintaining its structure and function in the future. When economic growth drives destruction of ecosystem functions, it can reduce a population's sphere of choice with respect to population size and quality of life. It is this understanding of future consequences of current choices which underlies much of the initial policy groundwork for sustainable development (see Bruntland, 1987).

If the Growth Plan for the GGH intends to facilitate regional economic expansion, than it should explicitly identify the intended beneficiaries of this growth and account for the widening gap in standards of living that this may induce. While the Plan justifies the need for

planning measures to ensure long run economic growth, it does not provide an explanation of why that growth is sensible policy objective.

5.3.2 How to grow?

If the Growth Plan does not justify economic growth as a means for achieving other policy objectives, perhaps it demonstrates thoughtfulness with respect to how the growth should take place. By supporting the development of industries which decouple economic growth from increased total resource use, the Plan could be seen as a vehicle for lessening impacts of human activity.

However, rather than providing directives for which directions the economy should grow, the Growth Plan specifies that land use in the region should support "the unique characteristics and strengths of its economy"(Ontario MPIR, 2006: 6). That is, an economy dependent on several materials-intensive manufacturing industries, with increasing focus on service and knowledge industries[5] catering to external markets, namely the US.

The Plan seeks to minimize some harmful effects of growth such as urban sprawl, traffic congestion, and conversion of employment lands[6]. When the negative impact of urban sprawl on the natural environment is mentioned, it is done so with reference to the consequences for the "natural resources so critical to the future of the economy"(Ontario MPIR, 2006: 8). While awareness of the dependence of the economy on natural systems is a positive step, the Plan promotes an instrumentalist valuation of the region's natural systems.

Municipalities are instructed to "promote economic development and

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[5] While service industries may have lower regional environmental impacts, the shift to a knowledge economy may not decrease the region's overall environmental impact. Ehrlich et al. note "[e]ven if the services sector continues to grow more rapidly than manufacturing, this does not necessarily imply a decrease in total quantities of physical resources mobilized or a decrease in environmental impacts." (1999: 271). In addition, they argue, gains in dematerialization may be offset by impacts occurring as a result of rising affluence.

[6] "Areas designated in an official plan for clusters of business and economic activities including, but not limited to, manufacturing, warehousing, offices, and associated retail and ancillary facilities. (Provincial Policy Statement, 2005)" (Ontario MPRI, 2006: 42)

competitiveness" (Ontario MPIR, 2006: 16) by:

> "[maintaining] an adequate supply of lands providing locations for a variety of appropriate employment uses … to accommodate the growth forecasts, … providing opportunities for a diversified economic base, including maintaining a range and choice of suitable sites for employment uses which support a wide range of economic activities, … planning for, protecting and preserving employment areas for current and future uses, … ensuring the necessary infrastructure is provided to support current and forecasted employment needs." (Ontario MPIR, 2006: 16)

Moreover, these areas are to be located near "existing major highway interchanges"(Ontario MPIR, 2006: 19) to facilitate the flow of goods and services. Placing "the first priority of highway investment [on the] efficient [movement of] goods" (Ontario MPIR, 2006: 25) is cited as a key strategy for maintaining competitive advantage for manufacturing industries (Gertler, 2003). However, it must also be noted that expanding highway capacity induces greater traffic and associated social and environmental impacts (Noland, 2001; Environmental Commissioner of Ontario, 2007; Gertler, 2003).

The Growth Plan's directives for how to grow offer some guidance for minimizing selected negative impacts of growth but fall silent on what policy objectives require continued economic growth.

5.3.3 Response

Amidst this plan for how to best achieve and manage growth, there is no discussion of whether this growth is desirable. As Victor (2008) has argued, economic growth has a mixed record for achieving social and environmental policy objectives and yet it is still being advanced as a primary goal in documents like the Growth Plan. Does economic growth effectively meet social objectives? Does it have associated costs and tradeoffs? Who might this growth benefit? Who might this growth harm? How much is enough? These questions are disappointingly ignored in the Growth Plan.

In his most recent annual report, the Environmental Commissioner of Ontario states "it appears to be a foregone conclusion that development always generates societal benefits in terms of positive economic returns, employment opportunities, higher property values, and so on." (Environmental Commissioner of Ontario, 2007: 50) Often, economic growth is heralded as a panacea to the socio-economic challenges which Canadian communities face: a rising tide lifting all ships. The factual basis for such arguments is seldom examined in detail.

Not only is economic growth not a panacea for the stated policy challenges, using growth as a development strategy may create new challenges for human and biotic communities.

Firstly, rising incomes exact a higher environmental toll across categories of human impact. A recent study for the Federation of Canadian Municipalities demonstrated a strong positive correlation between median household income and ecological footprints of Canadian communities (Wilson et al., 2005).

Moreover, by raising incomes, economic growth changes the nature of a population's environmental impact. A recent study by Kerkhof et al. (2009) showed that climate change and eutrophication increase less than proportionally with rising incomes while acidifcation increases proportionally and smog formation more than proportionally. Thus, the impacts of wealthier individuals differ from those of the poor. In addition to expanding their total volume of consumption, households in higher income brackets shift expenditures towards luxury goods which often embody a higher airshed burden than necessities (Kerkhof et al., 2009).

Finally, higher levels of economic activity at a macro-scale have been associated with loss of wilderness area (Skonhoft et al., 2001) suggesting that greater consumption may increase habitat fragmentation and the destruction of ecological systems.

These relationships confirm that the government of Ontario needs to carefully consider the full spectrum of consequences of promoting economic growth as the *summum bonum* of public policy. "At some point, fundamental questions of growth for what, for whom and with what consequences will be asked by more and more people until there is a shift in societal values away from a growth-first policy." (Victor, 2008: 170) It is this line of thought which inspires the alternative vision offered by ecological economics which will be discussed in Chapter 6.

5.4 Technology

Urban form is a key technology for mitigating human environmental impact. Influencing the behaviors of a population with respect to where one lives and works, how one travels and one's sense of community, urban form has a significant role in shaping our relationship with our environment. Arguably, the Growth Plan uses the technology of urban form as the principle means for reducing the per capita impact of the region's growing population. By concentrating growth in key corridors, increasing density and encouraging shorter commuting distances, the Growth Plan tries to limit the negative environmental consequences of urban development.

The Growth Plan identifies 25 urban growth centres which are intended as the primary receptacles for the anticipated population growth (see Figure 5). While some of these nodes are already developed, others require extensive public and private investment to be considered "complete communities". It may be difficult if not impossible to channel growth to these centres (Neptis Foundation, 2006). The challenge of attracting and maintaining effective employment and residential relationships in undeveloped areas is monumental. In the past decade, 62% of new employment areas have been concentrated near major highway interchanges in "non-transit-supportive office parks" (Neptis Foundation, 2006: 13). Reversing this trend will be challenging.

Figure 5: Proposed Urban Growth Centres in the Greater Golden Horseshoe

Source: Ontario Ministry of Public Infrastructure Renewal. 2006. Growth Plan for the Greater Golden Horseshoe. Schedule 4

The Plan mandates 40% of residential development to occur within existing built up areas (Ontario MPIR, 2006: 14). Winfield reports that the densities are "only about 15% higher than what is already being achieved in some Greater Golden Horseshoe municipalities" (Winfield, 2006: 1). Moreover, these densities are "barely sufficient to support any form of public transit" (Winfield, 2006: 2).

The remaining 60% of residential development will continue on greenfield sites, at a

density "only slightly higher than that achieved in recently built suburbs" (Environmental Commissioner of Ontario, 2007: 34). As average household sizes continue to fall (Neptis Foundation, 2006), achieving these target densities will become increasingly challenging."[M]ore affirmations of business as usual than catalysts for major changes in the location and form of urban development" (Winfield, 2006: 1), the Growth Plan creates lots of latitude for population growth to occur on currently undeveloped land.

5.4.1 Response

The technology of the built form of the GGH specified in the Growth Plan represents the most significant commitment on the part of the Ontario Government to reducing per capita environmental impact. The Plan's commitment to reducing urban sprawl in the GGH is admirable. Indeed, the Growth Plan's sister legislation, the Greenbelt Act, 2005, goes a long way towards preserving key natural systems and prime agricultural land in the region. Nonetheless, significant concerns remain with regards to transit viability and the feasibility of creating complete communities through legislation alone.

By mandating urban form for growing communities, the Plan attempts to limit the impact per capita of the projected population, but like its conceptual forefather, neoclassical economics, it fails to account for net impacts such as total energy consumption, waste generation and air and water effluents which affect the integrity of the region's natural communities. In a region which has grown with little regard for the natural environment, the more conscientious urban form promoted by the Growth Plan is a step in the right direction. However, a greater focus on limiting net rather than per capita impacts is needed.

5.5 Ethics

A community's ethical considerations represent an important opportunity for improving

their contribution to the well-being of human and natural systems. Brown et al. note

> "[e]veryone has duties not only to the individual people or animals that make up ecosystems but to ecosystems themselves. Interdependence is a key feature of the commonwealth of life… Citizenship in the commonwealth of life, then, includes the duty to be stewards of the entire planet – all systems, all its life forms." (2009: 52).

Here I consider the ethical guidance embodied in the Growth Plan for the GGH with respect to natural and human systems and its implications for the impact of the region's human population.

In some respects, the vision for 2031 presented by the Growth Plan is compelling. The Plan emphasizes a shared desire for a region with "a healthy natural environment …clean air, land and water"(Ontario MPIR, 2006: 8). The region's significant natural features have been "enhanced and protected in perpetuity… [and] form the key building blocks of the GGH's natural systems…Open spaces in our cities, towns and countryside will provide people with a sense of place" (Ontario MPIR, 2006: 9). This vision includes the need to "[p]rotect, conserve, enhance and wisely use the valuable natural resources of land, air and water for current and future generations."(Ontario MPIR, 2006: 10)

The Plan makes reference to the importance of "good land stewardship practices" (Ontario MPIR, 2006: 31) for a system of publicly accessible parkland in the region. This is complemented by the expressed need to instill a culture of conservation which wisely manages the use of energy, water and land resources.

But the Plan's vision of a right relationship with the natural world is not so clear-cut. In other parts of the Plan, the desire for protected natural heritage is expressed as an objective to be balanced with competing economic and social goals. The Plan endorses equally "the pillars of a strong economy, a clean and healthy

environment and social equity" (Ontario MPIR, 2006:9) but provides no guidance with respect to priorities or potential conflicts between these stated goals. This is particularly worrisome given that the final Growth Plan omits a definition of 'natural system' included in other versions (Winfield, 2006). At the same time, other features such as Prime Agricultural Area, Employment Area, Regional Market Area retain strong definitions, leaving some wiggle room for policy makers who must balance these considerations in the future.

With respect to our obligations to fellow members of the human community, the Plan offers a more muted vision and falls short in its delivery of practicable action. The vision statements at the beginning of the plan promote the ideals of "social equity…a high standard of living and an exceptional quality of life" (Ontario MPIR, 2006: 9). One might infer from these statements that a good community, as envisioned by the architects of the Growth Plan, is Pareto optimal. In other words, the region should allow for the highest quality of life for each individual which does not make any other individual worse off. But as for particular duties of individuals for the health of a community, such as commitments to participate in democratic decision making and to support the well-being of others, the Growth Plan offers no guidance. In the neo-classical world there is no community.

5.5.1 Response

In spite of a grand vision of economic, social and environmental harmony, the Plan does not speak to the duties and obligations for individuals and governments with respect to human and biotic communities. In this respect, the Plan is characterized by an instrumental view of the importance of natural systems. A clean environment "make[s] our communities more attractive and healthier places to live and work"(Ontario MPIR, 2006: 7). There is no

recognition of the intrinsic value of natural systems, nor sufficient acknowledgement of the deep interconnections between human communities and the environment. Rather, the Growth Plan's efforts with respect to natural heritage preservation are expressed in a language of improving regional competitiveness and attracting a highly skilled workforce.

> "…natural heritage features and areas, irreplaceable cultural heritage sites, and valuable renewable and non-renewable resources…are essential for the long-term economic prosperity, quality of life, and environmental health of the region. These valuable assets must be wisely protected and managed as part of planning for future growth." (Ontario MPIR, 2006: 30)

In sum, the natural heritage of the GGH is to be managed to improve quality of life in order to attract knowledge-intensive economic activity. The Environmental Commissioner of Ontario has noted something of a crisis of conscience in the province.

> "Our legislation, regulations and provincial policy statement all assert our devotion to [current growth patterns]. Yet, in practice, many of our stated priorities are partially or totally incompatible. When conflict forces a resolution, it is usually the environmental priorities that are sacrificed in favour of a short-term economic advantage. We keep saying that we want our cake, but we can't stop eating it." (2007: 5)

In omitting an important discussion of the intrinsic value of natural systems and the dependence of human communities on these systems, the Growth Plan does nothing to reconcile these priorities

While some might suggest that it is not the place of a growth plan to specify ethical obligations, I argue that this Plan does present its own implicit ethic. In the absence of duties to human and natural communities, the Plan suggests the goal of more population and economic growth. In its vision of the future, the Plan falls short of specifying our duties to human and natural communities and fails to specify realistic actions to ensure that the residents of the GGH practice what they plan.

5.6 Impact

With population, affluence, technology and ethics in mind, we can now turn to the overall regional environmental impact of the Growth Plan. Given that the Growth Plan was enacted in 2006, it is difficult to empirically measure the impacts of the policy at this stage. However, by examining the current state of a number of key global and regional environmental indicators, we can assess in what respects human activity in the GGH may already exceed biocentric and/or anthropocentric optima. If this is the case, it must then be determined whether the implementation of the Growth Plan is likely to exacerbate these conditions. If so, the Plan could be deemed ecologically incoherent.

5.6.1 Selection of Indicators

Given the constraints of this study, only a handful of indicators of environmental health could be examined and as with all measures, they present only a limited view of reality. Nonetheless, these indicators provide some insight into the state of the environment in the GGH and offer policy makers some additional guidance with the respect to the impact of growth decisions.

Indicators were selected to represent the nested duties of the residents of the GGH to global and regional systems' air, land and water components as well as overall system health. This choice was informed by a report regarding environmental considerations in the Growth Plan produced by the Neptis Foundation (Ogilvie, 2003). Indicators were selected for their applicability to human and biotic health as well as the availability of data and standards.

Encompassing a subset of the wider Mixedwood Plains Ecozone, the GGH is not considered a useful ecological unit. As a result, very little environmental data exists for the region. Consequently, the most precise unit of study available was used as each indicator

allowed. Common units include the City of Toronto, the Greater Toronto Area, the Greater Golden Horseshoe and the province of Ontario (see Figures 6 and 7). An explanation of each indicator and data source can be found in Appendix I.

Figure 6: Boundaries of the City of Toronto and Greater Golden Horseshoe

Adapted from: Ontario Ministry of Public Infrastructure Renewal. 2006. Growth Plan for the Greater Golden Horseshoe. Schedule 1

Figure 7: Province of Ontario

Source: Ontario Ministry of Public Infrastructure Renewal. 2006. Growth Plan for the Greater Golden Horseshoe. Appendix 1

5.6.2 Analysis

Data collected for each of the selected indicators was compared to biocentric and anthropocentric optima as suggested in scientific and policy literature.

Biocentric optima were identified as the maximum "critical load" thresholds which allowed organisms, ecosystems, the region and/or the planet to maintain structure and function. Anthropocentric optima were much more difficult to extract from the available literature because the notion of an upper bound on human activity is an uncommon one in policy circles (Fraser, personal communication). For this reason, I rely on economically optimal atmospheric greenhouse gas concentrations, a variety of national and provincial human health standards for pollutant concentrations, a minimum standard for forested area in disturbed ecosystems and an equal distribution of the earth's productive capacity amongst the human population in the case of ecological footprint. It should be noted that these values do not reflect true anthropocentric optima because the portion of resources required

to maintain natural capital essential to human existence is not accounted for. Therefore, future studies should consider incorporating a cushion for human support functions into the anthropocentric optima values.

5.6.2.1 Global Impacts

The GGH is a regional system within a larger global system. The impacts of the activities of residents extend far beyond the region's established boundaries. Given this level of interconnection, regional policy should account for the global impacts of local growth. Here, I focus on one key environmental indicator of global importance, atmospheric concentration of greenhouse gases.

5.6.2.1.1 Atmosphere

With respect to greenhouse gas emissions, Hansen et al. (2008) have identified 350ppm as the key threshold for the atmospheric concentration of carbon dioxide equivalent to avoid dangerous climate change. Nordhaus (2008) recommends 480 ppm as an economically optimal concentration which I adopt here as an anthropocentric optimum. Globally, the current atmospheric concentration of carbon dioxide equivalent, 387 ppm, exceeds the biocentric threshold (ESRL/NOAA, 2009). The Greater Toronto Area continues to contribute a great deal to those emissions, with each person emitting roughly 11 tonnes of carbon dioxide equivalent per year (Toronto City Summit Alliance, 2008). This greatly exceeds acceptable emission levels to remain below biocentric or anthropocentric thresholds (see Appendix II for the threshold calculation), as evidenced in Figure 8.

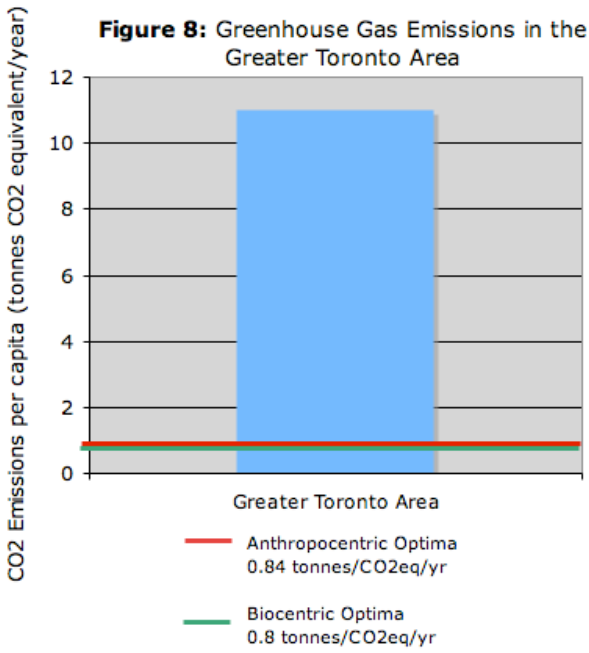


Figure 8: Greenhouse Gas Emissions in the Greater Toronto Area

Source: Toronto City Summit Alliance, 2008; Nordhaus, 2008; Hansen et al., 2008

5.6.2.2 Regional Impacts

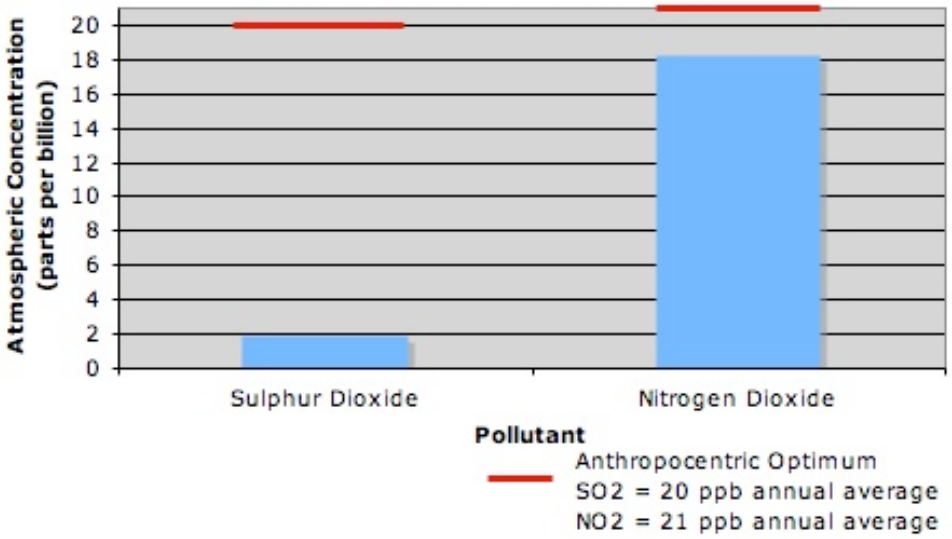
The analysis presented in this section is based on the understanding that human activity in the GGH should not undermine the structure and function of regional ecosystems. I examine the current trends of the regional ecosystem with respect to sulphur dioxide, nitrogen dioxide, ground level ozone emissions, urbanized area, protected greenlands and groundwater quality.

5.6.2.2.1 Air

Sulphur dioxide and nitrogen dioxide have measurable impacts on biotic and human health (Yaffe, 2004). Provincial air quality data from 2007 confirms that Greater Toronto registers well below Ontario and World Health Organization annual air quality criterion (recommended maximum concentrations) of these pollutants suggesting that, on the whole, the anthropocentric optimum has not been exceeded (Environmental Monitoring and

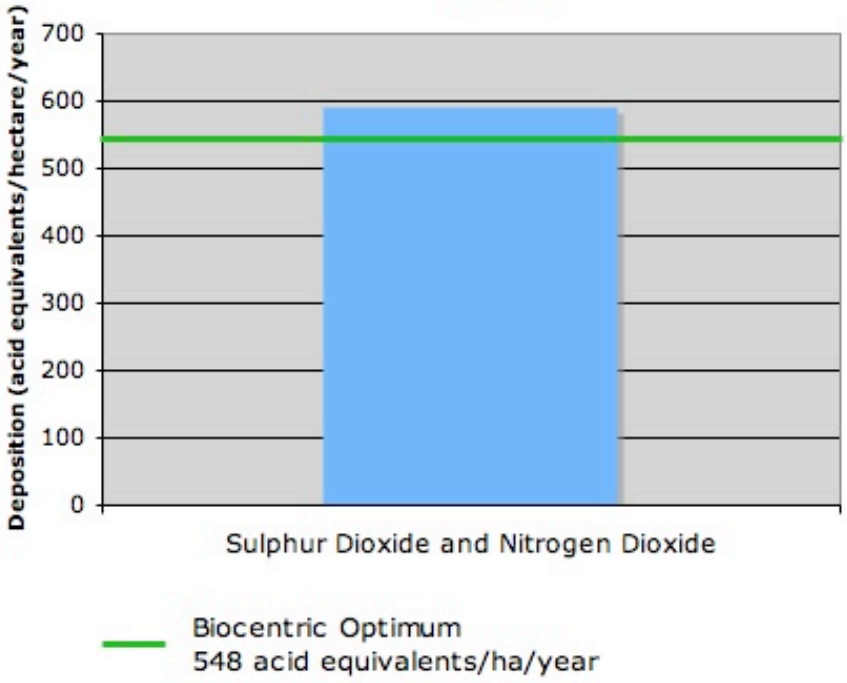
Reporting Branch, 2007) (see Figure 9). However, 1998 data indicates that Ontario forests are subject to greater deposition of these substances than the ecosystems can assimilate, with implications for long term forest health (Ouimet et al., 2006). This suggests that these pollutants exceed the biocentric optimum as presented in Figure 10.

Figure 9: Annual Average Atmospheric Concentration of Sulphur Dioxide and Nitrogen Dioxide in Toronto



Source: Environmental Monitoring and Reporting Branch, Ministry of the Environment, 2007

Figure 10: Deposition of Sulphur Dioxide and Nitrogen Dioxide in Ontario Forests



Source: Ouimet et al., 2006

Groundlevel ozone has serious health implications for both human and biotic communities (Yaffe, 2004; Krupa et al., 2001). For this reason, Health Canada and the United Nations Economic Commission for Europe have set thresholds for the maximum tolerable concentration of this substance over a one-hour period for humans and other species. Both of these thresholds are exceeded in the case of Greater Toronto, on the order of two to nine times per year (Environmental Monitoring and Reporting Branch, 2000) (see Figure 11).

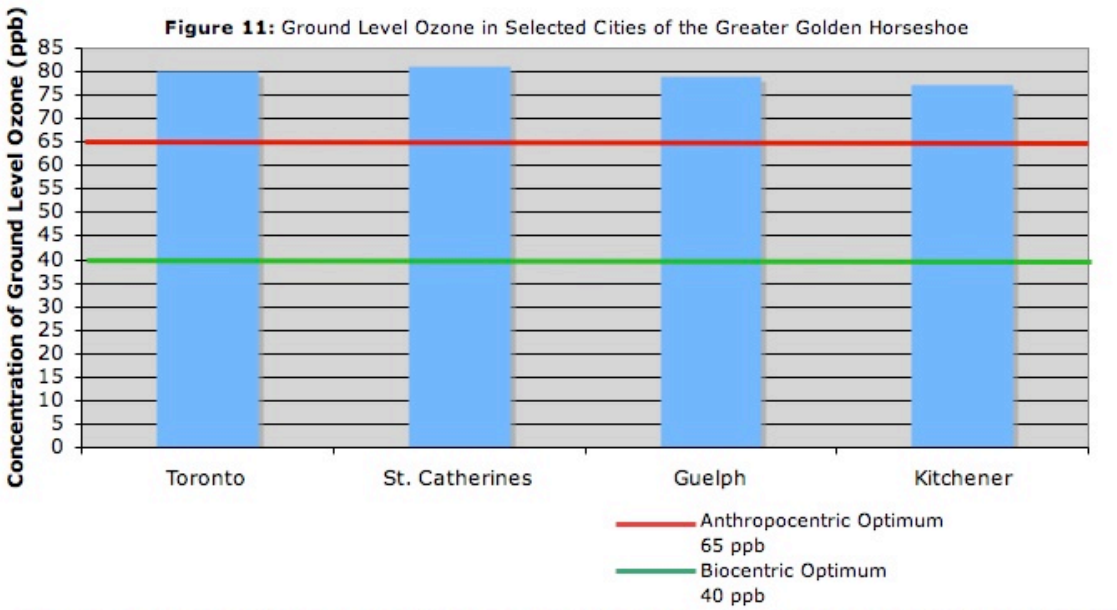


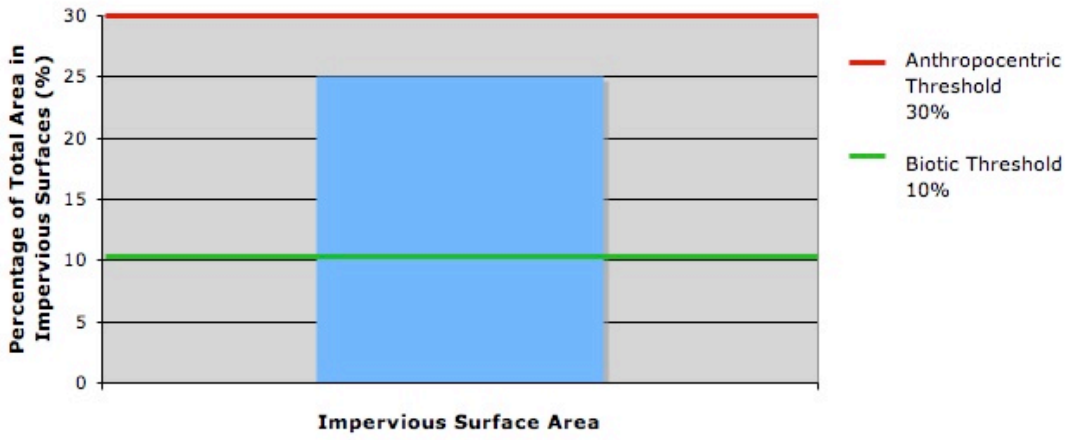
Figure 11: Ground Level Ozone in Selected Cities of the Greater Golden Horseshoe

Source: Environmental Monitoring and Reporting Branch, Ministry of the Environment, 2007; WHO, 2000

5.6.2.2.2 Land

Ontario development guidelines specify that ecological units should abide by a maximum of 10% impervious surface area to maintain system health or a maximum of 30% in degraded/urbanized ecosystems (Environment Canada, 2004). Environment Canada (2004) cites extensive scientific literature on the ecological impacts of increasing the impervious area of a watershed. Changes in runoff processes, degraded water quality, stream system decline due to impacts on fish and wildlife habitat and an overall decrease in diversity are notable when a watershed exceeds the recommended 10% threshold. Adopting 10% as a biocentric optimum and 30% as an anthropocentric optimum, Figure 12 shows that the biotic threshold has already been exceeded in the Greater Toronto Area. Of course, the wide range of land uses within the GGH means that some watersheds are almost completely impervious, while others remain largely natural. On a regional scale, however, the trend since at least the 1980s has been one of rapid urbanization (Tole, 2008). Such large-scale change in land cover has significant regional implications.

Figure 12: Area of Impervious Surfaces in the Greater Toronto Area



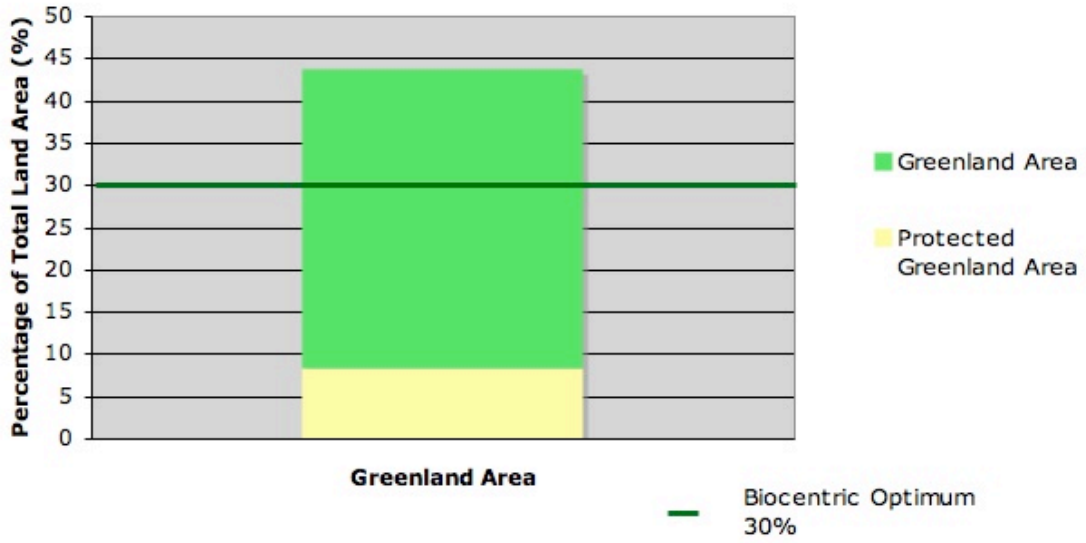
Source: Tole, 2008; Environment Canada, 2004

Environment Canada's (2004) ecosystem health guidelines recommend that at least 30% of an ecological unit have forest coverage. The GGH boasts 43.75% greenland[7] coverage, though a 2004 study of southern Ontario greenlands protection notes that only 19% of these areas are fully protected from development[8] (Fraser et al., 2004). In this sense, the GGH remains below biocentric and anthropocentric optima but must not let down its guard with respect to the protection of these ecosystems (see Figure 13). A 2008 study from the Ontario Biodiversity Council reports that these "remaining fragments of original forest account for Ontario's largest diversity of tree species. The Carolinian forest in southwestern Ontario, which occurs primarily in pockets of privately owned land and protected areas, has the highest species diversity of any of Ontario's forest ecosystems and includes many rare species." (2008: 7)

[7] Fraser et al. define greenlands as "as natural heritage features such as woodlands, wetlands, valleys, watercourses and waterbodies, as well as conservation areas, agricultural preserves, or Crown land. Agricultural areas are included only if protected by municipal policy." (2004: 6) He notes that many of the wetland areas retain additional designation as forested areas (Fraser, personal communication).

[8] The Fraser et al., 2004 study precedes the Ontario Greenbelt legislation (2005). Consequently, the percentage of greenlands protected has increased from the 19% mark.

Figure 13: Greenland Area in the Greater Golden Horseshoe



Source: Fraser et al., 2004;Environment Canada, 2004

Anecdotally, a recent study of the health of the Great Lakes basin reports that "the coastal zone is heavily stressed" (Environment Canada and USEPA, 2007a: 8) and that less than half of the original wetland area in the region remains. While these findings need to be examined at a finer scale, they do suggest that the GGH may have passed some key biocentric optima with respect to land use change.

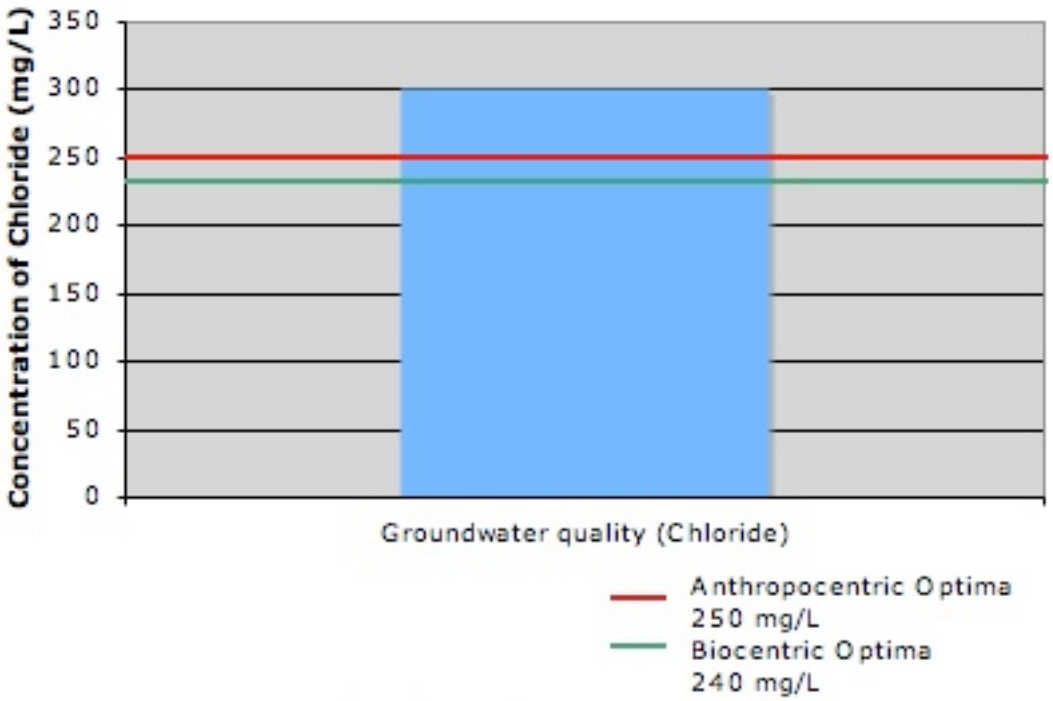
5.6.2.2.3 Water

The health of the region's water supply varies with respect to quality and quantity and is poorly suited to generalized analysis. However, studies of the Great Lakes basin confirm that, for the most part, the region meets anthropocentric optima with respect to the quality of municipally-treated drinking water. In contrast, "the aquatic food web is severely impaired in all the Great Lakes" (Environment Canada and USEPA, 2007a: 5). The study notes worrying concentrations of contaminants in gull eggs and the presence of 17 out of 21 possible organochlorine pesticides in Lake Ontario (Environment Canada and USEPA, 2007b: 97). While difficult to identify biocentric optima for these indicators, it is reasonable

to suggest that the region has exceeded these thresholds.

Many communities in the GGH rely on groundwater resources. As these regions urbanize, they are experiencing trends of increasing concentrations of chlorides, primarily from the application of road salt. The State of the Great Lakes Report 2009 notes that this impact is widespread across the urbanizing watersheds of the GGH (Environment Canada and United States Environmental Protection Agency, 2009). As evidenced in Figure 14, these concentrations surpass both anthropocentric and biocentric thresholds.

Figure 14: Groundwater Quality - Chloride Concentration in Waterloo Region



Source: Environment Canada and United States Environmental Protection Agency, 2009; Environment Canada, 2000

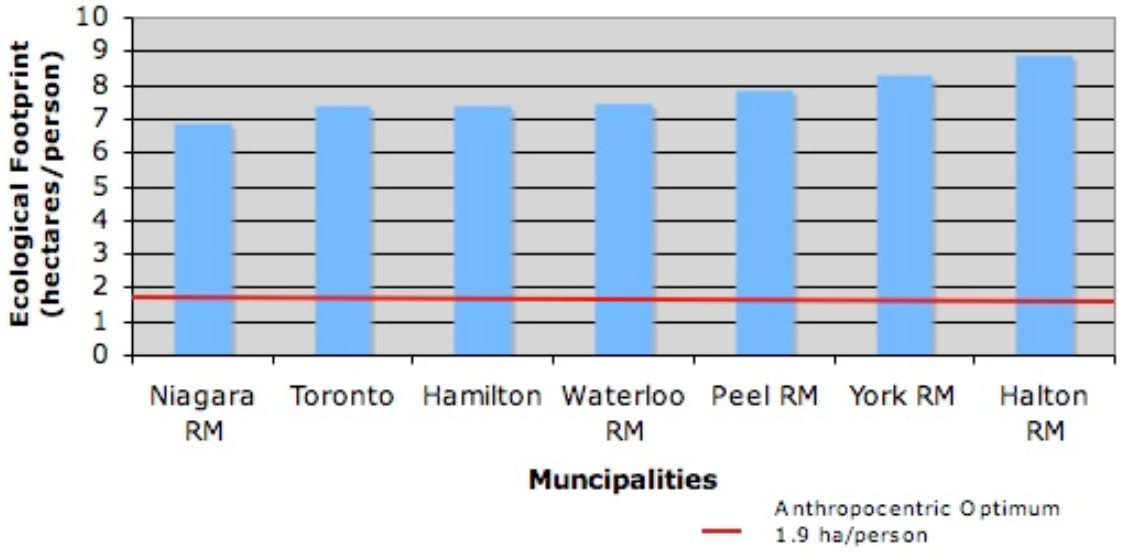
5.6.2.2.4 Overall System Impact

The complementary findings of ecological footprint and human appropriation of net primary productivity are used here as indicators of overall system health.

The threshold ecological footprint is calculated by dividing the planet's available

productive area equally amongst the human population. By this calculation, the anthropocentric optimum for ecological footprint is 1.9 ha/person. Citizens in all of the regional municipalities of the GGH greatly exceed this level (see Figure 15). While a biocentric optimum is not easily determined for this indicator, it would certainly be lower than the anthropocentric optimum and is therefore also exceeded in the GGH.

Figure 15: Ecological Footprint of Selected Municipalities of the Greater Golden Horseshoe



Source: Wilson and Anielski, 2005

While some scholars have attempted to identify a threshold of human appropriation of net primary productivity (Weterings et al., 1992), others recognize that this task is beyond the reach of current scientific and ethical capabilities (Haberl et al., 2004). Nonetheless, recent global data offers a range of 20-70% of net primary productivity being appropriated by humans in the GGH (Haberl et al., 2007). Given that a biocentric optimum accounts for the needs of all members of the biotic community, it is likely that human appropriation in the GGH exceeds this level.

5.6.3 Conclusions

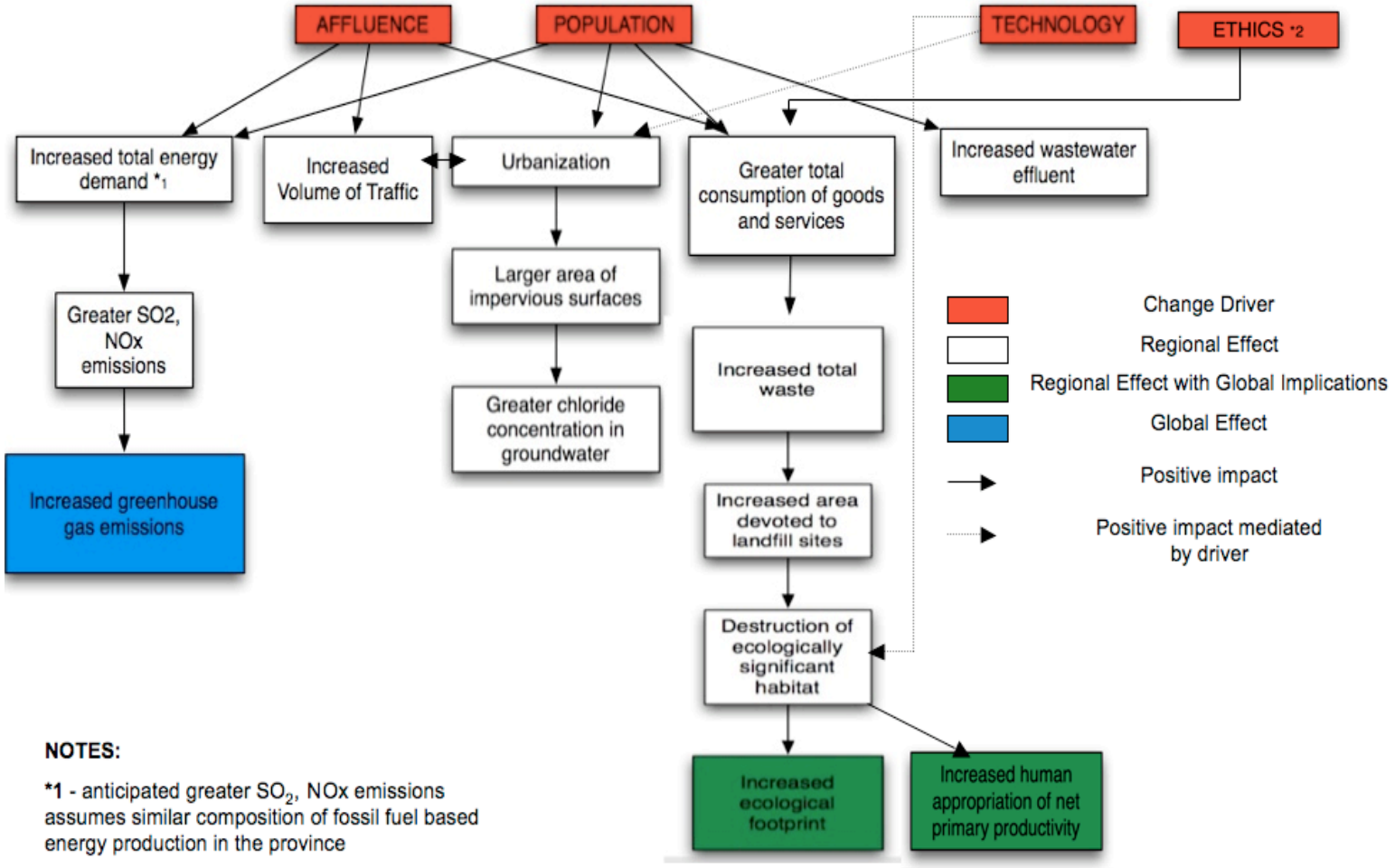
While the indicators presented above in no way offer a complete analysis of the

biocentric and anthropocentric thresholds for the GGH, they do present a stark picture of the impact of human development on the region's ecological systems.

Given that further growth as prescribed by the Growth Plan is likely to include or induce greater emission of airborne pollutants, increased generation of fossil-fuel based energy, greater volumes of vehicular traffic, an increase in carbon emissions, a larger area of impervious surfaces, destruction of significant habitat[9], greater total consumption of goods and services and greater production of waste, one could convincingly argue that the Plan mandates growth in excess of key anthropocentric and biocentric thresholds (see Figure 16). If effectively implemented, the Growth Plan will reduce some impacts below their business as usual levels. However, this improvement is unlikely to bring the GGH below anthropocentric or biocentric optima. Before further population and economic growth occurs in the region's municipalities, policy makers must address these optima through careful study and analysis.

[9] While the complementary Greenbelt, Oak Ridges Moraine and Niagara Escarpment acts were crafted to protect significant ecological features in the region, the leeway provided for aggregate extraction and infrastructure projects may substantially undermine the protection afforded to these features.

Figure 16: Expected Outcomes of the Growth Plan for the Greater Golden Horseshoe



NOTES:

***1** - anticipated greater SO_2, NOx emissions assumes similar composition of fossil fuel based energy production in the province

***2** - Pareto optimal improvements in individual quality of life

5.6.4 Response

As evidenced in the discussion presented above, human activity in the GGH appears to have surpassed certain biocentric and anthropocentric optima. At a regional scale, this will adversely impact the "high quality of life" (Ontario MPIR, 2006: 6) the Plan seeks to create for residents of the area and undermine the integrity of biotic communities in the region. At a global scale, the Growth Plan perpetuates patterns of greenhouse gas emissions which are undermining the integrity of the global climate system and the livelihoods of vulnerable populations the world over. Such a conclusion requires that growth policy in the GGH be revised such that it respects the biophysical capabilities of the region and the globe.

CHAPTER 6: ALTERNATIVE POLICIES INFORMED BY ECOLOGICAL ECONOMICS

6.1 Introduction

Where the previous chapter provided a critique of the Growth Plan for the Greater Golden Horseshoe, this chapter will offer a brief look at some of the policy alternatives of an ecological economics framework. This discussion will again be organized around the IPATE framework.

6.2 Population

Under an ecological economics framework, population policy for the GGH would seek to "stabilize [population] at a level consistent with the capacity of the earth to support its inhabitants at a level of per capita wealth sufficient for a good life" (Daly, 1994: 14). Thus, policy efforts would be directed towards identifying a population that fits within regional system resilience. Larger emphasis would be placed on identifying key system thresholds and investigating ways to move net human impact below these levels.. Individual impact of course depends on affluence, technology and ethics variables. Consequently, decisions about an appropriate population would need to be fundamentally linked to decisions about how that population will live and what constitutes a "good life" for the residents of the region. Ecological economics-based policy for the GGH would structure a notion of limits and appropriate scale into forecasting and planning.

6.3 Affluence

Economic policy would move away from an exclusive focus on increasing economic growth towards a more holistic approach of promoting the well-being of the biotic and human community. Using Daly's (1994) concept of biocentric optimum, policy makers would devote greater energy towards institutionalizing a notion of economic limits such that the invisible hand of the market can operate without putting unsupportable strain on natural

communities (Daly, 1994). In other words, planners and policy makers would help the region to abide by a standard of living which enhances quality of life for all members of biotic and human communities rather than destroying it.

Living within the means of the biotic system may well require a re-conceptualization of wealth, one which encompasses the health of communities as well as individuals. This involves a major shift in thinking which requires some leadership on the part of economists:

> "If [John] Ruskin is correct that real wealth is life (the powers of love, of joy, of full life functionality), then I would suggest that real economics should be concerned with real life issues, including the study and measurement of the quality of life conditions of individuals and households that make up a community" (Anielski, 2007: 19)

Regional decision makers should ask important questions about what we as a society regard as *good* and shape policy to best achieve these goals. As Victor identifies, "[other] policy objectives [such as full employment, lower levels of poverty etc.] can be achieved in a modern economy without relying on economic growth" (2008:183). In concert with a notion of limits, an economy which enhances the quality of life for the GGH's human and non-human communities can begin to take shape.

6.4 Technology

As discussed in section 5.3, the urban form specified in the Growth Plan is one of its strongest components. Complete communities which emphasize mixed land uses and proximity between employment and residential areas will help to reduce the region's per capita environmental impact and to solidify the bonds of community.

It is here that we must leave ecological economics behind. Once it has been established that the municipalities of the GGH must live within the biotic capacities of the region, the doctrine offers little guidance with respect to what makes a good community and the most desirable urban from.

Instead, I turn to the remarkable insights of urbanist, Jane Jacobs:

> "…we need all kinds of diversity, intricately mingled in mutual support…. The main responsibility of city planning and design should be to develop – insofar as public policy and action can do so – cities that are congenial places for this great range of unofficial plans, ideas and opportunities to flourish, along with the flourishing of the public enterprises." (1961: 241).

In this sense, the urban ecosystem is not dissimilar to its natural counterpart. Just as we must nurture the integrity, resilience and beauty (Brown et al., 2009) of the biotic community, the diversity of urban environments requires our respect and attention. Cities, like ecosystems, are "problems of organized complexity" (Jacobs, 1961: 434). By giving local communities room to interpret planning policy, the architects of the Growth Plan offer some recognition of the importance of a diversity of approaches.

A Jacobsian regional plan would affirm the importance of organized complexity while making strides on the issues of affordable housing, transportation and community investment, leaving individual choices within this framework to market forces.

While the Plan makes reference to a desire to promote social equity, it offers little in the way of tangible support for affordable housing. Moreover, as Alexander et al. (2002) explain, increased density may further exacerbate this problem. Recognizing the importance of neighbourhood diversity, a revised plan would address housing issues through supportive policies such as subsidized dwellings for lower income families in mixed income neighborhoods: increasing the sphere of choice in urban form for all citizens.

Given the extensive subsidy governments have offered to private vehicle owners through publicly maintained roads, highways and parking areas, a revised plan would seek to restore diversity to the transportation of people and goods. Where the current Growth Plan offers vague commitments to increase the modal share for walking and cycling, a revised plan would place greater emphasis and tangible action on these environmental and socially

important goals.

Finally, the Plan cites "decades of neglect and lack of sufficient investment" (Ontario MPIR, 2006: 8) as the principle cause for an inadequate urban infrastructure in the GGH. As a remedy, the many specifications regarding greenfield development, intensification and highway construction will require a dramatic investment of public funds into the region's urban form. While this scale of investment may well be needed in the region, Jacobs notes that cities require sustained and gradual investment to preserve diversity-supportive capacities. "City building that has a solid footing produces continual and gradual change, building complex diversifications. Growth of diversity itself is created by means of changes dependent upon each other to build increasingly effective combinations of uses." (1961: 294). For this type of urban evolution to occur, policy makers need to acknowledge that the investments encouraged in the Growth Plan are not a one-time solution to the region's infrastructure woes.

Urban form is an evolving technology which reflects not only economic considerations but also the complex interactions of cultural, social and political climates. Where the broad strokes of ecological economics fall short, Jane Jacobs fills in the details. By supporting organic diversity as well as rectifying social, transport and financial imbalances, an alternative regional plan for the GGH could enhance a mutually supportive future for biotic and human communities.

6.5 Ethics

With respect to ethics, ecological economics once again provides little in the way of guidance. Just as the Growth Plan for the GGH provides no recognition of the intrinsic value of natural systems, nor sufficient acknowledgement of the deep interconnections between human and natural communities, ecological economics avoids the difficult ethical

choices inherent to human existence.

Instead, I turn to those who apply an ethical framework to the work of ecological economists. According to Brown et al., "a first step in building a whole earth economy involves identifying oneself, both individually and in community, as citizens of the commonwealth of life" (2009: 51). As citizens of this commonwealth, we have duties to fellow biotic and human individuals and communities. Such duties must figure prominently in documents like the Growth Plan. With these duties in mind, it becomes clear that

> "the highest and best use of land is not what will bring the greatest economic return but what will bring resilient flourishing of life and the maintenance of capacity for self-renewal. Human uses of land dominated by economic considerations must be seen in the context of the well being of the landscape as a whole. *For the earth as a whole, preservation of self-organizational capacity must trump traditional economic arguments"* (original emphasis) (Brown, 2008: 172)

I would argue that it is this notion of a duty to preserve the planet's self-organizational capacity that behooves policy makers to apply this policy on the regional scale through limits to growth.

6.6 Impact

A revised growth plan would use the biophysical limits of the region as a starting point in planning for the future. Guided by an ethic which incorporates the needs of other species and biotic communities, such a plan would seek to re-scale human activity to a morally appropriate level. The result would be reduced human impact at both the regional and global scales.

Of course, the science of identifying a biotic threshold is imperfect. Resilient ecosystems usually function on a gradient of a variable, rather than reacting only at an identified threshold. Nonetheless, a revised growth plan should devote greater attention to identifying these key thresholds and limiting the impact of the human population through

the variables discussed above.

CHAPTER 7: CONCLUSION

As presented in the preceding chapters, the Growth Plan for the Greater Golden Horseshoe misses the mark in terms of respecting or even acknowledging the biophysical capacity of the region. As I have argued, much of this misguided focus can be attributed to the policy's grounding within the neoclassical economic paradigm. Informed by the ecological economics approach, I take this opportunity to briefly review where the Growth Plan goes astray and where revised policies should lead the region.

Ecological economics-based policy begins by acknowledging that the economy is a subsystem of the biosphere. The dependence of the economic system on the biotic community is profoundly intricate and requires sufficient appreciation.

The Growth Plan legislates growth which lacks a sense of place– encouraging population and economic expansion without regard for the biophysical realities of the region or the planet. This omission is made clear in the selection of the GGH as a planning unit. That the boundaries of the GGH hold little ecological significance is symbolic of the lack of attention paid to the environmental constraints for growth. The Growth Plan does not identify biotic thresholds nor analyze the social or environmental impacts of its implementation. When these thresholds are identified, as in Chapter 5, we see that the GGH has in many cases already surpassed these values and in other cases is on track to do so.

With these criticisms in mind, I offered some suggestions for a revised growth plan: one which addresses the fundamental biophysical limitations that the economy must respect, re-shaping policy on the basis of respect for the "organized complexity" of the region's human and biotic communities. This is achieved through careful consideration of appropriate population, affluence, technology and ethics. Additionally, the revised plan would pay greater attention to the global duties of the region, not as an "economic

powerhouse" (Ontario MPIR, 2006: 9) but as a small part of a fragile planet.

It is within this sphere of biophysical limits that democratic discussion of regional priorities must take place. While the biotic thresholds for the region are rarely up for debate, the social, environmental and economic goals of the region require collective consideration and engagement. It is here that the difficult ethical considerations of the region must be borne out.

On this front, ecological economics offers little guidance. What we are to strive for within the biophysical limits of the system is left up to the utility-maximizing individual. However, I would argue that there is inherent social value in the difficult discussions of our priorities. Addressing the complex issues of individual and community well-being require exchange and engagement amongst the residents of the region. Aiming to maintain the "integrity, resilience and beauty of human and biotic communities" (Brown et al., 2009: 5), the GGH can re-orient itself on a path of equity, compassion and progress.

Above all, this study points to the need for further analysis of ecological limits in the GGH. Future research should expand the small subset of indicators of environmental impact presented here. Additionally, this study has been limited by a narrow definition of anthropocentric optima, as constrained by available human health standards; incorporating the biophysical requirements of local ecosystems to support a given level of human activity into these thresholds would strengthen future research considerably. Finally, this study has presented a generalized view of the GGH as a whole, concealing regional heterogeneity with respect to human and natural communities. Future research should seek to address this variability.

REFERENCES

"Crossroads for growth". Guelph Tribune. December 11, 2007. Available at: http://www.guelphtribune.ca/opinions/article/109922

"Hamilton's Past",. Hamilton Public Library. 2007 Available at: http://www.myhamilton.ca/NR/exeres/0A0E9682-EC49-49DB-BBA7-FD1F9F53E82C.htm

Abel, Andrew B., Ben S. Bernanke, Gregor W. Smith and Ronald D. Kneebone. 2006. Macroeconomics, 4th Canadian Edition. Toronto: Pearson Addison Wesley.

Alexander, Don and Ray Tomalty. 2002. "Smart Growth and Sustainable Development: challenges, solutions and policy directions". Local Environment. 7(4): 397–409.

Anielski, Mark. 2007. The Economics of Happiness: Building Genuine Wealth. Gabriola Island, BC: New Society Publishers.

Arnold, C.L. and C.J. Gibbons. 1996. "Impervious surface coverage". American Planning Association Journal. 62(2): 243-258.

Ayres, Robert, Beatriz Castaneda, Cutler J. Cleveland, Robert Costanza, Herman Daly, Carl Folke, Bruce Hannon, Jonathan Harris, Robert Kaufmann, Xiannuan Lin, Richard Norgaard, Matthias Ruth, Daniel Spreng, David I. Stern and Jeroen C.J.M van den Bergh. 1996. "Natural Capital, Human Capital and Sustainable Economic Growth". Available at: www.bu.edu/cees/research/workingp/pdfs/9702.pdf

Brown Peter G. 2008. Commonwealth of Life: Economics for a Flourishing Earth. Montreal: Black Rose Books.

---. 1976. Ethics and Policy Research. Policy Analysis. 2(2): 325-340.

Brown, Peter G. and Geoff Garver. 2009. Right Relationship: Building a whole earth economy. San Francisco: Berrett-Koehler.

Bruntland, G. (ed.). 1987. Our common future: The World Commission on Environment and Development. Oxford: Oxford University Press.

Burchell, Robert W., David Listokin and Catherine C. Galley, 2000. "Smart Growth: More than a ghost of urban policy past, less than a bold new horizon". Housing Policy Debate. 11(4): 821-879.

Chertow, M. R. 2001. "The IPAT Equation and Its Variants; Changing Views of Technology and Environmental Impact," Journal of Industrial Ecology, 4(4): 13-29. Available at: http://mitpress.mit.edu/journals/pdf/jiec_4_4_13_0.pdf

Common, Michael S and Sigrid Stagl. 2005. Ecological economics: an introduction. Cambridge, UK; New York: Cambridge University Press.

Costanza, R., M. Mageau, B. Norton and B. Patten. 1998. "Predictors of ecosystem health". in: D. Raport, R. Costanza, P. Epstein, C. Gaudet and R. Levins, (eds.), Ecosystem Health, Massachusetts: Blackwell, pg. 241–250.

Daly, Herman. 1994. Beyond Growth. Boston: Beacon Press.

Downs, Anthony. 2005. "Smart Growth: Why We Discuss It More than We Do It". Journal of the American Planning Association. 71(4): 367 — 378.

Dryzek, John S., 1993. "Policy Analysis and Planning: From Science to Argument" in Fischer, Frank and John Forester (eds.) The argumentative turn in policy analysis and planning. London: UCL.

Earth Systems Research Laboratory (ESRL) / National Oceanic and Atmospheric Administration (NOAA). 2009. "Average Concentration of Atmospheric Carbon Dioxide". Available at: ftp://ftp.cmdl.noaa.gov/ccg/co2/trends/co2_mm_mlo.txt

Ehrlich, Paul R. and John P. Holdren. 1971. "Impact of Population Growth". Science. 171(3977): 1212-1217.

Ehrlich, Paul R., Gary Wolff, Gretchen C. Daily, Jennifer B. Hughes, Scott Daily, Michael Dalton and Lawrence Goulder. 1999. "Knowledge and the environment". Ecological Economics, 30(2): 267-284.

Environment Canada and United States Environmental Protection Agency. 2007a. "State of the Great Lakes: Highlights". Available at: http://www.on.ec.gc.ca/greatlakes/default.asp?lang=En&n=32EA0657-1

---. 2007b. "State of the Great Lakes". Available at: http://www.on.ec.gc.ca/greatlakes/default.asp?lang=En&n=32EA0657-1

---. 2009 "State of the Great Lakes – Draft Indicator Report 7100 Natural Groundwater Quality and Human-Induced Changes". Available at: http://www.solecregistration.ca/en/indicator_reports_aquatic_habitats.asp

Environment Canada. 2000. "Canadian Environmental Protection Act: Publication after Assessment of a Substance - Road Salts". Canada Gazette Part I, Vol. 134 No. 33 Available at: http://www.ec.gc.ca/CEPARegistry/notices/NoticeText.cfm?intNotice=70&intDocument=382

---. 2004. "How Much Habitat is Enough? A Framework for Guiding Habitat Rehabilitation in Great Lakes Areas of Concern". Second Edition. Available at: http://www.on.ec.gc.ca/wildlife/publications-e.html

Environmental Commissioner of Ontario. 2002. "2001-2002 Annual Report: Developing Sustainability". Available at: http://www.eco.on.ca/eng/index.php/pubs/eco-

publications/2001-02-annual-report.php

---. 2005. "2004-2005 Annual Report: Planning our Landscape". Available at: http://www.eco.on.ca/eng/index.php/pubs/eco-publications/2004-05-annual-report.php

---. 2007. "2006-2007 Annual Report: Reconciling Our Priorities". Available at: http://www.eco.on.ca/eng/index.php/pubs/eco-publications/2006-07-annual-report.php

Environmental Monitoring and Reporting Branch, Ministry of the Environment. 2007. "Air Quality in Ontario – 2007 Report". Available at: http://www.ene.gov.on.ca/en/publications/air/index.php#2.

---. 2000. "Air Quality in Ontario 2000". Available at: http://www.ene.gov.on.ca/en/publications/air/index.php#9a

Fraser, Donald M. and Bernard P. Neary. 2004. "The State of Greenlands Protection in South-Central Ontario". Neptis Foundation.

Fraser, Donald M., personal communication. "Growth Plan for the GGH: Ecological Impacts of Development." Personal interview: December 20, 2008.

Gertler, Meric. 2000. "A Region in Transition: The Changing Structure of Toronto's Regional Economy The Regional Economy of Toronto". Neptis Foundation. Available at: http://www.neptis.org/library/show.cfm?id=53&cat_id=7

---. 2001. "Urban Economy and Society in Canada: Flows of People, Capital and Ideas". The Canadian Journal of Policy Research. Available at: www.sppsr.ucla.edu/cgpr/docs/MericGertlerpaper.doc

---. 2003. "Smart Growth and the Regional Economy" Smart Growth Issues Papers, Neptis Foundation. Available at: http://www.neptis.org/library/show.cfm?cat_id=6&id=74

Haberl, Helmut, K. Heinz Erb, Fridolin Krausmann, Veronika Gaube, Alberte Bondeau, Christoph Plutzar, Simone Gingrich, Wolfgang Lucht, and Marina Fischer-Kowalski. 2007. "Quantifying and mapping the human appropriation of net primary production in earth's terrestrial ecosystems". PNAS. 104(31): 12942–12947.

Haberl, Helmut, Mathis Wackernagel, Fridolin Krausmann, Karl-Heinz Erba and Chad Monfreda. (2004). "Ecological footprints and human appropriation of net primary production: a comparison" Land Use Policy. 21: 279–288.

Hansen, J., Mki. Sato, P. Kharecha, D. Beerling, R. Berner, V. Masson-Delmotte, M. Pagani, M. Raymo, D.L. Royer, and J.C. Zachos. 2008. "Target atmospheric CO2: Where should humanity aim?" Open Atmos. Sci. J. 2: 217-231.

Hemson Consulting Ltd. 2005. "The Growth Outlook for the Greater Golden Horseshoe".

Available at: http://www.hemson.com/news/04.html

Hietel, Elke, Rainer Waldhardt and Annette Otte. 2007. "Statistical modeling of land-cover changes based on key socio-economic indicators". Ecological Economics. 62: 496-507

Hubacek, Klaus and Jeroen C.J.M. van den Bergh. 2006. "Changing concepts of 'land' in economic theory: From single to multi-disciplinary approaches". Ecological Economics. 56: 5 – 27.

Hulchanski, J. David. (2007). "The Three Cities within Toronto: Income polarization among Toronto's neighbourhoods, 1970–2000" Centre for Urban & Community Studies at the University of Toronto Research Bulletin 41. Available at: urbancentre.utoronto.ca

Immigration and Refugee Protection Act [Canada]. Bill C-11. 28 June 2002, Available online at: http://laws.justice.gc.ca/en/showdoc/cs/I-2.5/bo-ga:s_3//en#anchorbo-ga:s_3

Jacobs, Jane. 1961. The Death and Life of Great American Cities. New York: Random House.

Kerkhof, Annemarie C., Sanderine Nonhebel and Henri C. Moll. 2009."Relating the environmental impact of consumption to household expenditures: An input–output analysis". Ecological Economics. 68 (4): 1160-1170.

Kraehling, Paul and Marion Plaunt. 2008. "REPORT NUMBER Report # 08-83: Addendum Report - Guelph's Local Growth Management Strategy Recommendations". City of Guelph Council Report. Available at: <http://guelph.ca/living.cfm?smocid=2340>.

Krupa, Sagar, Margaret Tuttle McGrath, Christian P. Andersen, Fitzgerald L. Booker, Kent O. Burkey, Arthur H. Chappelka, Boris I. Chevone, Eva J. Pell and Barbara A. Zilinskas. 2001. "Ambient Ozone and Plant Health" Plant Disease. 85(1): 4-12.

Lambin, Eric F., B.L. Turner, Helmut J. Geist, Samuel B. Agbola, Arild Angelsen, John W. Bruce, Oliver T. Coomes, Rodolfo Dirzo, Guunther Fischer, Carl Folke, P.S. George, Katherine Homewood, Jacques Imbernon, Rik Leemans, Xiubin Li, Emilio F. Moran, Michael Mortimore, P.S. Ramakrishnan, John F. Richards, Helle Skaaness, Will Steffen, Glenn D. Stone, Uno Svedin, Tom A. Veldkamp, Coleen Vogel, Jianchu Xu. 2001. The causes of land-use and land-cover change: moving beyond the myths. Global Environmental Change. 11: 261–269.

Litman, Todd. 2007. "Evaluating Criticism of Smart Growth" Victoria Transport Policy Institute. Available at: www.vtpi.org/sgcritics.pdf.

MacKellar, L.F., W. Lutz, C. Prinz and A. Goujon. 1995. "Population, households, and CO2 emissions". Population and Development Review. 21(4): 849–865.

Mackenzie, Hugh, Hans Messinger and Rick Smith. 2008. "SIZE MATTERS: Canada's Ecological Footprint, By Income". Canadian Centre for Policy Alternatives. Available at:

http://www.policyalternatives.ca/Reports/2008/06/ReportsStudies1910/

Marshall, Alfred. 1961. Principles of economics. London, New York: Macmillan for the Royal Economic Society.

Max-Neef, Manfred. 1995. "Economic growth and quality of life: a threshold hypothesis". Ecological Economics. 15: 115-118.

McCandless, George T. 1991. Macroeconomic Theory. Englewood Cliffs: Prentice Hall.

Meridian Planning Consultants Inc. 2006. "City of Guelph: Local Growth Management Study". Available at: http://guelph.ca/living.cfm?subCatID=1532&smocid=2111

Neptis Foundation. 2006. Paper 3: Commentary on the Ontario Government's Proposed Growth Plan for the Greater Golden Horseshoe. Neptis Papers on Growth in the Toronto Metropolitan Region. Available at: http://www.neptis.org/library/show.cfm?id=82&cat_id=30

Noland, Robert B. 2001. "Relationships between highway capacity and induced vehicle travel". Transportation Research Part A: Policy and Practice. 35(1): 47-72.

Nordhaus W. D. 2008. A Question of balance: Weighing the options on global warming policies. New Haven, CT and London: Yale University Press.

Ogilvie, Ken. 2003. "Air, Water and Soil Quality". Smart Growth Issues Paper. Neptis Foundation. Available at: http://www.neptis.org/library/show.cfm?id=47&cat_id=9

Ontario Biodiversity Council. 2008. "Interim Report on Ontario's Biodiversity". Available at: http://www.mnr.gov.on.ca/en/Business/Biodiversity/Publication/243482.html

Ontario Ministry of Finance. 2008. "Table 13: Ontario and the G7, Unemployment Rates, 1994–2007". Available at: http://www.fin.gov.on.ca/english/budget/fallstatement/2008/08fs-ecotables.html#table13

---. 2008. "Table 2: Ontario, Growth in Gross Domestic Product, 1994–2007". Available at: http://www.fin.gov.on.ca/english/budget/fallstatement/2008/08fs-ecotables.html#table2

Ontario Ministry of Public Infrastructure Renewal. 2004. "A Growth Plan for the Greater Golden Horseshoe: Discussion Paper". Available at: http://www.placestogrow.ca/index.php?option=com_content&task=view&id=10&Itemid=15

---. 2006. "Growth Plan for the Greater Golden Horseshoe." Available at: http://www.placestogrow.ca/index.php?option=com_content&task=view&id=9&Itemid=14

Ontario Smart Growth. 2003. "Shaping the Future: Central Ontario Smart Growth Panel – Discussion Paper". Available at: https://ozone.scholarsportal.info/handle/1873/4852

Ouimet, Rock, Paul A. Arp, Shaun A. Watmough, Julian Aherne and Ian Demerchant 2006. "Determination and Mapping Critical Loads of Acidity and Exceedances for Upland Forest Soils in Eastern Canada." Water, Air, and Soil Pollution. 172: 57–66.

Parker, Brent H and Brian Craig. "The Status of Forest Health in Southern Ontario: An Assessment using Tree Mortality Rates". *Ecological Monitoring Coordinating Office, Environment Canada.* Available at: sof.eomf.on.ca.

Pebley, A.R., 1998. "Demography and the Environment". Demography. 35(4): 377-389.

Raskin, Paul D. 1995. "Methods for estimating the population contribution to environmental change". Ecological Economics. 15:225-233.

Rees, William and Mathis Wackernagel. 1996. "Urban Ecological Footprints: Why Cities Cannot Be Sustainable – And Why They are a Key to Sustainability". Environmental Impact Assessment Review. 16: 223-248.

Roca, J. 2002. "The IPAT formula and its limitations". Ecological Economics. 42: 1-2.

Ryan, Kathleen. "Places to Grow: Growth Plan for the GGH Questions." Telephone interview: January 16, 2009.

Schulze, Peter C., 2002. "I=PBAT". Ecological Economics, 40:149-150.

Skonhoft, Anders and Havard Solem. 2001. "Economic growth and land-use changes: the declining amount of wilderness land in Norway". Ecological Economics, 37: 289-301.

Slesnick, Daniel T. 2001. Consumption and social welfare: living standards and their distribution in the United States. Cambridge, U.K.; New York: Cambridge University Press.

Statistics Canada. 2007. "Low Income: Income Trends in Canada 1976 to 2006. Table 13F0022XIE.

Statistics Canada. 2007. Economic Concepts: Economic Growth. Available at: http://www.canadianeconomy.gc.ca/english/economy/economic_growth.html

Taylor, Zach. 2008. "Greenbelt Policy in Southern Ontario". Lecture, McGill University. School of Architecture. November 26, 2008.

Tole, Lisa. 2008. "Changes in the built vs. non-built environment in a rapidly urbanizing region: A case study of the Greater Toronto Area." Computers, Environment and Urban Systems. 32: 355–364.

Tomalty, Ray, Don Alexander, Mark Anielski, Jeffery Wilson, Alexandra Jozsa, Murtaza

Haider, Federico Cartin-Artrega, Daniel Casey. 2007. "Ontario Community Sustainability Report". Pembina Institute. Available at: pubs.pembina.org/reports/ocsr-07-report.pdf

Toronto City Summit Alliance. 2008. "Greening Greater Toronto". Available at: http://www.greeninggreatertoronto.ca/

Victor, Peter. 2008. Managing Without Growth: Slower By Design, Not Disaster. Cheltenham, UK. Edward Elgar Publishers.

Wachs, Martin. 1982. "Ethical dilemmas in forecasting public policy" in Bruce, Willa M. (ed.). 2001. Classics of Administrative Ethics. Boulder: Westview Press, pg. 102 -114.

Weterings, R.A.P.M. and J.B Opschoor. 1992. "The Ecocapacity as a Challenge to Technological Development." Rijswijk: Advisory Council for Research on Nature and the Environment. Publication RMNO No. 74a, 1992.

White, Richard. 2007. The Growth Plan for the Greater Golden Horseshoe in Historical Perspective. Neptis Foundation. Available at: http://www.neptis.org/library/show.cfm?id=84&cat_id=13

Wilson, Jeffrey and Mark Anielski. 2005. "Ecological Footprints of Canadian Municipalities and Regions". Available at: http://www.anielski.com

Winfield, Mark S. 2006. "The Pembina Institute Analysis of the Government of Ontario's Greater Holden Horseshoe Plan". Available at: http://communities.pembina.org/pub/1253

World Health Organization Regional Office for Europe. 2000. "Chapter 12: Effects of ozone on vegetation: critical levels". Copenhagen, Denmark. Available at: www.euro.who.int/document/aiq/12ozonelevel.pdf

Yaffe, Barbara. 2004. "Air Pollution Burden of Illness in Toronto". Toronto Public Health. Available at: http://www.toronto.ca/health/hphe/air_and_health.htm

Yalnizyan, Armine. 2007. Ontario's Growing Gap: Time for leadership. Canadian Centre for Policy Alternatives. Available at: http://policyalternatives.ca/documents/Ontario_Office_Pubs/2007/ontariogrowinggap.pdf

York, Richard, Eugene A. Rosa and Thomas Dietz. 2003. "STIRPAT, IPAT and ImPACT: analytic tools for unpacking the driving forces of environmental impacts". Ecological Economics. 46: 351-365.

APPENDIX I: Impact – Indicators and Data Sources

Indicator	Description	Area Extent	Data Source
SO_2	- Contributes to particulate matter, acid deposition - Primary sources in Ontario: smelters and utilities - Human Health impacts: breathing problems, respiratory illness, lung disease - Ecological Impacts: damages vegetation, acidification, climate change	Human: Downtown Toronto Biotic: Ontario	Current Concentration: Environmental Monitoring and Reporting Branch, Ministry of the Environment. (2007) Anthropocentric threshold: Environmental Monitoring and Reporting Branch, Ministry of the Environment. (2007) Biocentric threshold: Ouimet et al., 2006
NO_2	- Contributes to particular matter, acid deposition - Primary sources: transportation, utilities - Human health impacts: irritates the lungs, decreases resistance to respiratory infection - Ecological impacts: "decreasing tree growth; reducing forest productivity; leaching important nutrients such as calcium and magnesium from forest soils; and increasing tree sensitivity to frost" (Parker et al., pg. 2)	Human: Downtown Toronto Biotic: Ontario	Current Concentration: Environmental Monitoring and Reporting Branch, Ministry of the Environment. (2007) Anthropocentic threshold: Environmental Monitoring and Reporting Branch, Ministry of the Environment. (2007) Biocentric threshold: Ouimet et al., 2006
Ground level ozone	- Primary Source: dependent on meteorological conditions and presence of VOCs emitted from	Selected GGH cities	Current Concentration: Environmental Monitoring and Reporting Branch,

	transportation - Human health impacts: "linked to increased hospital admissions and premature deaths" (Environmental Monitoring and Reporting Branch, Ministry of the Environment, 2007) - Ecological impacts: decreased growth and yield (WHO, 2000)		Ministry of the Environment, 2007 Biocentric threshold: WHO, 2000 Anthropocentic threshold: Environmental Monitoring and Reporting Branch, Ministry of the Environment, 2007
GHG	- Primary Sources: fossil fuel industries, electricity, transportation, heavy industry and manufacturing - Biotic and Ecological impacts: climate change	Greater Toronto Area	Current Concentration: "Climate change 'can be tackled'", 2007 Biocentric threshold: Hansen et al., 2008 Anthropocentic threshold: Nordhaus, 2008
Impervious surfaces	- "any material that prevents the infiltration of water into the soil" (Arnold et al., 1996:) - Primary sources: roofs, roads, sidewalks, compacted soil - Ecological impacts: decline in water quality and interruption of the hydrogeologic cycles	Greater Toronto Area	Current Concentration: Tole, 2008 Anthropocentric Threshold: Environment Canada, 2004 Biocentric threshold: Environment Canada, 2004
Groundwater Quality: Chloride Concentration	- Primary source: road salt, positively correlated with road surface area - Human Health impacts: standard is largely aesthetic, taste - Ecological impacts: at the biotic threshold, 10 percent of species are	Waterloo RM	Current Concentration: Environment Canada and United States Environmental Protection Agency., 2009 Anthropocentric

	affected resulting in changes in populations or community structure (Environment Canada, 2000)		Threshold: Environment Canada and United States Environmental Protection Agency, 2009 Biocentric Threshold: Environment Canada, 2000
Protection of significant habitat	- Greenlands defined as terrestrial elements of the ecosystem and water-based features (Fraser et. al, 2004) - "The amount of forest cover in a landscape determines its ability to support wildlife species." (Environment Canada, 2004: 30)	Greater Golden Horseshoe	Current Concentration: Fraser et al., 2004 Biocentric threshold: Environment Canada, 2004
Ecological Footprint	- Definition: "Ecological Footprint assesses humanity's dependence on the biosphere's productivity in terms of the continuous flow of resources and other ecological services. This assessment builds on the assumption that human well-being will, at least in the long run, decline if human use of nature exceeds nature's regenerative capacity." (Haberl et al., 2004: 281) - Accounts for resource supply, waste absorption, and space occupied for human infrastructure. (Haberl et al., 2004)	Selected cities in the GGH	Current Concentration: Wilson and Anielski, 2005 Anthropocentic threshold: Wilson and Anielski, 2005
HANPP	- "HANPP identifies the intensity with which humans use [resource supply, waste absorption, and space occupied for human infrastructure] within a defined land area. HANPP maps the	Greater Golden Horseshoe – obtained from global dataset	Current Concentration: Haberl et al., 2007

	intensity of societal use of ecosystems in a spatially explicit manner. .. HANPP assesses the changes in ecological energy flows in a defined land area … resulting from human use of these three ecosystem functions." (Haberl et al., 2004, 279) "Increases in HANPP may lead to carbon fluxes from biota to the atmosphere, they may contribute to biodiversity loss, and they may result in diminished resilience of ecosystems, but the effect of a given level (or time path) of HANPP remains unknown." (Haberl et al., 2004: 283)		

APPENDIX II: Biocentric and Anthropocentric Thresholds for Greenhouse Gas Emissions Calculations

Biocentric Concentration = 350 ppm
= 1 PG of CO2e
=1 x 10^15 g C/year

Biocentric Emissions per person = Biocentric Concentration / World Population
= 1 PG / 6 x 10^9 people
= 0.16 PG/ person
= 0.2 x 10^6 g C/person/year
= 0.2 t C/person/year

CO2 molecule = 12 g of C
Total molecule mass = 44 g

= 0.2 t C/person/year (44/12)
= 0.8 tCO2/person/year

Anthropocentric Concentration = 480 ppm
=1.37 PG
=1.37 x 10^15 g C/year

World Population = 6 x 10^9

Anthropocentric Emissions per person = Anthropocentric Concentration / World Pop
= 1.37 PG/ 6 x 10^9 people
= 0.2283 tC/person/year

CO2 molecule = 12 g of C
Total molecule mass = 44 g

= 0.2283 tC/person/year (44/12)
= 0.84 tCO2/person/year