

INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each original is also photographed in one exposure and is included in reduced form at the back of the book.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

UMI

A Bell & Howell Information Company
300 North Zeeb Road, Ann Arbor MI 48106-1346 USA
313/761-4700 800/521-0600

**AN ASSESSMENT OF ECOLOGICAL ECONOMICS
AS A PARADIGM FOR DEVELOPMENT:**

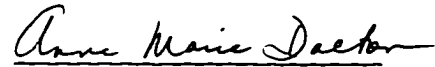
UTOPIAN PIPE-DREAM OR CONFRONTING REALITY

© Copyright 1997 by Heather Johannesen

A thesis submitted in partial fulfillment
of the requirements for the Master of Arts degree in
International Development Studies
at
Saint Mary's University

June 27, 1997

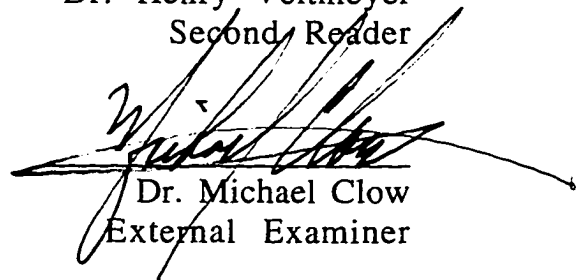
Signatures of the Examining Committee



Dr. Anne Marie Dalton
First Reader



Dr. Henry Veltmeyer
Second Reader



Dr. Michael Clow
External Examiner



National Library
of Canada

Acquisitions and
Bibliographic Services

395 Wellington Street
Ottawa ON K1A 0N4
Canada

Bibliothèque nationale
du Canada

Acquisitions et
services bibliographiques

395, rue Wellington
Ottawa ON K1A 0N4
Canada

Your file Votre référence

Our file Notre référence

The author has granted a non-exclusive licence allowing the National Library of Canada to reproduce, loan, distribute or sell copies of this thesis in microform, paper or electronic formats.

The author retains ownership of the copyright in this thesis. Neither the thesis nor substantial extracts from it may be printed or otherwise reproduced without the author's permission.

L'auteur a accordé une licence non exclusive permettant à la Bibliothèque nationale du Canada de reproduire, prêter, distribuer ou vendre des copies de cette thèse sous la forme de microfiche/film, de reproduction sur papier ou sur format électronique.

L'auteur conserve la propriété du droit d'auteur qui protège cette thèse. Ni la thèse ni des extraits substantiels de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation.

0-612-22798-7

Canada

Abstract
**An Assessment of Ecological Economics as a Paradigm for Development:
Utopian Pipe Dream or Confronting Reality?**

Heather Johannesen
June 27, 1997

This thesis compares two world views represented on the one hand, by the modernization paradigm with its growth orthodoxy and on the other hand, by the ecological economics paradigm which advocates limits to growth. It argues that the growth model is undermining the regenerative and assimilative capacity of the ecosphere and that it is weakening global scale ecosystems such as global climate regulators, stratospheric ozone, biodiversity, biomass stabilisation, and healthy soil for agriculture. Furthermore, the growth model, particularly in its current neoliberal configuration, is incapable of alleviating poverty. Instead it is widening the gap between the 'haves' and the 'have nots'.

In laying out the thesis, three icons are used which conceptualize environment/economy relationships. These icons demonstrate how big an economy can be, how big it actually is, and how big it should be. Vitousek et al put forward evidence that the global economy has grown to occupy 40% of the biosphere's total potential. Their hypothesis is tested using feedback from nature to conclude that the present economic subsystem has grown to its full potential and that further growth cannot be undertaken without risking catastrophic ecosystem disruption.

The thesis argues the ecological economics paradigm provides a more realistic and theoretically consistent approach to development. Ecological economics is a world view which recognizes limits to economic growth and which advocates ethical science and social justice. The thesis samples philosophical and economic viewpoints which provide inspiration for the ecological economics vision. Concepts which give the ecological economics paradigm form and biophysical dynamics binding the economy to the environment are explored. Tools such as footprint analysis provide a methodology for implementing ecological economics.

The thesis concludes that it is becoming impossible to ignore the reality that the modernization paradigm is a utopian world view that has run its course. The ecological economics paradigm offers a more realistic set of principles from which we can construct sustainable lifestyles for present and future generations.

CONTENTS

Abstract

Chapter One: Introduction and Thesis Overview

1.0	Introduction	1
1.1	Development Defined	7
1.2	Thesis Overview	11

Chapter Two: The Drive Toward Modernization

2.0	Introduction	14
2.1	Fifty Years of Modernization: An Overview	15
2.2	The Growth Debate	24
2.2.1	Socio-political Aspects	24
2.2.2	Biophysical and Social Limits to Growth	28
2.3	Environmental Impacts of the Growth Model	33
2.3.1	Evidence of Limits: Human Biomass Appropriation	34
2.3.2	Evidence of Limits: Global Climate Change and Variability ...	35
2.3.3	Evidence of Limits: Stratospheric Ozone Depletion	42
2.3.4	Evidence of Limits: Land Degradation	45
2.4	Impacts of Technology	47
2.5	Concluding Remarks	52

Chapter Three: The Evolution of Ecological Economics

3.0	Introduction	55
3.1	Native World View Vis a Vis European Philosophy.....	57
3.2	Marxism	61
3.2.1	Neo-Marxism	64
3.2.2	Distributive Justice Theory	66
3.3	Demographic Theories	71
3.4	Steady State Theory	76
3.5	Concluding Remarks	78

Chapter Four: The Ecological Economics Paradigm

4.0	Introduction	79
4.1	Ecological Economics: An Overview of the Paradigm	81
4.1	General Systems Theory	86
4.1.1	Hard Systems	87
4.1.2	General Systems	88
4.1.3	Systems Theory Relevance for Economic Modelling	89
4.2	Second Law of Thermodynamics	93
4.3	Ashby's Law of Requisite Variety: Managing Complexity	95
4.4	Carrying Capacity/Appropriated Carrying Capacity	99
4.5	Concluding Remarks	104

Chapter Five: Rounding Out the Vision

5.0	Introduction	106
5.1	The Challenge to Scientific Imperialism	106
5.2	Spiritual Dimensions of Ecological Economics	109
5.3	A Feminist Perspective	112
5.3.1	The Impact of Modernization on Women	114
5.4	Concluding Remarks	117

Chapter Six: Conclusion: Who are the Utopians?	
6.1	Limitless Growth as a Naive World View119
6.2	Practising the Politics of Self-Interest in the Name of Poverty Alleviation125
6.3	Confronting Reality.....130
	Bibliography135

An Assessment of Ecological Economics as a Paradigm for Development: Utopian Pipe Dream or Confronting Reality?

Chapter One: Introduction and Thesis Overview

1.0 Introduction

The myth of modern society is that economic growth will cure what ails us. This myth is defended most vigorously by its shareholders of course, but increasingly it is being challenged by the vast majority of humanity whose piece of the elusive pie seems to be shrinking rather than growing. The number of people now living near or below subsistence is increasing in spite of the international rhetoric which promises to reduce their plight. The widening gap within countries and between countries has been accompanied by a corresponding loss of economic and political influence and power. The most recent and gravest threat is that of global scale environmental deterioration and we now seem to be tumbling into a downward spiral in which poverty and ecological deterioration are feeding off each other.

Conditions of escalating inequity seem to be accompanied by heightened levels of insensitivity by those in a position to remedy the situation. The sole prescription being offered by international institutions is more growth facilitated by free market economies. Those who propose the possibility of a world where people can have the dignity of meaningful work to be able to meet their basic needs and the ability to live in a healthy environment are labelled naive utopians. But I would argue that it is more utopian to think that a few of the world's population can maintain a privileged existence at the expense of the vast majority in an atmosphere conditioned by war, abject poverty, famine, brutal dictatorships, oppressive and inequitable labour conditions and the destruction of global life support

systems. It is even more utopian to believe that a continuation of the present system would cure these global ills.

As we approach the millennium, one is easily torn between hope and despair: hope because there is so much potential in human ingenuity and creativity; despair because the outlets to express our creative talents are diminishing. For the past fifty years, we have been fixated with the global scale project of modernization. There is nothing inherently wrong with modernization.¹ However, the project as it has been implemented calls for engineering of economies within a very narrow band of possibilities while conveniently ignoring portentous limitations. The call for increased economic growth within the confines of a finite material environment simply ignores reality.

The challenges to this approach have become more articulate over the past quarter century and are beginning to gel under the rubric of a new paradigm known as ecological economics. These world views (growth paradigm and ecological economics) are conflictual and since the balance of world power is vested in the growth option, it will be no small challenge to turn the tides. One of the great weaknesses of growth orthodoxy is that it is not rooted in biophysical principles of the natural world. Planet Earth is a materially closed system. Population growth and material economic expansion in a closed system can only occur at the expense of other species and ultimately the functional integrity of the ecosphere itself.²

¹ Schuurman, Frans J. Beyond the Impasse: New Directions in Development Theory, N.J.: Zed Books, 1993, p. 27. Schuurman points out: "Social movements (new and old) in the Third World are not expressions of resistance against modernity; rather, they are demands for access to it. On the other hand, expressions against modernity can also be seen in the numerous movements by indigenous peoples who see the process as cultural annihilation and a way to expropriate their homelands.

² Daly, Herman, Beyond Growth: The Economics of Sustainable Development, Boston: Beacon Press, 1996, pp.33-37.

The starting point of ecological economics is that the human economy is a subsystem of the natural world (the ecosphere)¹. This view sees the present growth economy as an open, growing subsystem, embedded within a closed system (the ecosphere) as regards materials and capacity to absorb wastes.² Therefore, if the economic subsystem expands to a point that is greater than the ecosphere can support, the ecosphere will collapse and with it, the economic subsystem. Growth orthodoxy simply refuses to acknowledge this common sense reality. The following diagram illustrates the point. The diagram is viewed through an ecological economics lens.

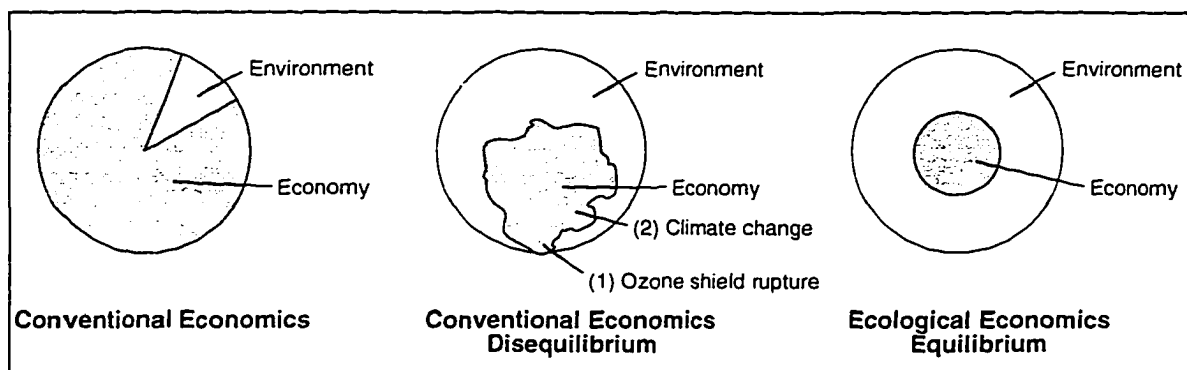


Figure 1.1 A comparison of environment/economy relationships viewed through an ecological economics lens.

¹ The ecosphere can be defined as a system that includes all living things and the air, water and soil which is their habitat. By conceptualising it as a system, its unity is emphasized in that a system is made up of interrelated parts in dynamic interaction with each other. The ecosphere is a self-regulating system in which the interacting subsystems behave in such a way as to ensure the stability of the whole system. If these self-regulating mechanisms are disrupted to the point where they can no longer perform the functions for which they were intended, the stability of the system is threatened. Thus, if we create waste in greater quantities and at a greater rate than the ecosphere can absorb we threaten its stability.

² The ecosphere can be thought of as an open system in regard to energy because earth is continuously being bombarded with solar radiation. It is closed as regards materials. Materials are continuously recycled and waste products from one process will serve as materials for the next.

The first icon depicts conventional economic models.⁵ Ideologies covering the spectrum between free market economies and centrally planned models fall under this world view because the central pillar of both perspectives is material economic growth even though they may differ on the distribution of the fruits of production. This paradigm has not reconciled its relationship with the natural world; in fact, the environment is treated as a sectoral interest, a subsystem of the human economy and subject to considerable adjustment by technological innovation. By separating environment and treating it as a sectoral interest, environment assumes a position that is one of many other economic considerations - transportation, communications, etc. These sectors are crucial underpinnings of a healthy economy (given that they are environmentally sensitive) and their value is self-evident. By conceptualising the environment as a 'sub-system', we can treat it as a variable. In managing this sub-system, we cut its budget when it becomes a threat to the economic 'whole' system. This world view places no intrinsic value on the ecosphere nor does it assign a value for the function nature provides as a source of all material inputs feeding the economic subsystem, the sink for its wastes, and the vital role it plays in maintaining life support systems. In fact these vital functions are considered to have marginal value because they are "free". The more critical aspect of this world view is that there are no boundaries to contain the economy. The conventional economics icon symbolises the way in which the economy is

⁵ For the purpose of this thesis, conventional economics will refer to mainstream economic models that have a growth orientation. At present, neoliberalism is the dominant economic model and unless otherwise indicated, conventional economics will refer to the neoliberal model. The neoliberal model is being adopted in a growing number of countries, in part, as a condition to being able to trade and to have access to investment funds. Central planning models are just as destructive of the natural environment and just as imperialist in its socio-economic policies as the neoliberal model.

seen to be “limitless”, a perpetual motion machine which can grow indefinitely.

The second icon depicts the present global economy as it relates to the ecosphere. This icon is viewed from the perspective of ecological economics. It demonstrates constraints to material growth and it shows that we have transgressed some ecosystem boundaries that are global in scope. The point (1) where the economy reaches beyond the ecosphere boundary symbolises holes in the ozone layer. The second area (2) that is approaching limits illustrates climate change. Ozone and climate are global scale ecosystems and their destruction is difficult to halt because they are part of the global commons. We all draw from the commons but are reluctant to assume responsibility for ensuring its health and resilience. The collapse of fish stocks, declining water tables, massive deforestation, desertification, dying lakes, and species decline are compelling indicators from nature that we have transgressed critical thresholds⁶.

Recent estimates suggest that our economy has grown to use about 40% of the net primary product of terrestrial photosynthetic activity of nature (see Chapter Two, Section 2.3.1 for a fuller discussion of this study) and that in the next doubling of the population, approximately 35 to 40 years, we will use about 80%. It is unlikely that the ecosphere will be able to withstand this level of economic activity. Even if we assume that the above estimates are too high, they are a dramatic demonstration of the direction in which we are headed. This biophysical reality is not reflected in the policy orientation of dominant international financial institutions, transnational corporations and government institutions which promote growth as necessary for poverty

⁶ Brown, Lester R. et al, eds., State of the World 1996. A Worldwatch Institute Report on Progress Toward a Sustainable Society. New York: World Watch Institute, 1996, p.4.

elimination and for providing the financial resources needed to deal effectively with environmental deterioration.

The third icon depicts an ideal economy in a state of equilibrium with the natural world. Chapter Three elaborates more fully on how this state is defined. However, as we can see from the illustration, the economy stays a respectful distance away from the boundaries. It means that we use resources and dispel wastes in accordance with the regenerative and assimilative capacity of the environment while bearing in mind the needs of future generations. This is not to be translated as a highly technical endeavour in which authority for the way we develop is vested in technocrats who use precision engineering to guide our efforts. Rather it means that we will replace “the economic norm of quantitative expansion (growth) with that of qualitative improvement (development) as the path of future progress.”⁷

It is becoming increasingly clear that a clash of world views is emerging and the points of divergence are coming into clear focus.

Further expansion of the human niche now frequently increases environmental costs faster than it increases production benefits, thus ushering in a new era of antieconomic growth, growth that impoverishes rather than enriches because it costs more at the margin than it is worth. This antieconomic growth makes it harder, not easier, to cure poverty and protect the biosphere. GNP continues to grow while the welfare of the people declines. ... (W)e continue to mistake the symbol for the reality symbolised. Even after the symbol has become a gross misrepresentation of reality we continue to serve it.⁸

We used to observe that development produced pollution and we undertook to address its more deleterious effects. Now we are observing that environmental degradation is beginning to limit development⁹. Further, there is no evidence that today’s brand of ‘development’ is alleviating

⁷ Daly, 1996, p.1.

⁸ Daly, 1996, p. 218.

⁹ Our Common Future: The World Commission on Environment and Development, Oxford: Oxford University Press, 1987, p.70.

poverty, in fact, the social inequities arising from present practices create greater conditions of poverty. The legacy of the modernization paradigm for the South has been falling personal incomes, falling commodity prices, lack of aid and investment, staggering debt loads, and environmental disaster. These same indicators are now in evidence in the North although their impact is moderated by the presence of a social net, even if the net is a bit tattered. Can we really call this development?

1.1 Development Defined

Wolfgang Sachs challenges the centrality of 'development' in the international discussion on the environment and the way in which responsibility for repair of the damage done has been handed over to those social forces (governments, agencies and corporations) which have largely been responsible for the damage inflicted¹⁰ as "degradation in the wake of development was redefined as a lack which called for yet another strategy of development."¹¹ He reminds us that development as we have come to know it has been responsible for the "dissolution of cultures which were not built around a frenzy of accumulation" and "the gradual subordination of ever more aspects of social life under the rule of the economy".¹² Development, in Sachs' view, is a meandering path in which "the challenge

¹⁰ Sachs, W., *Introduction, The Development Dictionary: A Guide to Knowledge s Power*, N.J.: Zed Books, 1993, p.4 The literature on the meaning of development is voluminous. See for instance: Sutcliffe, Bob, *Development After Ecology The North The South and The Environment: Ecological Constraints and the Global Economy*, Bhakar, V. and Glyn, Andrew (eds), London: Earthscan Publications Limited, 1995. Seers, Dudley, *The new meaning of development, International Development Review*, 1977, no. 3, pp 2-7. Seers, D. *The birth, life and death of development economics, Development and Change*, 1979, vol 10, pp. 707 - 19. Sen, A. *Development as capability expansion* in K. Griffin and J. Knight, eds. *Human Development and the International Development Strategy for the 1990s*, Basingstoke: Macmillan, 1990, pp. 41-58, Shiva, Vandana, ed., *Close to Home: Women Reconnect Ecology, Health and Development Worldwide*, Philadelphia: New Society Publishers, 1994.

¹¹ Sachs, 1993, p. 9.

¹² Sachs, 1993, p. 5.

consists in designing cultural/political limits to development. Each society is called upon to search for indigenous models of prosperity, which allow society's course to stay at a comfortable distance from the edge of the abyss."¹³ Development in this view is deferential to nature, living within the prescribed boundaries of nature rather than trying to redefine the boundaries. It is the spirit of this definition that ecological economics seeks to reflect.

The corollary to development, 'sustainable development', has become sufficiently vague that "nobody is sure of what it means" although the concepts attached to the term have significant "influence over our future."¹⁴ The World Bank for instance states: "Sustainable development is development that lasts".¹⁵ The World Commission on Environment and Development (WCED), under the guidance of Gro Harlem Brundtland, popularized the term defining it as "development that meets the needs of today without compromising the ability of future generations to meet their own needs".¹⁶ The authors of the report were sensitive to socioeconomic as well as environmental issues and attempted to combine what had previously been viewed as polarised focuses for development strategies into the same theoretical framework. Indeed the global response to the ideals sanctioned by the Commission has been overwhelming. But while we are united in embracing these ideals, we are strongly divided on the ways and means of achieving them; specifically, between those who believe sustainable development can be achieved by tinkering with our present systems and those who believe we need nothing short of a revolution in our way of thinking; a total transformation of the position assumed by humankind

¹³ Sachs, 1993, p.12.

¹⁴ Daly, 1996, p. 2.

¹⁵ WCED, 1987, p. 34.

¹⁶ WCED, 1987, p. 8.

within nature. ¹⁷

The modernization paradigm advocates a normative/conventional approach built on economic growth. The WCED identified a strong correlation between poverty and environmental degradation. Neoliberals have proposed that benefits from growth will trickle down to help the poor meet their basic needs. They further suggest that protection of the environment can be assured most effectively through government regulations by integrating economic growth with environmental management in a *financially*¹⁸ responsible manner.

Those who wish to transform the system subscribe to an alternative world view based on social equity and social self-determination, ecological stability and reorientation and transformation of socioeconomic systems. 'Sustainable development' in this view is criticised as being oxymoronic, particularly in view of the fact that the WCED advocated increased growth to achieve sustainable development. It is preferable to speak of developing sustainability because our present course of action is unsustainable.

Even when considering environment and economy in the same framework of analysis, conventional approaches to development do not recognize the existence of absolute limits to growth. For instance, the Brundtland report states "The concept of sustainable development does imply limits - *not absolute limits but limitations imposed by the present state of technology and social organization* on environmental resources and by the

¹⁷ See Shiva, 1994, Sachs, 1995 for arguments for radical change of the system. For arguments for reform of the system see: Sanyal, Bishwapriya, *Ideas and Institutions: Why the Alternative Development Paradigm Withered Away*, *Regional Development Dialogue*, Vol. 15, No. 1, Summer, 1994, pp.23-35. and Gore, Al. *Earth in Balance*. Boston: Houghton Mifflin, 1992.

¹⁸ This is code for ensuring that financial considerations take precedence over socio-environmental ones.

ability of the biosphere to absorb the effects of human activities.”¹⁹ The report calls for “more rapid economic growth in both industrial and developing countries”, anticipating a “five-to-tenfold increase in world industrial output” as a precondition to achieving sustainable development.²⁰ The call for increased economic growth has been enthusiastically endorsed by international financial institutions.²¹ Ecological economists have been forthright in their skepticism that a five-to-tenfold increase in world industrial output is achievable. For the most part, their prognosis of this scenario is the collapse of ecosystems long before we reach that level of growth.²²

Herman Daly offers an insightful discussion on the meaning of sustainable development. As he points out, even though there is much debate on the subject, the “human mind is clever” and capable of dealing with concepts that are “dialectically vague at the margins”. We know that development should not impoverish the future and that economic activity should respect natural laws that govern the health of the base that the activity depends upon. In particular the developed countries of the North should cease physical growth while qualitative improvement continues. Part of qualitative improvement will be equitable distribution, between and within nations.²³

On the basis of discussions such as I have presented here, development will be understood in this thesis to be a process rather than a goal in which

¹⁹ WCED, 1987, p.8, italics added.

²⁰ WCED, 1987, p.89.

²¹ It is assumed by these interests that concern for distribution of that wealth need not be articulated: trickle down assures it.

²² Goodland et al, Population, Technology, and Lifestyle: The Transition to Sustainability. Washington D.C.: Island Press, 1992.

²³ Daly, 1996, p. 1-3.

societies design indigenous models of prosperity through which their citizenry may achieve their full human potential within spatial and temporal limits. Acknowledging spatial limits will encourage people to live within the prescribed boundaries of nature. In organising our activities to meet our needs, we must recognize that humans are but one species among millions, all of which are interdependent and necessary for survival of the whole. This interdependence infers the need for recognition of more equitable relations within and between species. Acknowledging temporal limits will secure the rights of future generations, encouraging people to curb their extravagant use of resources and uncritical creation of wastes.

1.2 Thesis Overview

The cornucopian myth of boundless nature upon which growth models of development are premised, have altered and perhaps even irreparably damaged the biosphere from which they draw their wealth. Neoliberalism, the model which dominates most of the globe, views growth as a precondition of the health of development. Paradoxically, limits to growth are a precondition for the health of the ecosphere within which it operates. The “Age of Exuberance”²⁴ may have made sense at one time, but it is clear that conditions have changed and old ways of thinking must change as well. The neoliberal model has not only failed to provide even basic needs to the world’s poor, it is responsible for a widening disparity between and within nations laying waste to any remaining notions of the efficacy of “trickle down” theory. Clearly a new world vision is needed.

After all these years of ignoring nature’s limits and understanding our place within nature, it is perhaps time to usher in the ecological era.

²⁴Ophuls, William, Ecology and the Politics of Scarcity: Prologue to a Political Theory of the Steady State, San Francisco: W. H. Freeman and Company, 1977.

Ecological economics provides an alternative that conceptualizes the human economy as a subsystem of the ecosphere, thereby providing a more accurate depiction of our place within the natural environment. The goal of this model is frugality, meaning “neither poverty nor abundance”²⁵, based on physical flows and moral principles. By combining science and social conscience, this view builds on a strong conceptual base while taking into consideration the social, ecological, economic and cultural dynamics of population-environment linkages. Ecological economics offers an alternative vision for development which is timely, necessary and practical.

This thesis will compare the two world views represented on the one hand, by the modernization paradigm with its growth orthodoxy and on the other hand, by the ecological economics paradigm based on limits to growth. It will argue that the growth paradigm is unsustainable and must be replaced by a paradigm which recognizes physical limits to growth. If we do not soon take action, the spectre of ecofacism is not farfetched. It does not have to be that way and ecological economics offers a world view that can provide an acceptable standard of living for the world’s inhabitants in addition to a healthy environment. A participatory democracy in which all affected constituents are subjects of their own development will be critical to bringing about the social and political changes needed to underpin this transition.

Chapter Two will provide a brief overview of the past fifty years of modernization followed by a discussion of some of the more controversial aspects of its underlying paradigm. Specifically, growth orthodoxy, the scale of technology and signs of environmental deterioration resulting from the interaction of these two aspects of development will be explored. I will argue

²⁵ Ophuls, 1977, p. 47.

that the neoliberal view of the world has co-opted the ideal of sustainable development, using it to further an agenda which has more to do with sustainable growth than with sustainable development as understood here. I will demonstrate that growth does not eradicate poverty, it exacerbates it. In the drive for increased efficiency, technology is displacing people from the workplace creating greater poverty and environmental destruction. Physical evidence of environmental deterioration is increasing and the belief in the ability of technology to arrest this deterioration or to turn it around, if not accompanied by fundamental structural changes, is unfounded.

Chapter Three will provide some insight into the philosophical and economic viewpoints on which the vision for ecological economics is constructed. These will include the ecological outlook of indigenous peoples, the social critique of neo-Marxists, the warnings of demography theorists regarding the ability of the environment to support population growth, and steady state theorists who laid the groundwork for understanding the need to maintain a state of equilibrium between environment and economy relationships.

Chapter Four will provide an overview of some of the structural supports of ecological economics. Concepts will include systems theory, Lazlo's feedback model, thermodynamics, managing complexity, carrying capacity and appropriated carrying capacity concepts. In Chapter Five, we will again return to the visioning process. Here we will briefly explore some of the perspectives which are rarely heard but which offer critical insights to achieving sustainable development. These include the notion of "value free" research, spirituality and a feminist perspective. Chapter Six will provide concluding remarks and an assessment of the potential of the ecological

economics paradigm for effecting change.

Chapter Two: The Drive Toward Modernization

2.0 Introduction

Roughly fifty years have passed since newly emerging nation states of the South shrugged off the shackles of colonial domination and began in earnest to modernize their economies through large scale industrialization. A variety of theoretical frameworks and policy tools were employed to try to create the conditions for realization of human potential for the two thirds of the world faced with an omnipresent struggle for survival. The task at hand was to try to eliminate poverty, create large scale employment and eradicate inequality. Gross National Product was the measurement by which success was gauged.

My aim in this chapter is to demonstrate that the Western model which is being emulated by the South is an unsustainable project. Neo-liberalism with its growth ethos fails to provide even basic needs for the world's poor and is responsible for the widening disparity between and within nations. It is the contention of this thesis that an ecological economics approach to development is essential to understanding and rectifying the current ecological and socioeconomic crisis the world faces.

The argument is presented in four sections. The first section provides a basic overview of the past fifty years of modernization. It identifies some of the strategies undertaken, the struggles encountered as well as major issues that have arisen. The second section challenges the assumptions of the superiority of growth orthodoxy as a means of combating poverty. It also demonstrates the need to acknowledge biophysical limits to growth. Section three looks at four key indicators that suggest we may have transgressed

ecologically sustainable limits. Section four will challenge the neo-liberal optimistic view of technological innovation as a means of improving human welfare and of dealing effectively with environmental degradation.

2.1 Fifty Years of Modernization: An Overview

The past several centuries have been (largely) dominated by mechanistic thinking of the Enlightenment, with its emphasis on the privatization and commodification of nature and man; detachment and isolation from the natural world; and a near pathological obsession with creating a secure, autonomous existence, independent of the forces of nature.²⁶

With the passing of the colonial empires in Post World War II, came new hope for the future of the majority of the world's population. Prosperity it would seem was within the grasp of all and the success of the Marshall Plan in Europe meant that a model had been developed which would speed up the process. Early development models were based on a hierarchical linear approach that would "pull" the "backward" countries of the South (underdeveloped countries)²⁷ into line with the modernized prototype of the North (developed countries). By following a prescribed trajectory it was felt the less developed countries (LDCs) would be able to condense the timeframe of development and leapfrog into a modern industrialized state. Numerous and substantial loans were provided to help finance the transition and technology transfers were thus facilitated.²⁸ But the desired transformation did not materialize although the repayment schedules and interest charges

²⁶Rifkin, Jeremy *Biosphere Politics*, New York: Crown Publisher, 1991.

²⁷ See Esteva, Gustavo, *Development, The Development Dictionary: A Guide to Knowledge as Power*, ed. Sach, Wolfgang, London: Zed Books Ltd., pp. 6-23, 1992, for a discussion on the introduction of the concept of underdevelopment.

²⁸ Aid and concessionary loans have facilitated the duplication of the Western model in governments the world over. Environment in this model is a sectoral interest. As a general rule, the various sectors compete with each other for available budget. Usually the department of Environment (DOE) is the "poor cousin". Dialogue between departments is less than satisfactory and efforts by DOE to bring about sustainable development are viewed as restrictive and limiting to growth and influence of the other departments.

were no illusion. The early optimism of development practitioners began to fade as each new strategy failed to resolve the underlying structural issues of poverty. To be fair, a great deal was accomplished in some countries but for far too many of the world's poor, life on the margins was a destiny which was difficult to escape. Instead we began to witness a widening of the gap between and within nations and growth in poverty was accompanied by a new threat, diminished health of the global environment.²⁹

The dominant approach to development focused on modernization of economies through large scale industrialization and growth which would lead to mass consumption. Capital needed to finance the transition was acquired through the large scale export of raw resources and the use of a vast supply of cheap labour. Once industrialization took root, the engines of growth would roar into action spurring the national economy forward and creating a cornucopia of benefits that would trickle down from an entrepreneurial elite to the less fortunate. Rural development was neglected in favor of creating urban centers of influence which housed bureaucracies whose task was to consolidate the nation state and facilitate structural and institutional change. Crop land was transformed from subsistence production to cash crop production and displaced rural labour settled into urban ghettos. The result was increased poverty, homelessness and loss of livelihood and security for at least a billion people.

Increasingly it came to be realized that the "Third World" was not a homogeneous unit and that a "one size fits all" approach to development would not suffice. Further, growth of an economy did not guarantee

²⁹ During the 1980s the contribution of developing countries (with 2/3 of the population to the world's GDP shrank to 15% and the share of the industrial world (with 20% of the world's population) increased to 80%. Sachs, 1993, p. 5

equitable distribution of the fruits of that growth. Alternative development strategies arose which tried to fulfil the needs of the poor³⁰. Development practitioners came to realize that encouraging people to migrate from their rural communities to grease the wheels of industrialization not only failed to bring about what could be termed “development”, it was also creating conditions with grave environmental consequences for all the world’s population. The growth model is seemed, was consuming the base it was built upon - clearly an unsustainable project.

Although Rachel Carson’s book, *Silent Spring*³¹ provided a wake-up call to the problems of a polluted environment, it was the Club of Rome’s *Limits to Growth*³² that galvanized global attention on the seriousness of the issue. Although the report has undergone a great deal of critical analysis since its release, it paved the way for thoughtful reconsideration of fundamental assumptions long held dear by economists. About the same time, The Ecologist magazine published *A Blueprint for Survival* which argued that industrial society with its “ethos of expansion” was unsustainable. Further, it argued radical change was “both necessary and inevitable” because increasing population with its concomitant increasing consumption was disrupting ecosystems, depleting resources and “undermining the very foundations of survival.”³³ Schumacher³⁴ reinforced the need to rethink the economic structure of the Western world which was responsible for the building of “a system of production that

³⁰ These included the Basic Needs Approaches adopted in the 1970s by international agencies such as the ILO, UNEP and IBRD as well as national strategies that were people oriented and designed to alleviate poverty.

³¹ Carson, Rachel, *Silent Spring*, Riverside Press, Cambridge, Mass., 1962.

³² Meadows, et al, *The Limits to Growth*, New York: Potomac Associates, 1972.

³³ Goldsmith, et al, *Blueprint for Survival*, London: Tom Stacey Ltd., 1972, pp. 14 - 15.

³⁴ Schumacher, E.F. *Small is Beautiful: A Study of Economics as if People Mattered*, London: Penguin Group, 1973.

ravishes nature and a type of society that mutilates man". The emergence of a planetary consciousness began to take shape. Concepts such as limits to growth, Spaceship Earth and the global commons increasingly came into use. The United Nations Conference on Environment and Development held in Stockholm in 1972 emphasized that ecological systems transcended national boundaries and that humankind is ultimately dependent upon the biosphere for its continued existence. Global modelling and physical systems theories gained legitimacy. These theories sought to view the world as a physical whole whose ecological systems were influenced by human development processes. Conceiving the system as a whole was necessary to understanding important linkages and interactions that might otherwise be missed.³⁵

World systems theories evolved in part, as a criticism of dominant approaches to development of the 1950s and 1960s. Influenced by dependencia³⁶, the approach was Marxist "in spirit". According to world system theorists the capitalist world economy took root in the sixteenth century. Over time, capitalism broadened its reach to incorporate "a growing number of previously more or less isolated and self-sufficient societies into a complex system of functional relations", then deepened its tentacles into the socioeconomic realms of those societies. Thus a small number of core states

³⁵ Hetne, Bjorne, Development Theory and the Three Worlds, Essex: Longman Scientific & Technical, 1990, pp. 114-124.

³⁶ The dependency school is influenced by Marxist tradition and Latin American structuralism. It was a revolutionary creation indigenous to Latin America. Although there are several theoretical orientations on the theme, the Centre-Periphery model developed by Prebisch plays a central role. Dimensions of this view include holism v. particularism, external v. internal causal factors, sociopolitical v. economic analysis, sectoral/regional contradictions v. class contradictions, underdevelopment v. dependent development and voluntarism v. determinism. Theorists include Prebisch, R. The Economic Development of Latin America and its Principal Problems, New York, United Nations, 1950; Cardoso, F. H., Dependency and Development in Latin America, Berkley: University of California Press, 1979; Dos Santos, T., The Structure of Dependency, American Economic Review 60(21) May 1970; and Frank, A. G., The Development of Underdevelopment, Monthly Review, Sept, 1966, 17-30. Hetne, 1990, pp. 82-98.

transformed “a huge external arena into a periphery”. Between the core and the periphery was a semiperipheral group competing for core status.³⁷ Different “modes of exploitation” led to different modes of production which greatly influenced the development potential of peripheral nations. When all of the remaining “external areas” have been incorporated into the world system, “the capitalist process of expansion, which started during the sixteenth century, will be completed. ...When the frontiers of the world [economic] system are reached and the world constitutes a single mode of production, the Marxist model of the capitalist system would ultimately correspond to the empirical situation.”³⁸ It was not easy to back away from the ‘system’ and develop an independent course of action; in fact, the experience of most Third World countries was that they were part of the ‘system’ “whether they liked it or not”. Countries that embarked upon self-reliance strategies were considered ‘hostile’ to the ‘free world’ and subjected to destabilization tactics. Cuba, Jamaica and Nicaragua provided examples for those who contemplated stepping out of line.³⁹ This suggested that the industrialized world was perhaps becoming more dependent upon the conditions of poverty of the developing world than they cared to admit and that the conditions accompanying aid transfers were drafted more for the benefit of donors than recipients.

The debt that was amassed to undertake industrialization and the energy costs incurred to keep it going began to threaten international

³⁷ Hetne, 1990, p. 123.

³⁸ Hetne, 1990, p. 126.

³⁹ Hetne, 1990, pp. 123-126.

financial stability in the early 1980s.⁴⁰ International financial institutions (IFIs) enlisted the guidance of the International Monetary Fund (IMF) to undertake structural adjustment programs (SAPs) to improve payment performance. Thus an important shift in alliances was enacted. National governments, in order to have access to international markets had to choose between their fiscal masters (IFIs) and the constituents they represent (their citizens). The IFIs held sway. Between 1981 and 1985, \$159.1 billion was transferred from Latin America to banks in the industrialized countries to service the foreign debt, equivalent to 4-5 per cent of economic output for the region.⁴¹ The social costs were staggering.⁴² SAP policies led to the “compression of real earnings and to the reinforcement of the cheap labour export economy... budgetary austerity, trade liberalisation and privatization” and the relinquishment of fiscal and monetary control of nation states.⁴³

Strategies such as currency devaluation meant that developing countries which relied heavily on raw resource exports to generate foreign exchange, had to liquidate more bundles of raw resources to make up for the devaluation, a problem that was compounded by declining prices for primary

⁴⁰ During the 1970s, the major oil producing countries had surplus export revenues which they loaned internationally. Oil importing countries ran trade deficits because import expenses were higher than export earnings. The shift of income from resource-poor to resource-rich countries had the potential to cause a depression. “The spectre of world excess savings leading to deficient demand haunted Central Banks and Treasuries around the world”. To postpone the crash, oil savings were loaned to oil importing countries, to developing countries and to firms in developing countries. The “developing countries were enabled to run trade deficits to match OPEC surpluses, and hence to maintain world demand for manufactured goods.” The debt crisis surfaced in 1982 when interest rates increased dramatically and prices of developing country's exports declined precipitously. The net resource transfers from highly indebted countries in 1985 was about \$30 billion per year or 4% of their GDP. Between 1982 and 1987, “the real value of the foreign debt of the seventeen most heavily indebted countries increased from \$392 billion to an estimated \$485 billion.” Branford, Sue & Kucinski, Bernardo, The Debt Squads: The US, the Banks and Latin America, London: Zed Books, 1988.

⁴¹ Branford & Kucinski, 1988, p. 1.

⁴² The social effects of SAPs are well documented. See for instance Veltmeyer, 1993, Chossudovsky, 1991, UNICEF's study entitled Structural Adjustment with a Human Face.

⁴³ Chossudovsky, 1991, p. 1

products due to widespread recession. Communities that previously had depended upon these resources were uprooted and “resettled”. Indigenous knowledge and technology were obliterated together with the cultures they were housed in but this was not considered a loss because they were ‘backward’ and ‘primitive’.

Despite numerous rescheduling programs, the Lost Decade of the 1980s ended with Third World debt totalling \$1.290 trillion, accounting for approximately 44% of the GNP of all developing countries combined and utterly ruinous prospects for their futures.⁴⁴ Sub-saharan Africa earned a new place in the global pecking order, “Fourth World”, a title reflecting their debt load which accounted for 108 per cent of GNP.⁴⁵

In contrast to conditionalities imposed by the IMF, the US. government covered its own deficit by boosting interest rates to attract international capital investment, a policy which exacerbated the debt crisis in other countries. It is worth noting that a precedent had already been set in postwar Europe whose recovery owed much to “the realism of those early structural adjustment loans and debt writeoffs”⁴⁶ . After WWII, Britain was heavily indebted to the United States but they were “offered a package in which interest payments in excess of 2 percent of foreign exchange earnings would be forgiven completely - not just rolled over”.⁴⁷

The international financial crisis of the Eighties pushed environmental problems to the background. By the end of the decade however, it was becoming increasingly apparent that environmental

⁴⁴ Chossudovsky, 1991, p. 11

⁴⁵ Chossudovsky, 1991, p. 11

⁴⁶ Newbery, David M. *The Debt Crisis*, Development, Journal of SID, 1989, p. 36.

⁴⁷ Newbery, 1989, p. 36. Faber, Michael, *Conciliatory Debt Reduction*, 5th Dudley Seers Memorial Lecture, Institute of Development Studies, University of Sussex, 1988.

deterioration could no longer be ignored. The release of the Brundtland Commission's report, *Our Common Future*, heralded the most encompassing analysis of environment and development issues to date and popularized the term "sustainable development". Brundtland's great achievement was in garnering political consensus on the need to view environment and development in a single framework - something that had not been institutionally embraced to this point. Despite this, sagging economies in the North soon pushed environmental issues aside again and sustainable development came to be understood as "conservation of development, not conservation of nature"⁴⁸.

With the demise of the central planning model in Eastern Europe, the U.S. bourgeoisie promptly declared neo-liberalism victorious⁴⁹ and the free market economy came into full swing. Privatization of public assets, deregulation of markets, removal of trade and investment barriers and provision of incentives for investors to facilitate globalization of trade promised to provide the panacea to development where past efforts had failed. The Soviet Union was quickly dismantled and any development strategy that smacked of socialist tendencies was smothered. "Democratic" regimes were established to guarantee "free markets" that protected individual rights to pursue material welfare. "Free and transparent elections" legitimized these regimes. The result was an even greater skewing of the distribution of the products of development.

Increasingly nation states have traded their sovereignty to be included in the emerging global trade regime. The implementation of policies which

⁴⁸ Sachs, 1993, p.10.

⁴⁹ Marzani, Carl, On Interring Communism and Exalting Capitalism, Monthly Review Press, New York, 1990, p. 1.

create a "level playing field" is a condition of membership in this prestigious club. To be left out is to be marginalized. Thus billionaires compete with paupers for the same resources. Without a strong state, it is becomingly increasingly difficult to enact and enforce equitable social and environmental policy. Debt and high unemployment have resulted in budget cutbacks and a weakened state apparatus⁵⁰. It is against this backdrop that the health of our life support systems continue to decline while the demands on it increase.

In 1992, sixteen hundred esteemed scientists including 101 Nobel Laureates issued a "Warning to Humanity" that human beings and the natural world are "on a collision course" and that if we do not check the damage we are inflicting on the environment, we "may so alter the living world that it will be unable to sustain life in the manner that we know."⁵¹ Since that time, a growing number of scientists have joined the chorus; in fact, some suggest we may have already transgressed the boundaries of what is ecologically sustainable and cite ozone depletion, global climate change, loss of biodiversity, deforestation and a host of other indicators as evidence of the weakening of life support systems.

In spite of the clarion calls to reassess the neo-liberal model that now dominates the globe, business-as-usual is the only item on the international agenda. At issue is the fact that the neo-liberal growth model not only fails to deliver anything that resembles "development", it virtually destroys the base upon which development can occur.

⁵⁰ It is significant that the only item which never appears on the chopping block is corporate profits or anything that will restrict attaining them.

⁵¹ Union of Concerned Scientists, "World Scientists' Warning to Humanity". Cambridge, Ma: Union of Concerned Scientists Publications Department, Feb. 1993.

2.2 The Growth Debate

2.2.1 Sociopolitical Aspects

Brundtland's call for a five-to-tenfold increase in world industrial output was quickly taken up by proponents of neoliberalism. The task was determining the fastest way to achieve growth to alleviate poverty and income inequality. The primary indicator of progress was GNP and the major project was increasing GNP. The process entailed global economic integration through free trade to increase competition, make available lower priced products and most importantly, contribute to growth in GNP. All countries became hooked into a single international system and capital began to circulate globally seeking maximum advantage while pledging no allegiance. Neoliberals took no heed of the assumptions their classical predecessors laid out when arguing for trade between nations, primarily that capital would be immobile within nations and that capitalists were nationalists. Smith's legacy of *laissez-faire*, *division of labour* and *comparative advantage* was invoked while his protest "that the freedom of trade should ever be entirely restored in Great Britain, is as absurd as to expect that an Oceania or Utopia should ever be established in it" was virtually ignored.⁵² Seizing the moment, neoliberals dismissed the other important lessons of history yielded by those who have attempted to conquer the world.

There is no empirical evidence to support the notion that free trade will eradicate poverty⁵³. To the contrary, what we are witnessing is a downward push on wages, labour and environmental standards and worker benefits. The only thing that is increasing is profit margins and

⁵² Smith, Adam, *An Inquiry Into the Natures and Causes of the Wealth of Nations*, New York: Modern Library Inc., originally published in 1776), p. 241.

⁵³ The issue being taken is not with trade per se, rather it is with the terms of trade that are presently being enacted.

environmental deterioration. The outcome thus far is not surprising considering the large body of economic theory that asserts that “highly *unequal* distributions are *necessary* conditions for generating rapid growth.”⁵⁴

If wide inequalities are a necessary condition of maximum growth and if in the long run maximum growth is a necessary condition of rising standards of living for all, through the natural “trickle-down” processes of competitive and mixed economic systems, then it follows that direct concern with the alleviation of poverty would be self-defeating. Needless to say, such a viewpoint, whether correct or not, provided a... rationalization for the accumulation of wealth by powerful elite groups.⁵⁵

The argument supporting inequality of incomes was premised on the belief that the rich saved and invested their income and the poor spent their income on consumption goods. High GNP growth rates were indicative of high national income savings; therefore, high levels of income inequality meant greater savings and faster rates of economic growth. The short term pain was worth the long term gain of a larger economic pie that would eventually be redistributed through tax and subsidy programs *when they could be afforded*.

Michael Todaro counters the view represented here with four points:⁵⁶

1. A century ago the wealthy may have saved and invested but empirical data now demonstrates that the contemporary elite are not known for their frugality or their penchant for investing in their local communities. They are more likely to squander their income on imported luxury goods, opulent homes, luxury cars and international travel, and to “seek safe havens” abroad for their savings in the form of flight capital.”⁵⁷ This detracts from rather than adds to a nation’s

⁵⁴ Todaro, Michael P., 1989, Economic Development in the Third World, New York: Longman Inc. 1989, p. 168.

⁵⁵ Todaro, 1989, p. 169.

⁵⁶ Todaro, 1989, pp. 169-170. See also Chambers, Robert, Rural Development: Putting the Last First, Essex: Longman Scientific & Technical, 1983.

⁵⁷ Todaro, 1989, p. 169.

productive resources. There is no evidence to support the notion that the rich save and invest more in the domestic economy than the poor do which makes the strategy of promoting income inequality to generate the necessary preconditions for economic growth unfounded; rather such "strategies might better be called "antidevelopmental".⁵⁸

UN studies indicate that small farmers and individuals in less developed countries (LDCs) are among the highest savers.⁵⁹ Experience with small lending programs such as the Grameen Bank demonstrate that the poor are also superior performers at repaying their debt in comparison to their wealthier counterparts. The poor live too close to the margins to be complacent about "saving for a rainy day."

2. Low income levels and poor standards of living are more likely to create the conditions of lower productivity among the poor which in turn, leads to slower economic growth. Structural adjustment programs have placed too much emphasis on balance-of-payments problems without paying attention to reforms that improve human resource productivity (health, education and nutrition) or access by the poor to productive resources (land and capital). Trade liberalization and privatization of markets without the reformation of institutions that are adverse to the poor result in "rapid accumulations of wealth among a small number of people with only limited benefits to the

⁵⁸ It is noteworthy that an inverse relation between productivity and farm size has been documented in Argentina, Brazil and Chile. Minifundios in these three countries were found to yield more than twice the value of output per hectare under cultivation than the latifundios and more than 10 times the value per hectare of total farmland. Todaro, 1989, pp. 304-305.

⁵⁹ Todaro, 1989, p. 183.

poor”.⁶⁰ Strategies to improve the material well being of the poor have been shown to improve productivity and economic prosperity as a whole.

3. Higher incomes levels for the poor result in increased demand for locally produced goods like food and clothing. The rich tend to purchase imported luxury goods which does not stimulate the local economy. Increased local production, employment and investment lead to rapid economic growth with broader participation.

4. Greater income equality brought about by a mass reduction in poverty can be a “powerful material and psychological incentive” to broader participatory development leading to increased economic activity. Greater inequalities can be “powerful material and psychological disincentives to economic progress” and can fuel considerable social unrest.

In 1960, the Northern countries were twenty times richer than their Southern counterparts; by 1980, they had grown to forty-six times richer.⁶¹ The view that income inequality will lead to rapid economic growth and poverty alleviation through trickle down is no longer tenable. Instead, the evidence suggests that the gigantic social engineering experiment has created inescapable misery and social disenfranchisement. Traditional societies have been destroyed and the “new ways are not viable”.⁶²

People are caught in the deadlock of development: the peasant who is dependent on buying seeds, yet finds no cash to do so; ... the clerk who had made it in the city, but is now laid off as a result of cost-cutting measures. They are all like refugees who have been rejected and have no place to go ... forced to get by in a no-man’s land between tradition and modernity.⁶³

⁶⁰ Pinstup-Andersen, Per, World Food Trends and Future Food Security, Food Policy Report, The International Food Policy Research Institute, March 1994, Washington, p. 12.

⁶¹ Sachs, 1992, p. 3.

⁶² Sachs, 1992, p. 3.

⁶³ Sachs, 1992, p.3.

The viewpoints of Todaro and Sachs outlined above illustrate the perspective of this thesis. There is no evidence to support the notion that economic growth alleviates poverty. Placing wealth in the hands of the so-called entrepreneurial elite with the expectation that they will invest and generate new wealth which will trickle down to the masses is a nothing more than a ruthless myth perpetuated by the ruling class.

2.2.2 Biophysical and Social Limits to Growth

Growth is constrained by two fundamental limits.⁶⁴ The first is biophysical. From a biophysical aspect, economic growth can be defined as “an increase in physical scale of the matter/energy throughput that sustains the economic activities of production and consumption of commodities”.⁶⁵ Rates of resource extraction must be representative of nature’s ability to renew those resources. Economic activity generates wastes and these too are constrained by nature’s ability to assimilate wastes back into the ecosphere. In economic parlance, we can consider resources to be natural capital and the ideal situation is to keep the stock constant (maintaining capital intact) and live off the interest (annual regenerative capacity). This way, subsequent generations will inherit a constant stock of natural capital that can be used for sustenance. Growth economics seeks to speed up the process of resource extraction by using large scale technology, much of which is powered by fossil fuels. The entire economic process creates waste at a faster pace than the ecosphere can deal with in terms of its regenerative and assimilative capacity. Because of the global integration of the economy, this process is now global in scale. The vast majority of developing countries lack the institutional and infrastructural capacity to deal with these issues at a meaningful level. The

⁶⁴ Daly, 1996, p. 35

⁶⁵ Daly, 1996, p. 31.

developed countries lack the political will to deal with them.⁶⁶

It is often proposed that human ingenuity will find a way to work through the bottlenecks that resource constraints pose by substituting different stocks or through technological innovation. However, ecological economists argue, stocks are complimentary to capital investment, and substitution options are limited.⁶⁷ For instance, a sawmill is of no use without logs and fishing boats are useless without fish.⁶⁸ Technological innovation can evade the boundaries of Nature's carrying capacity, but these extensions are only temporary as another shortage in resource generation or sink capacity will quickly come into play. The only acceptable reasons to try to extend carrying capacity are when steps are being taken simultaneously to radically change those processes which created the problem in the first place. For example, we now know that the use of non-renewable fossil fuels is creating a carbon imbalance in the atmosphere which, in turn, is creating a host of spinoff problems. It may make sense to continue to use fossil fuels for the short term to keep activity going but only if we are actively seeking to replace fossil fuel energy with renewable sources. Clearly this is not being done. Most of our research is being devoted to making our technology more energy efficient rather than changing the energy source, thus evading nature's boundaries a little longer. This strategy gives us a brief respite but in a short time we will face another constraint, whether it be a sink constraint which creates havoc with weather or a source constraint in which we finally deplete oil reserves. Either way, the day of reckoning is fast approaching. Because so much economic activity is fossil fuel based, competition is sure to increase as

⁶⁶ Gore, Al, Earth in Balance, Boston: Houghton Mifflin, 1992.

⁶⁷ Daly, 1996, Wackersnagel, 1996.

⁶⁸ Daly, 1992, pp. 23-37.

supplies dwindle, heightening international tension. More importantly, the health of the biosphere (and of its inhabitants) will be further impoverished as carbon imbalances increase. The key question from a biophysical perspective, is how much can we assault the biosphere before it collapses?

Long before we reach biophysical limits, we will be confronted with socio-political limits because the escalating tension resulting from the inability to meet basic needs will create more social unrest than can be successfully contained within current political arrangements. The tragedy of civil strife in areas like Zaire, Mozambique, Israel and Palestine, Ethiopia, Laos and elsewhere speak to the tragedy of unequal social relations, whether they be internal or international, leading to inequities in the allocation of resources needed for survival.

Even if we could continue growth using human ingenuity, "ethicosocial limits may render it undesirable" if we consider Daly's four principles.⁶⁹

1. *The desirability of growth financed by the drawdown of geological capital is limited by the cost imposed on future generations. While the basic needs of the present generation should take precedence over those of the future, the "basic needs of the future should take precedence over the extravagant luxury of the present".*⁷⁰
2. *The desirability of growth financed by takeover of habitat is limited by the extinction or reduction in number of sentient subhuman species whose habitat disappears. The instrumental value of other species, particularly in terms of the life support services they provide is poorly understood and vastly undervalued. The intrinsic value of these species*

⁶⁹ Daly, 1996, pp. 35-37. Italicised points quote Daly.

⁷⁰ Daly, 1996, p. 36, italics added.

is virtually ignored and presents a major philosophical dilemma in view of the rate of extinction which is now taking place.

3. *The desirability of aggregate growth is limited by its self-cancelling effects on welfare.* J.S. Mills observed that "Men do not desire to be rich, but to be richer than other men."⁷¹ Once absolute needs have been met, satisfying relative wants becomes a 'zero-sum game', cancelling out any gains that have been made.

4. *The desirability of aggregate growth is limited by the corrosive effects on moral standards resulting from the very attitudes that foster growth.*

Greed and acquisitiveness fan the flames of growth. "Expanding power and shrinking purpose lead to uncontrolled growth for its own sake which is wrecking the moral and social order as well as the ecological order".⁷²

Population size and technological innovation that allow us to temporarily evade the boundaries of Nature's limits, "have made satisfaction of today's human aspirations dependent upon massive deprivation for posterity".⁷³ Humans are taking over the habitat of other species at a rate that is unprecedented in human history; in fact habitat destruction is the primary cause of extinction.⁷⁴ Conservative estimates suggest 5,000 species become irreversibly extinct each year, about 10,000 times as fast as prehuman extinction rates. Less conservative estimates put the rate at 150,000 species per year.⁷⁵ Other species of life have an intrinsic value beyond their utility to humans. Enlightened self interest should tell us that we do not know enough about biodiversity to determine which species are *necessary* to sustain

⁷¹ J. S. Mills cited in Daly, 1996, p.36.

⁷² Daly, 1996, p.37.

⁷³ Catton, 1980, pp. 3 - 4.

⁷⁴ Corson, Walter H., ed. 1990. Global Ecology Handbook: What You Can Do About the Environmental Crisis. Boston: Beacon Press. p. 102.

⁷⁵ Goodland, 1992, p. 14.

our continued existence. Even categorizing other species as *sub* human, establishes a hierarchy of worth that prejudices our thinking.

What we do know is that all species are part of the web of life that is needed to sustain life and that the loss of a species creates a hole in the web. How do we weigh the worth of a species? In terms of policy, we concern ourselves with those species which are deemed to be beneficial to human kind, particularly if they are of economic importance. We are prepared to rank those species (keystone species) which we are prepared to save from extinction and to allow others to go by the wayside. This attitude clearly demonstrates the anthropocentrism which is rampant in our policy formulation. It also underscores a lack of sophistication in terms of the workings of the natural order. We do not know what we do not know so how can we assess which species we *need* to survive?

Biological diversity is our most important natural resource.⁷⁶ The health of life support services needed for our survival (clean water, air and healthy soil) depend on a wide range of species. Symbiotic relationships between species highlight the concept of interdependence. For example, plants absorb carbon dioxide and release oxygen while humans absorb oxygen and release carbon dioxide. The root system of plants together with worms, insects, fungi, and soil bacteria “regulate stream flows and groundwater levels, cleanse pollutants from surface waters, and help recycle soil nutrients.”⁷⁷ Insects and bats are important pollinators. For example, insects pollinate ninety of the most important crops in the U.S., valued at more than \$4 billion and the productivity of nine others is enhanced when pollinated by

⁷⁶Corson, 1990, p. 103.

⁷⁷ Corson, 1990, p.103.

insects.⁷⁸ These life support services are “free” but we do not become aware of their value until they are disrupted or eliminated. The cost of fixing them is astronomical, if indeed they can be fixed. Maintaining the health of life support services is a pillar of ecological economics.

2.3 Environmental Impacts of the Growth Model

Neo-liberal economics assumes an infinite supply of natural resources and sinks for disposing of wastes resulting from the exploitation of those resources. Technology will take care of the problems market societies encounter and the “invisible hand of the market” will take care of the economy. Because nature is not considered to be a limiting factor, dominant theories of economics have only to be concerned with the use and allocation of scarce resources. The logic is that shortages of goods or services will be identified by an increase in prices and an overabundance will be reflected by a decrease in prices. Goods and services provided by the ecosphere have no formal value with few exceptions, hence they are free and free signals abundance.

Substitution of natural resources with artificial ones renders the potential for price to signal shortages as meaningless. Substitution in this context simply eliminates the market for natural resources thus depressing the price they fetch. Since developing countries rely heavily on the sale of natural resources to generate income, they will lower their price to compete with artificial substitutes. Under these circumstances, a resource can become completely depleted while the price continues to decline. This is not seen as a problem because a replacement for the resource has been identified. However, the natural resource is part of the web of life and thus serves a life

⁷⁸Corson, 1990, p. 103.

support function which may not be readily discernible.

The abundance of nature may have been a given a couple of centuries ago but this viewpoint is no longer appropriate in today's circumstance. Not to be dismayed, conventional economics assumes that technological innovation can get us out of our present predicament and add to GNP in the process. Even so, evidence is mounting that we are coming closer to exceeding the regenerative and assimilative capacity of global ecosystems and that we are endangering essential life-support functions.⁷⁹ Neoclassical economic models have failed to detect these disruptions. The strategy of promoting increased growth to address the environmental degradation we currently face demonstrates a profound ignorance of life support systems. Although a number of areas have been identified as cause for concern, this study will focus on four major indicators of ecosystem disruption: human biomass appropriation, global climate change and variability, stratospheric ozone depletion, land degradation.⁸⁰

2.3.1 Evidence of Limits: Human Biomass Appropriation

Vitousek et al relate the human economy to the concept of carrying capacity from a global perspective in a study conducted in 1986. They estimated that the human economy uses nearly forty percent⁸¹ of the earth's annual net primary production(NPP) of terrestrial photosynthesis today

⁷⁹ See Ophuls, 1977. Goodland, 1992. Brown, 1996. Rees, William E., Boothroyd, Peter, Ed., *Ecological Principles Relevant to Population Growth and Carrying Capacity in Population-Environment Linkages: Toward a Conceptual Framework*. Halifax, Dalhousie University, 1994. Catton, 1980. Clowe, Michael, *Why are We in the Environmental Mess?: A Sociological Perspective*, Lecture at Halifax Regional Library, Sept. 28, 1989.

⁸⁰ Goodland, 1992, pp.3-22. Contributions of other authors are cited as appropriate but the indicators identified in this chapter follow Goodland's lead.

⁸¹ Vitousek, Peter M., et al. *Human Appropriation of the Products of Photosynthesis*. *BioScience*. 34(6)(1986): 368-73. intermediate calculations range from 19% to 37.8% depending on assumptions used and the high estimates range from 40% to 41%, again depending on assumptions. pp. 371-372.

either directly or indirectly⁸² and that they affect much of the other sixty percent of terrestrial net primary production, often heavily. This other sixty percent must be shared by the millions of other land-based species on the planet. If we take this percentage as an index of the human carrying capacity of the Earth and assume that a growing economy could come to appropriate 80% of photosynthetic production before destroying the functional integrity of the ecosphere, the earth will effectively go from half empty to nearly full by the middle of the next century.⁸³ Rising per capita consumption would shorten the doubling time. "Observers who believe that limits to growth are so distant as to be of no consequence for today's decision makers appear unaware of these biological realities."⁸⁴

It is not unreasonable to assume then, that bioproductivity may soon be a limiting factor for the global economy. The weakening of some ecosystems may undermine the resilience of the biosphere exacerbating the potential for a crisis situation. It is worth noting that the study cited has not been challenged to date. While the numbers are subject to some debate, the reasoning behind the study is sound implying that we rethink our stewardship responsibilities without delay.

2.3.2 Evidence of Limits: Global Climate Change and Variability

Climate change and variability has been identified as the number one

⁸² NPP used directly includes all primary food consumed by humans and domestic animals; firewood and timber for construction and fibres, about 5% of NPP; indirectly: co-opted bioproductivity (inevitable byproducts of agriculture and forest management which are not consumed, about 25% of NPP), and foregone bioproductivity (deforestation, desertification, human settlements and lower production due to agriculture, about 10% of terrestrial NPP). Vitousek et al cited in Wackersnagel, Mathis. 1992. Boothroyd, Peter, ed. *Comparing Three Thinking Tools for Policy Analysis. Population-Environment: Toward a Conceptual Framework*. Halifax: Dalhousie University. p. 48.

⁸³ Medium fertility estimates put world population at 10 billion in the year 2050. Kendall, Henry W. & Pimentel, David, *Constraints on the Expansion of the Global Food Supply, Ambio: A Journal of the Human Environment*, 1994.

⁸⁴ Vitousek, et al, 1986, p. 373.

issue in coming years by sustainable development experts from OECD countries. An increase in the concentration of greenhouse gases is contributing to changes in the Earth's atmosphere leading to greater climatic swings and more intense and severe weather patterns. Climate variations brought about by changes in temperature, precipitation, soil moisture and sea level are expected to have adverse impacts that are global in scope on socioeconomic and ecological systems.⁸⁵

Greenhouse gases such as carbon dioxide shape the earth's climate by trapping heat in the atmosphere. The process is a natural one, providing favourable conditions for life on earth. It occurs when radiation from the sun is reflected off the earth and trapped in the troposphere by a combination of chemical reactions caused by gases such as carbon dioxide, chlorofluorocarbons, methane and nitrous oxide. Human activities intensify this process resulting in disequilibrium of climate regulating systems.

Carbon dioxide caused by the burning of fossil fuels (coal, oil and natural gas) is the major contributor to green house gases. The other major source of carbon emissions is deforestation. Six billion tons of carbon are released into the atmosphere annually by human activity through fossil fuels and deforestation.⁸⁶ Three billion tons remain in the atmosphere and the world's oceans and northern hemisphere forests each absorb about 1.5 billion tons of carbon dioxide annually.⁸⁷

Other greenhouse gas pollutants include methane, caused primarily by intensive agriculture, coal mining, and leaky natural-gas lines,

⁸⁵ IPCC Working Group II (1995) UNEP.

⁸⁶ Flavin, Christopher. 1996, *Facing Up to the Risks of Climate Change* in Brown, Lester R. et al, eds. State of the World 1996: A Worldwatch Institute Report on Progress Toward a Sustainable Society. New York: W.W. Norton & Company. p. 24. Goodland, 1992. p. 10.

⁸⁷ Flavin, 1996, p. 24.

chlorofluorocarbons (CFCs), from industrial production, and nitrous oxide from fertilized soils. These three pollutants are “orders of magnitude more damaging than carbon dioxide” although their amounts are much less.⁸⁸

While scientists are in agreement that climate change is underway, they are uncertain of the exact impacts of that change. Studies carried out to date are based primarily on a doubling of greenhouse gas concentrations. These studies do not take into account dynamic responses to increasing greenhouse gases, the consequences of increases beyond a doubling of greenhouse gases or an assessment of the implications of multiple stress factors.⁸⁹

We can expect human-induced global warming to contribute to a rise in global mean sea level. The main factors will be melting of mountain glaciers and expansion of the warming seas.⁹⁰ Sea level rise will make coastal ground water saltier, endangering wetlands and inundating farmland and coastal communities. We can anticipate the migration of millions of refugees from low-lying coastal regions (coasts and estuaries currently hold fifty-five percent of the world’s population and sixty percent live within one hundred kilometers of sea coasts), an increase in the duration and intensity of storms, damage to ports and coastal cities as well as to agriculture.⁹¹

Climatic swings will dramatically affect growing seasons, forest cover, drainage patterns, ice caps, sea and lake levels, permafrost, the health of trees in cities as well as the distribution of vector-borne diseases.⁹² Changing

⁸⁸ Goodland, 1992. pp. 8-9.

⁸⁹ IPCC Working Group 2 (1995), UNEP.

⁹⁰ “Greenland ice-cores, two miles thick, show that changes in the climate system may be non-linear. “Jumps” into new regimes can occur abruptly within three to seven years and volatility and greater extremes can herald that climate “jump”. Epstein, p.1.

⁹¹ Goodland, 1992, p. 9 & Globe & Mail, July 27, 1996, pp. A1, A6.

⁹² Epstein p. 1, Goodland,1992, p. 10.

patterns of vector-borne diseases⁹³ and the spread of agricultural pests⁹⁴ are consistent with projections made by climate change models. Technological control has limited potential because repercussions resulting from the use of pesticides, fungicides and insecticides include negative impacts on the “composition, structure and function of ecosystems” and opportunistic species gaining “selective advantage as resistant insects appear, and predators and competitors are selectively harmed.”⁹⁵ Rainfall is expected to decrease in inland areas making arid and semiarid regions vulnerable and resulting increases in desertification are expected to be irreversible.⁹⁶

Since the Industrial Revolution, an increase in global carbon emissions has been detected. There is a direct correlation between the scale of the economy and the amount of carbon released into the atmosphere. Improvements in energy efficiency suggest that reductions in carbon emissions can be made without reducing living standards in the short term. For instance Japan increased output 81 percent since 1973 with the same amount of energy. GNP in the U.S. grew nearly 39 percent since 1973 with little increase in energy use. Sweden doubled electric efficiency, decreased CO₂ by 34 percent, phased out the nuclear power that supplies 50 percent of the country's electricity and in the process, was able to achieve a reduction of US \$1billion per year in consumers' energy costs.⁹⁷ It is important to keep in mind that increases in energy efficiency have limited long term potential in

⁹³ For example, malarial and dengue fever outbreaks show a strong correlation to climate change. Epstein, p. 4.

⁹⁴ Insects, fungi and bacteria “which have well defined ecological thresholds” are undergoing shifts in patterns consistent to climate change. Epstein, p.4.

⁹⁵ Epstein, p. 4.

⁹⁶ IPCC Working Group II (1995), UNEP, Union of Concerned Scientists, January, 1994.

⁹⁷ Lovins, 1990 cited in Goodland, 1992, p. 10.

that they simply slow down the pace of fossil fuel depletion.⁹⁸ Further, as developing countries escalate their use of fossil fuels, the total environmental load will also increase and feedback from the environment may make the use of fossil fuel increasingly undesirable.

Effective action to curtail the effects of global climate change will be difficult to achieve. Organizations such as the National Academy of Sciences, the World Meteorological Organization, and the United Nations Environment Programme have concluded that the “threat is sufficiently grave and well-documented that strong international action should be taken”.⁹⁹ However, a small but vocal group of global-warming skeptics seem to have disproportionate influence on the issue. Powerful political and economic groups with a vested interests in continuing high emissions of greenhouse gases use these skeptics to avoid taking action, making it difficult to achieve the dramatic reductions in use of fossil fuels necessary to reach meaningful targets.¹⁰⁰

The United Nations Framework Convention on Climate Change signed in Rio de Janeiro in 1992 has committed industrialized nations to stabilize greenhouse gases at 1990 levels by the year 2000 but most now believe they will not be able to meet these commitments. Global climate change has strong symbolic value in the arena of international negotiations. The North is accused of preaching to the South without taking action to curtail the

⁹⁸ At 1984 consumption rates, global petroleum reserves are estimated at about 31 years, natural gas 52 years and bituminous coal 175 years. World Resources Institute. World Resources 1987: An Assessment of the Resource Base that Supports the Global Economy, New York: Basic Books, Inc., 1987, p. 299.

⁹⁹ Union of Concerned Scientists, January, 1994.

¹⁰⁰ Union of Concerned Scientists, January, 1994. Groups such as the Global Climate Coalition and International Climate Change Partnership, composed of oil, coal and automobile interests use possible economic and employment impacts to slow action and suppress development of cleaner technologies. See Flavin, 1996 for overview of Global Climate Coalition.

damage industrial nations are causing. An Alliance of Small Island States (AOSIS) has been formed by 36 nations particularly vulnerable to the impacts of sea level rise and increases in storm severity resulting from human-induced climate change. However, they have little political power and their efforts are confined primarily to small scale lobbying efforts. At issue is the fact that these countries for the most part have not benefited from industrialization yet they must pay the greatest costs in terms of trying to deal with the impacts of climate change.

The ability to deal effectively with the situation will be a challenge in that most developing countries lack the financial means to deal with current issues let alone future climate change issues. The Maldives, for instance is a small group of islands reaching barely more than a meter above sea level. Long before the islands become submerged they will be made uninhabitable by salt water intrusion, salination of soil and intense storm damage. Where will the 300,000 inhabitants go and who will pay for their relocation? Even if space were identified, income generating opportunities would have to be found and there would also be the conflicts that are bound to occur when two (or more) cultures come into contact. Given the increased competition we are currently seeing for resources like safe drinking water, it is unlikely that those dislocated are going to be welcomed with open arms on the scale that is needed. Thus, climate change is a significant threat to geopolitical stability.

It is instructive that the insurance industry, known for its conservative viewpoints is taking a leadership role in the push for action on global climate change. Between 1989 and 1995, worldwide losses for storms averaged \$9.3 billion annually, peaking in 1992 at \$20 billion in payouts for floods and

storms.¹⁰¹ The insurance industry is anxious to contain the problem as the financial implications are substantial. Increases in insurance premiums, the loss of business opportunities due to unacceptable environmental risk and a host of related issues will create significant disruption environmentally, economically, socially and politically in the coming years. Because the insurance industry insures risk, it is natural that this sector will be among the first to evaluate their exposure to environmental disruption. Other industries, notably energy and transportation contribute substantially to global warming, however, the technologies they use have not impacted their profitability to the extent experienced by insurers.¹⁰² Despite a few newsworthy instances of heavy fines and costly cleanups, today's cost to polluters for using the sink capacity of the ecosphere is still practically zero although the opportunity costs may turn out to be astronomical.¹⁰³ Insurance companies could conceivably be the driving force in terms of speeding up the search for alternative development solutions. International financial institutions will not be far behind because losses which are not insured or those which are underinsured will have to be paid for by someone. This is not reason to rest assured that solutions will be forthcoming; the band aid approach may be to twist the arm of government to underwrite larger portions of losses incurred, thus transferring the burden onto the public. This will be an interesting exercise in that the private sector is also pushing for less government interference. High unemployment rates, tattered social nets and aging infrastructure may hamper government ability to underwrite future

¹⁰¹ *Insurers call for action on climate change*, Globe & Mail, July 27, 1996, pp. A1, A6.

¹⁰² It is interesting that the oil and gas industry denied sufficient proof existed on any negative impacts of fossil fuel emissions on climate change while the insurance industry insisted the proof was overwhelming at the Symposium on Climate Change and Variability in Atlantic Canada, Halifax, December, 1996.

¹⁰³ Goodland, 1992, p. 9.

losses.

2.3.3 Evidence of Limits: Stratospheric Ozone Depletion

Stratospheric ozone is a form of oxygen which acts to shield the earth's surface from ultraviolet rays released by the sun. The majority of ozone destruction results from human activity in industrialized nations. Organic chemical compounds containing chlorine or bromine destroy ozone under certain circumstances. Compounds such as chlorofluorocarbons (CFCs) and other halocarbons, including carbon tetrachloride and halons are commonly used as industrial solvents, for air-conditioning systems and refrigeration, and in blown-foam insulation and packaging. Each year several hundred thousand tons of chemically reactive chlorine are released which find their way to the stratosphere.¹⁰⁴

CFCs take about ten years to "waft up to the ozone layer, where they destroy it with a half-life of 100 to 150 years."¹⁰⁵ Even if we were to stop emitting CFCs into the atmosphere today, it will take an additional ten years for today's damage to appear. Then it will take decades (estimates range from 50 - 150 years) for ozone levels in the stratosphere to return to their predamage levels.¹⁰⁶

Although the processes involving destruction of stratospheric ozone are complex and not fully understood, scientists are generally in agreement about the nature of the phenomenon of ozone depletion and its potential impact. The degree of ozone loss appears to be seasonal and varies according to latitude. Since 1979, a hole has been detected over the Antarctic which covered an area the size of the U.S. with a depth of Mount Everest.¹⁰⁷ That

¹⁰⁴ Union of Concerned Scientists, January, 1994.

¹⁰⁵ Goodland, 1992, p. 12.

¹⁰⁶ Goodland, 1992, p. 12, Union of Concerned Scientists, January 1994.

¹⁰⁷ Goodland, 1992, p. 11.

hole has now "gone global" in the sense that a second hole has been discovered over the Arctic and significant thinning over both north and south temperate latitudes has been detected. The holes initially occurred in winter but they now last into spring.

Scientists are in agreement that a loss of ozone protection will have a detrimental impact on all life forms. Phytoplankton, which are aquatic microplants and algae which play a crucial role as primary photosynthetic producers are particularly vulnerable and yields in the Antarctic ocean have already decreased.¹⁰⁸ Ozone depletion allows greater amounts of ultraviolet "B" radiation leakage resulting in skin cancers and cataracts. The U.S. EPA upped by *twentyfold* their estimate of UV-radiation cancer deaths" in 1991 and one billion additional skin cancers are predicted for people who are alive today.¹⁰⁹ Blindness attributable to ozone depletion has been detected in Chilean sheep and Patagonian rabbits in the Andes.¹¹⁰

Other serious effects include depression of immune systems, increasing vulnerability to tumors, parasites, and infectious diseases. Crop yields and marine fisheries can be expected to decline. The gravest threat is the potential this phenomenon has to disrupt balances in natural vegetation. Impacts to plants include reduced leaf size, stunted growth, poor seed quality, as well as increased susceptibility to weeds, disease, and pests.¹¹¹ Keystone species which other species depend upon for survival may be lost "leading to widespread disruption in environmental services and accelerating extinctions".¹¹²

¹⁰⁸ Kendall & Pimentel, 1994.

¹⁰⁹ Goodland, 1992, p. 10.

¹¹⁰ Goodland, 1992, p. 12.

¹¹¹ Kendall, H. & Pimentel, D., 1994.

¹¹² Goodland, 1992, p. 12.

In 1987, forty-seven countries negotiated the *Montreal Protocol on Substances That Deplete the Ozone Layer*. The protocol determined a timetable for reducing production and consumption of many CFCs. Since that time new evidence revealed ozone depletion posed a more serious threat than previously anticipated and timetables for phase out were accelerated. Recent research indicates ozone depletion is saturated (occurring as fast as chemically possible) and that the Antarctic ozone hole is not getting any bigger but develops faster and persists longer than in the past.¹¹³

Hydrofluorocarbons (HFCs), used to replace CFCs have been shown to have very large growth rates in both hemispheres. Recent studies indicate that HFCs are efficient heat-trapping gases and contributors to global warming.¹¹⁴

Scientists are now researching a newly discovered threat to the ozone, methyl bromide (CH₃Br), an extremely toxic compound used widely in industry and agriculture for its pesticidal properties. This compound destroys ozone 50 times more efficiently than chlorine does. Methyl bromide occurs naturally as well as through human emissions. Sources of emissions include direct production, leaded gasoline, biomass burning, tropical forest fires and natural emissions.¹¹⁵ Agribusiness has argued against banning the chemical from use until they can find a suitable replacement although the chemical is scheduled to be banned in the US by the year 2001 under the 1990 Clear Air

¹¹³ Jiang, Y, et al, *Decadal Evolution of the Antarctic Ozone Hole*, J. Geophys. Res., Vol 101, No. D4 (April 20, 1996) 8985 - 8999.

¹¹⁴ Montzka, S.A. et al *Decline in the Tropospheric Abundance of Halogen from Halocarbons: Implications for Stratospheric Ozone Depletion*, Science, Vol 272, May 31, 1996, p. 1318-22. See also *Our Future's Up in the Air: Du Pont leads the pack in ozone destruction* Greenpeace Canada Action, Vol 3, No. 1 Winter/Spring 1992.

¹¹⁵ Butler, James H. *Scientific Uncertainties in the Budget of Atmospheric Methyl Bromide*, Atmospheric Environment 1996. Vol 30 (7) i-iii. Butler, J.H., & Rodriguez, *Methyl Bromide in the Atmosphere*, *The Methyl Bromide Issue*, C. H. Bell, N. Price and B. Chakrabarti (eds.) Published 1996 by John Wiley & Sons, New York, NY. Jeffers, P.M. & Wolfe, N.L., *On the Degradation of Methyl Bromide in Sea Water*, Geophysical Research Letters, vol. 23, #14, July 1, 1996 pp. 1773 - 1776.

Act Amendments.¹¹⁶

2.3.4 Evidence of Limits: Land Degradation

Land degradation has been occurring for thousands of years through soil erosion, salination and desertification. Thirty-five percent of the earth's land is presently degraded and is continuing to degrade at an accelerated pace. Ninety-seven percent of our food supply comes from land.¹¹⁷ Over the next 25 years, global food demand is expected to increase by 64 percent.¹¹⁸

World agricultural production is being compromised by serious levels of soil erosion and the issue is compounded as marginal soils are brought into production. Soil is created at about one ton per hectare per year¹¹⁹ but soil loss rates, generally range from 10 to 100 tons per hectare per year, exceeding soil formation rates by at least tenfold. Agriculture practices are leading to erosion, salination, or waterlogging of possibly six million hectares per year creating the potential for a crisis situation affecting global food security.¹²⁰ Unjust land distribution patterns contribute to soil degradation as farmers are forced onto marginal lands to survive. For instance, in Latin America, the smallest 66 percent of farms cover 4 percent of farmland. The inhabitants of this land can only expand by moving onto hillsides or other low quality land.¹²¹

As land is degraded, productivity is lowered which could lead to higher food prices. However, the presence of one billion people who currently earn

¹¹⁶Butler, J.H., 1996.

¹¹⁷ Goodland, 1994, p. 12.

¹¹⁸ Gardner, Gary, *Preserving Agricultural Resources*, in Brown et al, eds., State of the World 1996, p. 80.

¹¹⁹ Gardner, Gary, 1996, p. 83.

¹²⁰ Goodland, 1994, p. 13. See also Pinstup-Andersen, Per, *World Food Trends and Future Food Security, Food Policy Report*, Washington: The International Food Policy Research Institute, March 1994.

¹²¹ Gardner, 1996, pp. 83-84.

US\$1 per day or less together with increased population growth (90-100 million people per year) keep real world market prices for food depressed (low market demand). This creates a particularly precarious situation for the poor. Their poverty is due in part to low market prices for food but a fall in productivity due to environmental deterioration could escalate prices in a way that would not benefit their circumstance. Since food goes to the highest bidder, any shortfall in supply will cause increase suffering among the malnourished.¹²²

Poverty exacerbates soil erosion which in turn intensifies hunger and poverty. As competition for land increases, due in part to the conversion of crops for consumption to crops for export,¹²³ people clear forests for subsistence farming. This increases fuel wood shortages so people use crop residues and dung previously used for agriculture for their energy needs.

Unsound agricultural practices are damaging soil quality. Soil is a living medium for food production rather than another technical input like pesticides, fertilizers or tractors. Overgrazing, deforestation, repeated planting of row crops all result in increased wind and water erosion. In more extreme cases, regenerative capacity of the soil has been difficult to achieve and desertification has resulted. Poor irrigation practices increase soil salinity. Conventional agricultural practices damage soil fertility by compacting it or reducing the amount of organic matter. The use of pesticides and chemical fertilizers pose environmental and human health issues. Agriculture is also closely tied to water issues as two-thirds of fresh water consumed world wide is for agricultural purposes. Half of the water devoted to agriculture is lost

¹²² Pinstup-Andersen, 1994, p.p. 6 - 9. Goodland, p. 13.

¹²³ This process is encouraged to raise foreign exchange and through intensification of agriculture.

through runoff and evaporation.

The neoliberal view is that biotechnology will be the panacea to our current food problems. Efforts are underway to develop strains that are disease resistant and which have characteristics with the ability to withstand stronger pesticides.¹²⁴ Pessimists are concerned this will result in the creation of a new breed of "superpests" which will wipe out huge tracts of agriculture because of the monocropping techniques used in agribusiness. Numerous other ethical and health related concerns have been voiced. Biotechnologies are very expensive to develop and the licensing arrangements and costs involved in using them make them available only to a few large scale farmers.¹²⁵ Experience has shown that developments in technology are often accompanied by unanticipated new risks. For instance, CFCs were seen to be an improvement on ammonia for refrigeration but they caused ozone depletion. Similarly the HFCs that were developed to replace CFCs are exacerbating global warming trends.

2.4 Impacts of Technology

Technology is more than a package of nuts and bolts or computer chips. Technology can be looked at as "a way of doing things". As Kenneth Boulding has pointed out, there is a technology of prayer and of ploughing and a technology of fear control as well as flood control.¹²⁶ Technology is so much a part of our lives that it is almost imperceptible, as natural as breathing. Each culture has its own array of technologies that relate to resources of the area, the climate, the social relationships. Indigenous

¹²⁴ Monsanto has developed varieties that can withstand pesticides with the strength of Agent Orange and Roundup which they also developed. CBC, April 13, 1997.

¹²⁵ For instance, Monsanto farmers must sign agreements which include strict use of input packages, auditing for compliance by Monsanto personnel, agreement to not save seed and a fee for each acre planted. CBC, April 13, 1997.

¹²⁶ Cited in Franklin, Ursula, The Real World of Technology, Toronto: CBC Enterprises, 1990.

technologies illuminate the cumulative wisdom of many years of scientific experimentation even if that experimentation was in the field rather than the lab. Indigenous technologies represent the outcome of life and death struggles for survival and they stand quite apart from the money economy. Modernization changed all that.

When it was deemed appropriate that countries of the South should “develop” in the image of the North, tied aid was provided to purchase the technologies that would industrialize countries. Many of these technologies proved to be inappropriate to local conditions, weather patterns, available resources, energy, transportation, communication systems and societal management systems. Some attempts to modernize economies were outright disasters and the literature is filled with condemnation of the outcomes. The North has sold fish plants needing refrigeration where energy supplies were inadequate, bakeries to areas that did not have wheat and agricultural technologies that created conditions which aggravated food insecurity. The presumption was that the technology of the North was superior because it was modern. However, if poverty were to be solved in an area with an abundance of labour, the last thing needed was capital intensive technology that displaced labour. Aid helped to pay for new technology but then the issue became how to pay for its energy and upkeep. The technology was developed in the *historical context* of the infrastructure, the management systems and the social arrangements of the North. The technology could be transferred, the context could not.

It is important to emphasize that the issue here is not with technology per se, rather it is with the scale of technology and with its transferability to any context whatever. The context of the North evolved under a set of

conditions that were very different from the set of conditions in the South. These conditions had nothing to do with the intelligence or ability of citizens living in the South, rather they demonstrated that a different path had been followed in the development process, a path that was organic and reflective of local conditions.

E. F. Schumacher, one of the world's great thinkers of the social impacts of technology pointed out that a half a billion people in the world live on less than \$50 a year and that people in the North would not be able to survive under such conditions.

But they (the poor in the South) are surviving. They have a know-how that we don't have. They are real, and we must not think of them as poor little souls, and luckily we have come along and we are going to develop them. No, they are survival artists and it is quite certain that if there should be a real resources crisis, or a real ecological crisis, in this world, these people will survive. ... That New York will survive is an impossibility...the same applies for an awful number of other cities. ... (If) I, as an economic magician, could double the ... average income per head, in Burma from the £20 it was at that time to £40, if I would do that without destroying the secret pattern of life which enabled them to live, then I would have turned Burma, I am sure, into the nearest thing to paradise we know. ... If I doubled the income of Burma from £20 to £40, whilst changing the pattern from the traditional Burmese pattern to the English pattern, then I would have turned Burma into the world's worst slum.¹²⁷

Aid and development loans insured the technologies of the North have become firmly entrenched in the systems of the South, even if they are mismatched and the result is as Schumacher presumed, the creation of some of "the world's worst slums".¹²⁸ Under the circumstances, it is a cruel irony that consultants from the North lecture those in the South on how to achieve sustainable development. It is the developed countries of the North that need help and guidance. Ours is a technology that is resource intensive with

¹²⁷ Schumacher cited in McRobie, George, Small is Possible, Great Britain: Jonathan Cape, 1981 pp. 1-2.

¹²⁸ McRobie, 1981 p. 1.

cavernous appetites for non-renewable fossil fuels, generating more wastes than the biosphere can absorb. Ours is a technology that is out of reach of the majority of the population and reducing more and more of our work force to “surplus labour” and forcing even more to work at mindless low paying Macjobs with no future opportunities. Why would anyone want to transfer such a system to their people?

The South is struggling to find ways to feed a massive population. The solutions from the North are to add a large population of machines to the human population. Ursula Franklin goes to the heart of the matter.

(N)obody does the type of nose-counting for machines and devices that is commonly applied to people. ... Almost nothing is known about the global energy need of devices or about their lifespans. China can embark on a rigorous one-child-per-family policy for the sake of the country's future, and in general that policy has been approved by the world community. But where in North America, western Europe, or Japan is there serious discussion on the political level about ... the need for a one-car-per-family policy for the sake of the country's or the world's future? Now may be the time to take machine demography seriously and enter into real discussions about *machine* population control.¹²⁹

Schumacher observed that technological innovation seems to be subject to the “law of the disappearing middle”.¹³⁰ Available technology is becoming more powerful, sophisticated and expensive while the technology which traditionally has been used to supplement human endeavours is disappearing. Franklin makes a similar observation, that people are now extensions of technology whereas technology used to be an extension of the human. This creates quite a different set of circumstances in terms of who owns the technology and who benefits from the outputs of that technology. The result of course is greater inequity because only the wealthier citizens can afford today's technology and that which is available for the poor is too low

¹²⁹ Franklin, 1990, p. 30.

¹³⁰ Schumacher cited in McRobie, 1981, p. 3.

tech to help improve productivity.

We know that the lifestyle of the industrialized nations is unsustainable and we have encouraged the South to take the lessons of our mistakes to heart. Nonetheless, we continue to try to sell our unsustainable technology and transnational corporations use employment opportunities as bargaining chips for low environmental standards, tax concessions, low wages, and so forth. The message is mixed and Western lifestyles are too addictive to quit. If China were to fully embrace the lifestyle of the North, all remaining sink capacity of the environment would be used up in very short order. It now becomes a delicate diplomacy act to negotiate a truce that will protect life support systems of the ecosphere while prying the strangling grip of the privileged off the levers of control. The North must drastically cut material consumption and that necessitates a change in lifestyle. The South needs to increase consumption in order to meet basic needs but experience shows that increased consumption does not translate into equitable distribution.

Technology will have to be changed to reduce throughput of material resources to the point where we are using surplus rather than stock supplies, reduce pollution, and start using renewable sources of energy. Unfortunately, improvements gained in throughput efficiencies are often lost due to more rapid rates of stock depletion. Similarly, reduction in pollution is countered by aggregate increases in pollution as the scale of the global economy escalates. Research on renewable energy supplies have not fared much better; rather the focus seems to be on research and development of unsustainable processes. In 1989 the twenty-one member countries of the International Energy Agency (IEA) devoted 75 percent of their U.S. \$7.3 billion energy

research budget on fossil fuels and nuclear energy. Seven percent of the budget was spent on renewables and five percent was devoted to energy conservation.¹³¹ Meanwhile, the clock is ticking away on the time we have to find adequate alternatives before fossil fuels run out.

2.5 Concluding Remarks

Although the modernization of economies has been responsible for the creation of considerable material wealth and increases in creature comforts, its blessings have been bestowed upon precious few. The modernization paradigm (especially in its current neoliberal form) calls for the consolidation of wealth (capital accumulation) in order to undertake large scale industrialization which is seen as a precondition for growth. As a country's economy grows, wealth will trickle down to the masses. This view does not see the natural world as finite, rather it has a cornucopian vision in which the wealthier class does not take less in order that the poorer class can have some. Rather the pie gets progressively larger and the poor begin to reap the benefits once the pie becomes large enough.

The empirical evidence shows that the gap between the rich and the poor is widening. At the same time, the resource base and the sink capacity upon which economic activity depends is declining. The pie simply cannot grow any larger. With ninety million people being added to the global population each year, the size of the economic pie simply cannot keep pace. Further, if the pie begins to shrink because of environmental deterioration, the poor will be even worse off.

Neoliberalism with its growth ethos is a utopian view of the world.

¹³¹ von Droste, Bernd & Dogse, Peter, *Sustainable Development: The Role of Investment in Goodland*, Robert, Daly, Herman, El Serafy, Salah, eds. 1992. Population, Technology and Lifestyle: The Transition to Sustainability. Washington: Island Press, p. 97.

Contrary to this view, the economy is a subsystem of the ecosphere. The ecosphere has a limited capacity to regenerate resources for throughput growth and a limited capacity to absorb the wastes generated in that growth. We are accumulating evidence which demonstrates the resource base and the sink capacity upon which economic activity depends, is shrinking. GNP as the sole measurement of progress, obscures the reality of ecological limits. Conventional models of development have no way of accounting for the erosion of natural capital or for degradation of sink capacity of the environment. Indicators of ecological decline such as ozone shield rupture, climate change or collapse of fish stocks mean that economic activity now costs more than it is worth at the margins, therefore, economic activity is becoming antieconomic. Feeble attempts are being made to internalize environmental costs but these are simply tinkering with a fatally flawed system. Daly points out that the internalization of what are now externalities is being taken up with increasing frequency by economists but this approach to environmental problems is "proving inadequate".

The increasing frequency of appeal to externalities is the clearest possible evidence that more and more relevant facts do not fit within the existing theoretical framework. When increasingly vital facts, including the very capacity of the earth to support life, have to be treated as "externalities," then it is past time to change the basic framework of our thinking so that we can treat these critical issues internally and centrally.¹³²

It would appear that only radical transformation of the system will yield the desired results. However, it is becoming increasingly clear that any such change will be vehemently resisted by those who stand to benefit by maintenance of the status quo. We now have scientific consensus that climate change is underway. With global warming, sea levels will rise. Small island states are extraordinarily vulnerable on this issue and many will likely

¹³² Daly, 1996, p. 45.

become uninhabitable. The industrialized nations have made commitments to stabilizing greenhouse gases to avert catastrophe but there is a lot of foot dragging when it comes to meeting those commitments. One of the biggest contributors to global warming is the use of fossil fuels. Organizations representing fossil fuel industries are resisting efforts to cap emissions citing economic suicide, mass unemployment and a return to the days of horse drawn buggies as reasons for their challenge.¹³³ Lost in the discussion is the economic genocide, loss of livelihood and inability to move beyond horse drawn wagon days that is being forced upon small island states. Growth of the fossil fuel industry takes precedence over the prevention of a catastrophe that is global in scope and which is literally incalculable in terms of temporal scale.

The change that is needed can be brought about most effectively by viewing the world through an ecological economics lens. The ecological economics paradigm provides a clear vision which sees the need to maintain the integrity of ecosystem health as a basic principle around which societies can be organized. From this principle we can structure society in a way that ensures the maintenance of healthy life support systems is paramount. Elements of this structure would include stabilisation of growth, redistribution of wealth and income and participatory democracy. We would see the reemergence of indigenous models of development and greater recognition of the contribution of non-western technologies and wisdoms.

¹³³ David Suzuki Foundation, *Mobilising Canada to Address Global Warming, the Most Urgent Slow-Motion Catastrophe Facing Humankind*, The Globe and Mail. Flavin, Christopher, *Facing Up to the Risks of Climate Change*. Brown et al., eds., State of the World 1996.

Chapter Three: The Evolution of Ecological Economics

3.0 Introduction

The Club of Rome released their report during a time of great social agitation. A generation had turned their backs on the Establishment, challenging the wisdom of the quest for materialism and the creation of weapons of mass destruction; agitating instead for greater social justice. The growing awareness of issues revolving around global hunger, poverty, women's liberation, oppression of aboriginal peoples, spiritual revival and environmental degradation punctuated with politically-motivated revolutions in the South served to provide much food for thought and the opportunity for cross fertilization of ideas across a wide spectrum of social, economic and political issues. The result was a more holistic analysis of systemic problems people everywhere were facing. Facilitating these discussions was the work of general systems theorists whose contributions helped to improve (in some cases create) lines of communications between disciplines. The challenge to Newtonian analytical thinking with its atomistic viewpoint began in earnest.

A growing number of ecologists and economists began arguing for a steady-state economy.¹³⁴ Demography theorists resurrected the spectre of possible shortages of food as green revolution productivity peaked while population continued to grow exponentially. Development economics was invigorated with new perspectives as the voice from the South resonated with calls for greater social justice. Influenced by the historical context within which it grew, the beginnings of ecological economics took hold at a time

¹³⁴See for example, Daly, Herman, *Steady-State Economics*, Washington, D.C.: Island Press, 1977. Catton, William R., Jr., *Overshoot: the Ecological Basis of Revolutionary Change*, Illinois: Illini Books, 1980. Ophuls, 1977. Georgescu-Roegen, N., *The Steady-State and Ecological Salvation: A Thermo-Dynamic Analysis*. *Bioscience*. 1977, 27 (4):266-270.

when environmental awareness was increasing and when political tensions were high. What began as a critique of development economics evolved to become a new paradigm.

This call for holism reflected disillusionment with the increasingly atomistic compartmentalization and fragmentation of society that accompanied modernization. Growing corporations with limited liability responded to calls for increased profits from faceless shareholders, reducing social transactions to cold hard bottom lines. As the walls of nation states crumble in the wake of international economics, the stark realities of possible futures are coming into focus. No where are the goods being delivered and the system is beginning to take on a life of its own. A century and a half ago, Marx pointed out that the system itself is flawed. Yet we continue to prop up this failed experiment knowing full well it is taking us at breakneck speed toward an ignominious end.

Can ecological economics help us find a way? The previous chapter provided a review of the past fifty years of modernization. I argued that neo-liberalism with its growth ethos is an unsustainable project in a finite world. Rather than solving issues of poverty and environmental degradation, the approach of this model serves to worsen the situation. In this chapter, I will explore some of the historical and present day fields of thought that provide the intellectual roots of ecological economics. I have chosen these bodies of thought, not because they are the only ones relevant to the formulation of the ecological economics paradigm but because they form part of the historical context within which ecological economics evolved and because they are illustrative of concepts from which to build a workable relevant model of ecological economics.

We begin our foray by stepping back into history to the time when European culture came into contact with the indigenous peoples of the Americas¹³⁵. The comparison will yield an insight into the way these two cultures related to nature and hence an insight into the perspective ecological economics emulates. The Western world view is still emulated in dominant economic models but the indigenous world view illuminates the thinking of ecological economics. From there we will explore Marx and contemporary Marxist perspectives because the way society is organized has environmental implications. Of special relevance for the purpose of this thesis is class relations, distribution and the relation of labour to the means of production. Contemporary perspectives on class analysis, social justice and demography theories will also be reviewed. The chapter will conclude with a brief overview of steady state theory which, as the name infers, attempts to bring the human economy into balance with the natural world. This approach reflects the indigenous perspective as regards Nature and it incorporates notions of both Marx and Malthus as regards socioeconomic challenges to poverty.

3.1 Native World View Vis a Vis European Philosophy

Cronon presents an insightful analysis of the clash brought about by Europe's philosophy on human's relationship to resources and the philosophy of indigenous people they encountered. Although Cronon focuses his discussion on America, he points out that parallels can be drawn to indigenous people of other continents. "If the Indians considered

¹³⁵ Native peoples had very diverse social, political and economic systems and much of the literature has tended to treat them all as one as well as to romanticise their way of life. However, as a general rule, native peoples have shown great deference to nature, seeing themselves as part of nature rather than having mastery over nature and feeling part of a web of interdependence with other species.

themselves happy with the fruits of relatively little labour, they were like any peoples of the world as described by modern anthropologists."¹³⁶ Cronon comments on Locke's chapter on property in the *Two Treatises of Government* in which "Locke sought to explain how people came to possess unequal rights to a natural abundance he supposed had originally been held in common" by contrasting the societies of Europe with those of indigenous Americans. "In the beginning all the world was America".¹³⁷ Locke argues the claim to property was directly related to the labour one expended in its acquisition. People could accumulate wealth beyond the limits of natural spoilage by storing wealth in the form of money thus facilitating the accumulation of surplus capital.¹³⁸

Land in this view was attached to a marketplace "and the accumulation of its value in a society with institutional ways of recognizing abstract wealth" committed colonial America to an "expanding economy" that was ecologically transformative." Locke saw the indigenous population as living in great poverty because they "lacked the incentives of money and commerce" and "failed to improve their land" thus remaining "a people devoid of wealth and comfort." According to Cronon, Locke failed to understand that the indigenous people didn't consider themselves to be poor. "The endless accumulation of capital which he saw as a natural consequence of the human love for wealth made little sense to them."¹³⁹ Indeed as Dr. Charles Eastman (born Ohiyesa of the Santee Sioux) points out:

The native American has been generally despised by his white conquerors for his poverty and simplicity (but) ... his religion forbade the accumulation of wealth and the enjoyment of luxury. To him ... the love of possessions has

¹³⁶ Cronon, William, Changes in the Land: Indians, Colonists, and the Ecology of New England. Toronto: McGraw-Hill Ryerson Ltd., 1983, p. 80.

¹³⁷ Locke, cited in Cronon, 1983, p. 29.

¹³⁸ Locke, cited in Cronon, 1983, p. 28-29.

¹³⁹ Cronon, 1983, p.79.

appeared a snare and the burdens of a complex society a source of needless peril and temptation. Furthermore, it was the rule of his life to share the fruits of his skill and success with his less fortunate brothers.¹⁴⁰

Marshall Sahlins suggested there were two ways to be rich. "Wants may be 'easily satisfied' either by producing much or desiring little." Similarly, Thomas Morton perceived New England's indigenous people as having chosen this second path. "(O)n their own understanding, they "lived richly," and had little in the way of either wants or complaints."¹⁴¹ Morton surmised the difference between indigenous Americans and Europeans was not that one had property and the other had none; rather, it was that they loved property differently. Perelman notes that primitive societies tended to live "within the limits imposed by their environments" and by "acknowledging humanity's existence *as part of nature* rather than its *mastery over nature*."¹⁴² By transforming land and the resources it yielded into stored wealth and hence technologies of escalating power, the European philosophy "overwhelmed" the indigenous philosophy toward land and this viewpoint manifested in the brutal conquests and exploitation that followed.

Today many indigenous cultures have been destroyed and survivors have been herded onto reservations or otherwise displaced where they suffer severe social and psychological stress brought about by this clash of world views. These views were deeply entrenched and to expect whole nations to "convert" to a world view that degraded the earth and reduced other species to mere economic "inputs" was to deny deeply held spiritual belief systems. This fracturing of the psyche came at great cost. While many indigenous

¹⁴⁰ Eastman, Dr. Charles Alexander, born Ohiyesa of the Santee Sioux, in 1858, *The Soul of the Indian*, 1911, p. 2, Web Publication by Mountain Man Graphics, Australia in the Southern Autumn of 1996

¹⁴¹ Thomas Morton, quoted in Cronon, 1983, p. 80.

¹⁴² Perelman, Michael, *Farming for Profit in a Hungry World: Capital and The Crisis in Agriculture*, New Jersey: Allanheld, Osmun & Co. Publishers, Inc., 1977, p.207, italics added.

societies are trying to maintain their beliefs and practices, it is no easy feat to defy "the system". Social anthropologists fear that today's generation may be the last of most indigenous cultures.¹⁴³ Their language, customs and technology are very much tied to their landscape and all are under threat.

Rather than *power over*, this view shared *power with*. Other species were considered to have an intrinsic value beyond their utility for humans. By thinking of other species, parts of the landscape (trees and mountains) and forces of nature (such as the wind) as 'brothers' or 'sisters', concepts like interdependence and the web of life were illuminated. This view showed deference for nature and acknowledged human dependence upon nature for continued existence. The land and everything on it was regarded as sacred. You could not own the land, rather you were part of it, so humans were very much part of the landscape.

As Fritjof Capra notes:

Systemic wisdom (characteristic of traditional non literature cultures ... sadly neglected in our over rational and mechanised society) is based on a profound respect for the wisdom of nature, which is totally consistent with the insights of modern ecology.¹⁴⁴

The indigenous world view is illustrative of the relationship between humans and nature I propose is embodied within the ecological economics paradigm. Concepts like power with, interdependence, web of life, deference for "Mother Earth", and the intrinsic value of other species have significant heuristic value for ecological economics and have been invoked regularly by proponents of the field. Taken together, they demonstrate spatial and temporal holism.

¹⁴³ For example, social anthropologist, Adrian Forsythe, sees even the very primitive cultures of Irian Jaya which have only recently been exposed to outside influences as lasting no more than one generation as "development" forces come to bear. Personal conversation.

¹⁴⁴ Cited in the Introduction, Foreword and Summary to The Gaia Hypothesis by Brown, R.P.F., Web Publication by Mountain Man Graphics, Australia in the Southern Autumn of 1996.

3.2 Marxism

Within Europe two main streams of thought surfaced: liberalism and its counterpoint of the day, Marxist tradition. They evolved in the context of emerging industrial societies. While both traditions focused on the need to accumulate capital, they differed on the relationship to production.

Beneficiaries of the process were caught up in the euphoria of the profits garnered with rapid advances of technology and the power it brought them. In the view of the day, Europe was the seat of civilization and with the fervor of religious zealots, they sought to convert the rest of the "uncivilized" world. The competition generated among European nation states to accumulate capital resulted in a monumental land grab culminating in the build up of colonial empires that legitimated the appropriation of resources of far off lands, the denigration of those colonized to the relative equivalent of slave labour involved in the extraction of raw resources and the transformation of elites within those societies to compradores and consumers of finished goods.

As Engels noted:

England was to become the "workshop of the world"; all other countries were to become for England what Ireland already was - markets for her manufactured goods, supplying her in return with raw materials and food. England, the great manufacturing centre of an agricultural world, with an ever-increasing number of corn and cotton-growing Irelands revolving around her, the industrial sun. What a glorious prospect!¹⁴⁵

Thus began the division of labour in the colonies and the growth of mono-cultures. Colonial rule began a process that allowed colonies neither the incentive nor the opportunity to develop a healthy, sustainable economy. As Marx & Engels noted, the ideas of the ruling class are the ruling ideas in a society, made into a law for all to obey, a law, "whose essential character and direction are determined by the economical conditions of existence" of the

¹⁴⁵ Engels cited in Perelman, 1977, p. 126.

ruling class.¹⁴⁶

Karl Marx believed that the "roots of surplus population are social. " He argued that "in capitalist society population is not excessive relative to natural resources but to employment, since the system has inherent tendencies to recreate job scarcity and unemployment. Thus it was only those with no means of survival other than wage labour who appear constantly to be in surplus. The defects of capitalist society were not surface phenomena whose elimination requires only the correction of certain 'abuses'. Rather it was the system itself that was "abusive."

Marx argued that the presence of massive poverty and starvation was a result of the overpopulation in urban slums: a "massive social problem created by the dynamics of expanding capitalism." Large capitalist farms squeezed small peasant farmers off their land forcing them into cities where they became part of industrial capitalism's "reserve army of labour", essential to ensuring capitalists a continuous supply of cheap labour. Their hunger and their poverty was an "outgrowth of the social and economic organization of society." Their exploitation was rooted in capitalist relations of production. This view did not see population growth as a problem in socialist society. Rather, the capitalist mode of production and its inevitable results: poverty, unemployment and inequality was the problem.¹⁴⁷

The concepts of Marx as outlined above provide important insights for ecological economics. For Marx, the struggle for a share of the economic pie was rooted in class relations. Those who controlled the levers of production controlled the way in which the fruits of production were distributed. Marx

¹⁴⁶ Marx Karl & Engels, Friedrich, The Communist Manifesto, Tirana: Nentori Publishing House, 1981, originally published in 1848.

¹⁴⁷ Marx , Karl & Engels,Friedrick, Selected Works in Two Volumes, London: Lawrence & Wishart Ltd., 1950.

may have been ahead of his time by predicting the fatal contradiction that plagued capitalism; that its efficient production creates vast quantities of goods but its ceaseless drive to replace workers with machines would make the proletariat (working population) unemployed and thereby unable to purchase and consume these goods.¹⁴⁸

As we have seen in the previous chapter, inequitable relations between capital and labour are creating conditions of greater poverty for humans and the biosphere. Industrial scale technology stresses the regenerative and assimilative capacity of the biosphere and replaces the energy of workers with fossil fuel energy all of which is unsustainable. Population growth under conditions where people have no physical space to go and declining opportunities to participate in wage labour exacerbates the suffering. As Marx correctly points out, these defects of capitalist society are not surface phenomena; rather the system is inherently flawed. Marx foresaw the social causes for collapse of the capitalist system but not the environmental causes.

Ecological economics advocates limits to growth, citing the potential for ecosystem and sociopolitical collapse as justification. Capitalism requires growth for survival and it relies on inequitable social conditions to be profitable. However, inequity is exacerbating environmental deterioration, which in turn, makes the pie smaller, pulling society into the vortex of a downward spiral. Marx's analysis suggests the capitalist mode of production is the root cause of environmental decline.

The symptoms of system malfunction became particularly acute in the 1970s. At that time, neo-Marxism took root and a transformation in

¹⁴⁸ Marx cited in Riley et al, ed., *Karl Marx and Friedrich Engels, The Communist Manifesto, The Global Experience Readings in World History Since 1500 Volume II*, Prentice-Hall, New Jersey, 1987 pp. 113.

development thinking occurred, focusing on the concept of “underdevelopment” from a Third World perspective.

3.2.1 Neo-Marxism

The 1970s, known as the “Growth with Equity Era” was a time of great social agitation. Neo-Marxism expanded upon and reformulated many of Marx’s earlier theories. Radical critiques of Western development economics surfaced and gave rise to theories such as dependency¹⁴⁹ and unequal exchange. Development goals were reevaluated to make them more responsive to the deleterious effects of development economics in some countries. It was apparent the benefits of economic growth were not trickling down to the poor and the income gap between the rich and the poor was widening.

This led to greater attention being focused on the effects of economic growth on the small farm, employment generation and the existence of employment-output tradeoffs in industry and agriculture. Ways were sought to keep people in rural areas¹⁵⁰ rather than having them migrate to urban slums when it became apparent industry could no longer grow fast enough to absorb surplus labour from rural areas. Basic needs strategies were enacted to “correct the abuses” but as Marx had theorized more than a century earlier, tinkering with the system would be of no avail.

The modernization paradigm presupposes harmony and benevolence towards the poor by elites at the national level. It further presupposes

¹⁴⁹ Considerable critiques have been brought forth on dependency theory at the paradigmatic, theoretical, methodological and empirical levels. However, the impact of the dependency school was quite substantial. It contributed to the decline of the modernization paradigm, stimulated dependency analysis in other areas of the Third World, and created new development strategies and theoretical frameworks. I propose the theory offers valuable insights that cannot be dismissed for given situations. See Hetne, 1990 for a discussion of dependency theory and the criticisms it engendered.

¹⁵⁰ See for Instance, Chambers, 1983.

harmony through interdependence at the international level, assuming the present world system is beneficial to all nations and that trade should be conducted on principles of comparative advantage. A class analysis approach sees the world as being not just divided into rich/powerful and poor/relatively powerless nations. Rather all countries, including the rich, are characterized by dominating and dominated classes, each with its own "subdivisions". This view does not see the NIEO as guaranteeing benefits to the poor, rather it advocates a "decent livelihood and dignity of all human beings". Conflict is central to this view rather than harmony. It is assumed that Third World elites will not give up their privilege without a struggle and will prevent substantial advantages from trickling down. Rich nations exploit poor ones with their counterparts in the Third World.

In this view, development which benefits the poor will be unacceptable to dominant classes or nations unless their interests are adequately served. Development which benefits only the poor will be suppressed by the powerful. Development which serves the interests of elites will still be enacted if it is negative for the poor and will be maintained by violence if necessary to prevent basic change in the balance of social and political relations.

Neo-Marxist theory offered considerable resistance to Western-style development. It created conditions for reform of the system by putting a "human face" on development that diffused revolutionary challenges to some degree. This alleviated some of the immediate pressure for transformation of the system but it did not address underlying structural issues or the continuing environmental deterioration. Other special interest groups, emboldened by the challenge of neo-Marxists, continued to press for

change. Their criticisms thus providing a fertile breeding ground for the jelling of the ecological economics paradigm in the 1970s.

3.2.2 Distributive Justice Theory

This body of thought blends branches of neo-Marxist analysis, Feminist Theory¹⁵¹ and Liberation Theology.¹⁵² It also incorporates an environmental analysis. Two general principles form the basis for the broad category of distributive justice theory: the first emphasizes an ethical or moral approach, often connected to Christian tradition. Liberation theology and Christian radicalism, particularly within the Roman Catholic Church has made an important contribution to this body of thought. Also associated is dependency theory which sees "poverty and hunger as the result of colonialism, neo-colonialism and gross inequalities of wealth, income and power."¹⁵³ Dependency theorists argue that poverty is due to: "(1) the existence of gross inequalities in wealth, income and power; (2) the unequal levels of national economic development that result in exploitation of the poorer countries through trade, investment, and foreign aid; and (3) the links between the governments of the western states and local regimes in the

¹⁵¹ See Brydon, L. & Chant, S., eds., Women in the Third World: gender issues in rural and urban areas, New Brunswick: Rutgers University, 1989. Rathgerber, Eva, M. *WID, WAD, GAD: Trends in research and practice*, Pearson Notes, Dalhousie University, Vol 4 No. 3 Summer 1989. Sen, Gita and Grown, Caren, Development, Crises and Alternative visions: Third World Women's Perspectives, Monthly Review Press, New York, 1987

¹⁵² See for instance Goulet Denis, A New Moral Order: Studies in development ethics and liberation theology, Maryknoll, N.Y., Orbis Books, 1974; Lopez Trujillo, Alfonso, Liberation or Revolution? an examination of the priest's role in the socioeconomic class struggle of Latin America, Huntington, Ind.: Our Sunday Visitor, 1977; Ruether, Rosemary Radford, Liberation Theology: Human Hope Confronts Christian History and American Power, N.Y.: Paulist Press, 1972; Bopane, Blase, Guerrillas of Peace: Liberation Theology and the Central American Revolution, Boston, Ma.: South End Press, 1985; Boff, Leonardo, Faith on the Edge: Religion and Marginalized Existence, San Francisco: Harper & Row, 1989; Boff, Leonardo, When Theology Listens to the Poor, San Francisco: Harper & Row, 1988.

¹⁵³ Warnock, John W., The Politics of Hunger, New York, Methuen Publications, 1987, p.51.

underdeveloped world."¹⁵⁴

Because the poor lack access to their own resources, they are unable to provide for themselves. Imported technological solutions from the industrialized nations will not solve the problems and their carriers, transnational corporations are a major source of the problem. These global corporations have compounded poverty by "(1) concentrating income and eliminating jobs; (2) controlling the use of arable land; and (3) through advertising, establishing ... tastes to suit their interests."¹⁵⁵ The present environmental crisis in agriculture, namely soil erosion, desertification, deforestation, and overgrazing, is seen as the "result of colonial patterns of resource exploitation and existing social relations of agricultural production."¹⁵⁶ Population growth in the South is not the cause of hunger, rather it is the result of persistent poverty and inequality, lack of education, health services, social security and employment.¹⁵⁷

In a similar vein, Lappe and Collins suggest that poverty and hunger is not a scarcity of food or land, rather it is a scarcity of democracy. Democratic structures provide avenues for input from people in areas that affect their well-being. Leadership is accountable to the needs of the majority.¹⁵⁸ Antidemocratic structures are those which concentrate power in a powerful minority and leave the majority of people with no voice at all. Lappe and

¹⁵⁴ Warnock, 1987, p. 52. See also George, Susan, How the Other Half Dies: the Real Reason for World Hunger, Markham, Ontario: Penguin Books Canada Ltd., 1976. Burbach, Roger & Flynn, Patricia, Agribusiness in the Americas, New York: Monthly Review Press, 1980. Lappe, Frances Moore and Collins, Joseph, World Hunger: 12 Myths, London: Earthscan Publications Ltd., 1986.

¹⁵⁵ Warnock, 1987, p. 52.

¹⁵⁶ Warnock, 1987, p. 52. See also Dinham, Barbara & Hines, Colin, Agribusiness in Africa, Trenton, N.J.: Africa World Press, 1984.

¹⁵⁷ Warnock, 1987, p. 49. See also Sen, Amartya, Poverty and Famine. An Essay on Entitlement and Deprivation, Oxford, Oxford University Press, 1981.

¹⁵⁸ Lappe & Collins, 1986, p. 3.

Collins identify four main levels of antidemocratic decision making that rob people of power and hence of control over their lives in the home, village, national and international arenas:

First, democracy is absent in the home. Women are responsible for growing at least half the world's food but in some areas, changes in land ownership and land use patterns have robbed them of the ability to control food production. These changes are the end result of a long process of colonialization, privatization and cash cropping. The monetarization of economies that previously engaged in subsistence production and the rapid integration of these societies into the global economy has resulted in changes in crop composition from crops for consumption to cash crops for export. This focus on export crops has "robbed" women of opportunities. Incentives are more likely to be given to men's cash crops whereas the impacts these policies have on women's lives are poorly understood.¹⁵⁹ Women usually grow food crops to satisfy their immediate needs (i.e. feeding their families) but often in the process, their strategic gender interests are left unmet.

Second, at the village level, who controls the land? Globally, the trend has been to concentrate ownership of land in fewer hands. As concentration of land occurs, due in part to the accumulation of capital, fewer people control greater areas of land and the number of landless is increasing globally. Unless their needs can be met with increased employment opportunities the majority of people have no control over the most basic resource - land to feed their families. Unfortunately, new opportunities have not been opened up to accommodate the displaced, rather these opportunities are shrinking because of advanced technological change.

¹⁵⁹ Lappe & Collins, 1986, p. 4.

Third, "at the national level, how are public resources allocated?" If governments are unaccountable to ordinary people, answering only to elites, the result is unfair allocation of credit, subsidies and other assistance. To protect this unfair distribution, the tendency is to increase military expenditures and address the resulting social unrest with brutality. On average, third world governments devote less than 10 percent of their budgets to agriculture and of that ten percent, the majority of funding is channelled through the elite who are seen as "engines of growth".

A fourth level at which democracy is scarce is that of the international arena of commerce and finance. "A handful of corporations dominate world trade in those commodities that are the lifeblood of third world economies."¹⁶⁰ Traders, processors and marketers reap the profits from the \$200 billion a year trade in agricultural products that is consumed in the industrial countries. Of the 15% of the consumer's dollar that is retained by the third world, only a tiny fraction returns to producers themselves.¹⁶¹ Further, prices are dictated by the global market and producers have little if any control over prices. Between 1969 and 1983 for instance, prices paid to African producers dropped 17 percent on average.¹⁶² Debt makes it difficult to break out of the cycle of control. While thousands die, food crops that would normally make up the diets of these unfortunates, are exported out of the area. As terms of trade decline, debts increase and as debt increases, options decline, both at the macro level and at the micro level.

As a result of these undemocratic economic processes, social problems accelerate. Insecurity increases, economic pressures result in the

¹⁶⁰ Lappe & Collins, 1986, p. 5.

¹⁶¹ George, 1982, p. 56.

¹⁶² Lappe & Collins, 1986, p. 136.

disintegration of family ties as men migrate in search of work, leaving families behind to be cared for by single mothers. A global system that grows and distributes food based on the profit motive does not bode well for the women who are increasingly left with the responsibility of caring for families while lacking adequate resources to do so. As a result, most of the hungry in the world are women and children and most of those who die each year from hunger are children.¹⁶³

Distributive justice theorists made an important contribution to the formulation of ecological economics. In part, they provided an early critique of modernization, identifying the unsustainability of a system that both produced and exacerbated conditions of poverty and squalor - the very conditions modernization proposed to do away with! Important linkages between environmental deterioration and inequitable social relations were discerned. Oppressive institutions were unmasked and policy was critiqued from the perspective of the marginalized. Inequitable social relations are a necessary precondition for the success of neo-liberalism but they are unhinging life support systems in the process. Neo-liberalism seeks to socialise costs and privatize benefits but the process for doing so accelerates the pace at which the Earth winds down entropically.¹⁶⁴ Therefore neo-liberalism is actually shrinking the ecological pie at a time when population growth is accelerating. Distributive justice theorists provide an alternative set of conceptual tools for modelling society in a way that is socially just and ecologically sustainable. The ecological economics paradigm synthesized these schools of thought in the search for another way.

The issue of population provides a fundamental dividing line for

¹⁶³ UNICEF, *State of the World's Children*, 1985, pp. 5.

¹⁶⁴ Section 4.2 discusses the concept of entropy.

theorists who aspire to the ecological economics paradigm. In the section on demography which follows, I will argue that following the lead of Malthus creates a contradiction in an otherwise conceptually coherent framework. In dealing with population pressures, the class analysis approach of distributive justice theory is a superior way of maintaining the intellectual integrity of the ecological economics paradigm.

3.3 Demographic Theories

In 1798, British economist, Thomas Malthus, sounded an alarm in his *Essay on the Principle of Population* in which he focused on the relationship between population and food supply.

Population, when unchecked, increases in a geometrical ratio. Subsistence increases only in an arithmetical ratio ... By that law of our nature which makes food necessary to the life of man, the effects of these two unequal powers must be kept equal.¹⁶⁵

His argument was based on two postulates. First, that food is necessary for human existence. Second, that the passion between the sexes is inevitable and will remain in its present state.¹⁶⁶ Malthus theorized that populations would grow geometrically, doubling every twenty-five years but would be checked by disease, war, famine and other calamities that would especially affect the poorer classes. Land, the fixed factor, would yield diminishing returns because food supplies would only expand arithmetically. As populations increased, land availability per person would decline resulting in the income of the working class being driven down to the subsistence level. Poor nutrition and starvation would stabilize the population at slightly above the subsistence level. Malthus contended that the only way for the poor to avoid "absolute poverty" was to engage in "moral restraint", and limit their

¹⁶⁵ Malthus, T., *An Essay on the Principle of Population*, 2nd ed., London: J. Johnson, 1803, p.9.

¹⁶⁶ Malthus, 1803, p. 8.

numbers.¹⁶⁷

By the end of the Eighteenth Century, wages were being supplemented to provide a minimum standard in some areas of Britain. Malthus felt this would only encourage population growth without doing anything to increase the production of food. If the natural checks on population were interfered with by human intervention, population growth might well outstrip food production. He was against the Poor Law which he saw as serving the interests of the rulers and the rich "under the garb of benevolence". He felt the Law would be "cordially received by the common people" because they would not anticipate its long-term consequences.

Malthus has been somewhat misrepresented in that although he was a conservative and defender of private property, he was against the production of luxury goods for the rich on the grounds that it was unproductive. "The present great inequality of property ... is neither necessary nor useful to society. On the contrary, it must certainly be considered as an evil."¹⁶⁸ He was a supporter of public investment of agriculture in order to provide food and employment and recognized that demand for fewer available labourers "would better the condition of the poor... a labourer might then support his wife and family as well by the labour of six hours as he could before by the labour of eight."¹⁶⁹

Contemporary demography theorists (neo-Malthusians) have built upon the framework provided by Malthus. Two basic assumptions underline the contemporary debate. First, food production in developing nations has

¹⁶⁷ See Todaro, pp. 217-221 for elaboration and critique of Malthus on this point. See also George, Susan & Paige, Nigel, Food for Beginners, Oxford: Writers and Readers Publishing, 1982, pp. 66-67.

¹⁶⁸ Malthus cited in George & Paige, 1982, p. 67.

¹⁶⁹ Malthus cited in George & Paige, 1982, p. 67.

lagged behind population growth thereby increasing hunger. This will create conditions enabling the rich to get richer while the poor will become poorer. Second, in developed economies such as the U.S., there is no food shortage but environmental deterioration and increased difficulty in obtaining resources to support their affluence as well as the inability of science to progress at a sufficiently rapid pace will make growth orthodoxy unsustainable. In the meantime, rising expectations in the South and aspirations to emulate Western lifestyles will put increasing pressures on global ecosystems.¹⁷⁰

This view advocates ecologically sound development and population control together with strong action to reverse the deterioration that has already taken place in our environment. Ehrlich reasoned that we can "stretch" the carrying capacity of earth by increasing food production and more equitable distribution of available food supply but such programs provide only "a stay of execution" unless accompanied by "determined and successful population control efforts." Technological solutions of enforced population control programs have been advocated including long-term injectable contraceptives, sterilization, financial incentives and penalties. Compulsory programs were advocated if voluntary ones failed. Critics of this body of thought point out that family planning programs aimed at controlling populations rather than enhancing the self-determination and well-being of women have failed.¹⁷¹ Cuba is a case in point. Redistribution

¹⁷⁰ Ehrlich, Dr. Paul R., *The Population Bomb* (Revised) New York: Balentine Books, 1971, p. 3; Hardin, Garrett, *The Tragedy of the Commons*, *Science*, Vol. 162, pp. 1243-8.

¹⁷¹ In Bangladesh, during the flood months of July to October, 1984, one quarter million sterilisations occurred, which was one quarter of all the sterilisations performed between 1972 and 1982. This was accomplished with incentives which looked more attractive as hunger increased. Devices such as Depo-Provera, considered too hazardous for use in the U.S, were used in Thailand. The device is suspected of causing cervical cancer. Lappe & Collins, 1986, pp. 25-26, See also George, 1976.

of land, food, old-age security, health care and education has resulted in declining birth rates even though Cuba had no public education for birth control.¹⁷²

Demography theorists argue the wealthy will have to change their way of living to minimize their impact on the globe's resources and environment. On the political front, the U.S. has cooperated in a "rich man's club" of nations which controlled the world trade situation to the detriment of the South and together with other "overdeveloped" countries, has grabbed the "lions's share" of the world's resources, taking more from the resource-starved citizens of developing nations than were returned to them.¹⁷³ In terms of science and technology, the South will be unable to develop because the supply of energy resources and industrial raw materials is inadequate for the task. Further, the environment simply cannot support the elevation of the South to the Western standard of living. Particularly disturbing is the unequal distribution of resources whereby the United States which comprises six percent of the world's population consumes as much as fifty percent of the world's raw materials. In fact, when one considers the impact of the North's population on the environment, the logical solution is to implement population control programs in the North. Demography theorists have proposed "de-development" of the North together with a shift in investment to the less developed countries but this advice has been met with open

¹⁷² Lappe & Collins, 1986, pp. 26-27. Sen, 1981. See also Sen and Grown, 1987 for a review of the population debate as it relates to feminist theory. It is noteworthy that birthrates for Canada's aboriginal population are doubling while birthrates for non-aboriginal residents are dropping. Poverty and social injustice for aboriginal peoples in Canada is increasing. News report on the meeting of the Native Physicians Association of Canada, Daily News, August 24, 1997, pp. 73.

¹⁷³ Ehrlich, 1971, p.23.

hostility from proponents of growth and "the consumer society".¹⁷⁴

The argument that population pressures cause hunger focuses on two basic issues: first, are population density and population growth the cause of hunger; and secondly, can slowing population growth end hunger? The suggestion is that there does not seem to be a cause and effect relationship. In China with only half the crop land per person that India has, "Indians suffer widespread and severe hunger while the Chinese do not although recent liberalization of their economy is increasing economic disparity. Hunger and rapid population growth are linked "where societies deny security and opportunity to the majority of their citizens - where adequate land, jobs, education, health care, and old-age security are beyond the reach of most people." In this context (poverty) it is a rational choice for poor people to have many children. It provides a defence against "enforced poverty: children provide labour and/or income. Bigger families also carry more "weight in community affairs." A "lottery mentality" develops in the hopes the next child will be the one to get a better job and support the family.¹⁷⁵

The population issue is a critical one for ecological economists. Malthus sounded the alarm on population growth but contemporary demography theorists seen unwilling to commit themselves to fundamental social change needed to effectively deal with the issue.¹⁷⁶ In this section, I have argued that social security systems are more likely to stabilize population growth than technological fixes. In my view, approaches of the neo-Marxist ilk have the potential to eradicate social and environmental inequities while neo-Malthusian approaches are ineffective in dealing with

¹⁷⁴ Warnock, 1987, pp. 31-32. See also WCED, 1987 proposals for a shift in the composition of growth.

¹⁷⁵ Lappe & Collins, 1986, pp. 20-21.

¹⁷⁶ Warnock, 1987, p. 53.

them. Neo-Marxist approaches compliment ecological economics objectives while neo-Malthusian approaches create fundamental contradictions.

The following section on steady state theory continues the discussion on population but puts greater emphasis on the physical environment and on the necessity of maintaining health life support systems. Steady state theory is a logical, reasoned, 'ethical science' approach seeking balance between the human economy and the biosphere.

3.4 Steady State Theory

A stationary human population and an attempt to stabilize the earth's capital stock are key to this body of thought. Consumption is sustainable to the degree that it can be continued without degrading natural capital stocks. Natural capital includes material resources such as petroleum, forests, soil and fish as well as process resources including waste assimilation, erosion and flood control, and photosynthesis. Because ecosystems function as intact systems, the structure and diversity of the systems is also considered to be an important component of natural capital. Natural capital is typically considered to include three categories: renewable, replenishable and non-renewable. Renewable natural capital includes living species and ecosystems and are self-producing and self-maintaining, using solar energy and photosynthesis. Replenishable natural capital are non-living but continuously restored, including for instance, stratospheric ozone and surface and ground water. Non-renewable forms of natural capital such as fossil fuels and minerals can be compared to inventories in that any use implies liquidating stock. Natural capital then, comprises "those components of the ecosphere, and the structural relationships among them, whose organizational integrity is essential for the continuous self-production and

self-regulation of the system itself". ... (T)he ecosphere is produced, in part, by the very organisms it comprises."¹⁷⁷

A steady-state economy means "maintaining all life at some desired, sufficient level of production; but at the same time there must be the lowest feasible flows of matter and energy".¹⁷⁸ A steady state economy can develop in the sense that it can be qualitatively improved upon but it cannot grow in the sense of quantitative physical throughput.¹⁷⁹ The view is grounded in systems theory¹⁸⁰ and is holistic in its approach, drawing on disciplines of economics, politics, sociology and ecology. Ophuls notes that everything in an ecosystem is interdependent. "(T)here are no linear relationships; every effect is also a cause in the web of natural interdependency ... interdependence is total."¹⁸¹ Interventions produce unintended consequences because changing one factor in the ecosystem causes the whole interdependent system to react.¹⁸² Ophuls argues that "energy is the currency of nature's economy"¹⁸³ and that a crisis of "ecological scarcity has dawned". His argument focuses on a few key factors such as energy "that are truly critical for the system as a whole". The goal of steady-state theory is frugality "which means neither poverty nor abundance" and calls for a new paradigm founded on "real physical flows (or thermodynamics) and moral principles instead of prices."¹⁸⁴

¹⁷⁷ Wackernagel, Mathis & Rees, William, Our Ecological Footprint: Reducing Human Impact on the Earth, Gabriola Island: New Society Publishers, 1996, p. 35.

¹⁷⁸ Warnock, 1987, p. 38.

¹⁷⁹ Daly, 1996, p. 31.

¹⁸⁰ Boulding, Kenneth, The World as a Total System, Beverly Hills, Ca.: Sage Publications, 1985.

¹⁸¹ Ophuls, 1977, p. 21.

¹⁸² Ophuls, 1977, p. 23.

¹⁸³ Ophuls, 1977, p. 41.

¹⁸⁴ Ophuls, 1977, p. 47, p. 182, pp. 241-242. See also Georgescu-Roegen, 1977, Boulding, 1985, Daly, 1977, 1986, 1989, 1990, 1991, 1996, Catton, 1980, Rees, 1992, 1996.

Steady state economists are still a minority in their profession but their numbers and influence are growing. They have confronted the neoclassical assumption that technological development makes the concept of carrying capacity meaningless when capacity to carry the human species is being considered. They have demonstrated the way in which feedback loops among population, consumption and environment are complex and multi-faceted and how the present growth-oriented system propelled by feedback loops cannot be sustained. Steady-state theorists argue that population growth combined with technological development and increasing consumption leads to an escalation of resource exploitation culminating in exhaustion and collapse of ecosystems.¹⁸⁵

The strength of steady state theory and thus, the kernel of insight it provides for ecological economics, is that the economy is a subsystem of the environment and subject to the limits imposed by the biosphere. Steady state theory provides a sound structural base upon which to build a new vision for organising society. The theory is predisposed to greater social justice. As such, it shows much promise for constructing a coherent vision for organising society in a way that maintains the health and integrity of the biosphere.

3.5 Concluding Remarks

The foregoing bodies of philosophical and economic theory provide examples of the intellectual roots of the ecological economics paradigm.¹⁸⁶ Native world views remind us that we are subservient to rather than

¹⁸⁵ Boothroyd, 1992, p. 142.

¹⁸⁶ I have chosen the foregoing bodies of philosophical and economic theory because they are illustrative of concepts which I feel are important to understanding the ecological economics paradigm. Other theorists have proposed alternative bodies of thought that offer equally valid insights.

dominant over Nature. It inspires us to have *power with* rather than *power over*. These concepts provide a powerful spiritual guiding system that give us a moral compass in dealing with Earth and her species.

Marx contributes insight into the root causes of poverty and social injustices. His vision also reflects *power with* rather than *power over* in that he seeks to free the poor from the bondage of a fatally flawed system. Malthus and the demography theorists who followed, provide provocative insights into the concept of carrying capacity; however, class analysis theorists have brought balance to this view from the North by pointing out that much of the carrying capacity of the world is appropriated by those who have *power over* and that only by sharing *power with* will we solve the problems of pollution, poverty and population. Steady state theorists follow this general theme by reminding us that people and the environment they are embedded within must find a harmonious balance if we are all to survive and this view as well, is based on *power with*.

Taken together these bodies of thought yield fruitful conceptual tools for the construction of ecological economics theory that is intellectually cohesive and which speaks to the experience of the vast majority human kind.

Chapter Four: The Ecological Economics Paradigm

4.0 Introduction

In the previous chapter, we reviewed some of the bodies of philosophical and economic theory that provide ecological economics with a vision. In this chapter, we will look at some of the concepts that give the paradigm form. The chapter is divided into five sections. The first provides a brief comparative analysis of conventional economics with ecological

economics. The remainder of the chapter deals with four concepts that provide a framework from which ecological economics can be operationalized. General systems theory (GST) forms the backbone of ecological economics. GST facilitates the multidisciplinary discourse that is typical of ecological economics. It promotes a view that is holistic, multidimensional and integrative. The Second Law of Thermodynamics (the entropy law) tells us that matter and energy are continuously being degraded to an unusable state. Energy and material flows through the human economy are unidirectional and irreversible rather than circular.¹⁸⁷

Ashby's Law of Requisite Variety tells us that the manager of a system must be more complex than the system being managed. Since nature's complexity is unfathomable, the whole science of environmental management is laced with folly. All of the technical innovations humans can muster will be inadequate to the task of managing nature because humans and the most complex computer system humans can build will still be less complex than the natural systems they seek to manage. Since we don't know what we don't know, it makes sense to manage our activities with deference to nature's systems. The final concept we will deal with is carrying capacity and appropriated carrying capacity. Carrying capacity tells us how many humans a given area can support and appropriated carrying capacity tells us how much we appropriate from other regions to support our lifestyles. This concept is useful in helping humans to identify how big our economy is relative to limits imposed by the ecosphere. It is particularly useful in determining the size of the share a nation or an individual is using

¹⁸⁷ For a discussion on the circular flow model, see Blomqvist, Wonnacott, Wonnacott, An Introduction to Macroeconomics, Toronto: McGraw-Hill Ryerson Limited, 1983, pp. 34, 120-21, 147-49. For a critical view of circular flow model Daly, 1996, pp. 33-34,47.

and how much is left for others. This concept is built on Wackersnagel and Rees "ecological footprint".¹⁸⁸

4.1 Ecological Economics: An Overview of the Paradigm

Ecological economics is a relatively new field which has grown out of the need to provide an analytical framework to adequately deal with environment and development linkages. It is grounded in systems theory and is multi-disciplinary in its approach with the main focus on the interface between ecology and economics. The field of thought has arisen primarily out of concern for the long term unsustainability of our present development path. Our chances of achieving sustainable development (and geopolitical stability) will be enhanced through a better understanding of the multifaceted relationship of humans with each other and the biophysical world. What began as a critical analysis of development has evolved to become a new paradigm.

Ecology for the purpose of this study will be regarded in its broadest sense as "human ecology" embracing the totality of relationships between organisms (including humans) and their physical and living environments. It is a branch of science concerned with the flows of energy and material resources through ecosystems and of the competitive and cooperative mechanisms that have evolved for the allocation of these resources among different species.

The root of the prefix "eco" derives from the Greek word oikos, meaning "household". Ecology then, could logically be considered to be "the science or study of the household of the human race in its totality."¹⁸⁹ It is interesting to note the original meaning of "economics" derives from the

¹⁸⁸ Wackersnagel & Rees, 1996.

¹⁸⁹ Ophuls, 1977, p.5.

same Greek term and meant "a science or art of managing a house or household", while economy was "the management of a group, community, or establishment with a view to ensuring its maintenance or productiveness."¹⁹⁰ It is unfortunate that Newtonian analytical thinking resulted in the atomizing of these complementary fields to the point where they have come to be regarded as competitive rather than complementary and where economics which is in reality a sub-system of ecology, focused almost exclusively on "the money economy - treating this sub-system as though it were autonomous"¹⁹¹ and independent of the forces of nature.

Conventional economics focuses on the transformation of natural resources into goods and services and with distribution and consumption of these goods in human society. Neoclassical economics, grounded as it is in the methods and concepts of Newtonian analytic mechanics, lacks "any representation of the materials, energy sources, physical structures, and time dependent processes basic to an ecological approach". Its analytic models are "based on reductionist deterministic assumptions about resources, people, firms and technology that have little resemblance to the natural world."¹⁹²

Conventional economic theory treats capital and inputs to production as "inherently productive, ignoring both their physical connectedness to the ecosphere (backward linkages) and the effects of over-exploitation on the functional properties of ecosystems."¹⁹³ Production from this vantage point is really consumption: consumption of the natural environment.¹⁹⁴ Rees identifies two aspects of this "theoretical dichotomy" which are essential to

¹⁹⁰ Ophuls, 1977, p. 5.

¹⁹¹ Ophuls, 1977, p.6.

¹⁹² Christiansen, 1991, cited in Rees, 1994.

¹⁹³ Rees, 1994, p.2.

¹⁹⁴ Rees, 1994. Daly, 1996.

understanding relationships between population and environment. "The ecological perspective sees the human economy as an inextricably integrated, completely contained, and wholly dependent sub-set of the ecosphere. By contrast, economic models often represent the economy as essentially separate from and independent of "the environment." This is essentially the difference between conventional and ecological economics.

Costanza considers ecological economics as a synthesis of a number of different disciplines. These include "conventional" economics, environmental economics, resource economics and "conventional" ecology. The following figure illustrates one aspect of the relationship between conventional approaches and ecological economics, based on the domains of the different subdisciplines.

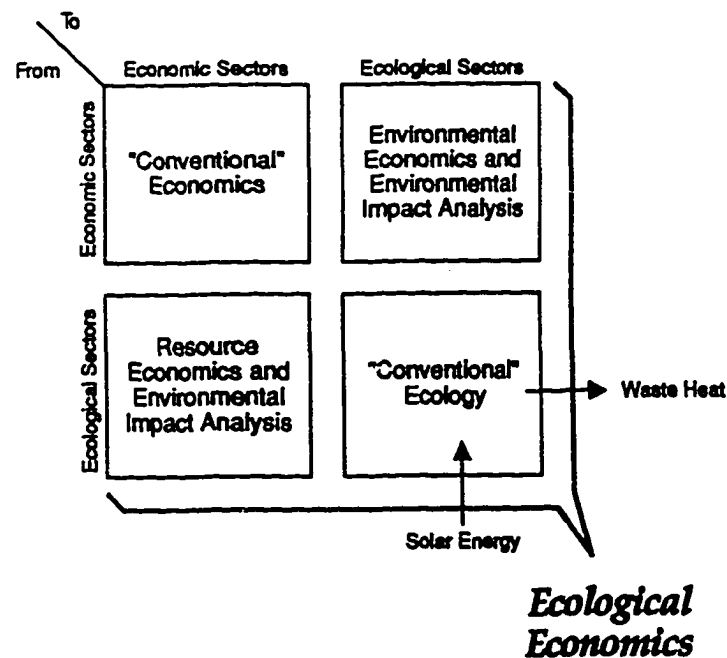


Figure 2: The domains of conventional economics, conventional ecology, environmental and resource economics, and ecological economics.
Source: Costanza, 1992, p. 107.

Figure 2 illustrates the way in which ecological economics "encompasses and transcends" disciplinary boundaries. The domain of conventional economics, represented by the upper left box, illustrates the interactions of economic sectors such as mining, manufacturing and households with each other. Resource economics and environmental impact analysis, represented by the lower left box, illustrates the inputs from ecological sectors to economic sectors, or the use of renewable and nonrenewable natural resources by the economy. The domain of conventional ecology (lower right box) represents the interactions of ecosystems and their components with one another. Environmental economics and environmental impact analysis represents the use of economic products by ecological sectors. Unwanted by-products of production and wastes from consumption are dealt with in this domain: "pollution and its mitigation, prevention, and mediation."¹⁹⁵ The figure illustrates that ecological economics transcends and subsumes these domains, each are part of a larger whole.¹⁹⁶

¹⁹⁵ Costanza, Robert, *The Ecological Economics of Sustainability: Investing in Natural Capital, in Population, Technology, and Lifestyle*, Washington: Island Press, 1992, p.107.

¹⁹⁶ The information in this paragraph is from Costanza, 1992, pp.106-107.

The following table compares conventional economics and conventional ecology with ecological economics.

	"Conventional" Economics	"Conventional" Ecology	Ecological Economics
<i>Basic World View</i>	<i>Mechanistic, Static, Atomistic</i>	<i>Evolutionary, Atomistic</i>	<i>Dynamic, Systems, Evolutionary</i>
	Individual taxes and preferences are taken as given and the dominant force. The resource base is viewed as essentially limitless due to technical progress and infinite substitutability.	Evolutionary acting at the generic level is viewed as the dominant force. The resource base is limited. Humans are just another species but are rarely studied.	Human preferences, understanding, technology, and organization co-evolve to reflect broad ecological opportunities and constraints. Humans are responsible for understanding their role in the larger system and managing it for sustainability.
<i>Time Frame</i>	<i>Short</i> 50 years maximum; 1-4 years.	<i>Multi scale</i> Days to eons, but time scales often define noncommunicating sub-disciplines	<i>Multi scale</i> Days to eons, multi scale synthesis.
<i>Space Frame</i>	<i>Local to International</i> Framework invariant at increasing spatial scale; basic units change from individuals to firms to countries.	<i>Local to Regional</i> Most research has focused on relatively small research sites in single ecosystems, but larger scales becoming more important recently.	<i>Local to Global</i> Hierarchy of scales.
<i>Species Frame</i>	<i>Humans Only</i>	<i>Nonhumans Only</i>	<i>Whole Ecosystem, Including Humans</i>
	Plants and only rarely included for contributory value.	Attempts to find "pristine" ecosystems untouched by humans.	Acknowledges interconnectedness between humans and rest of nature.
<i>Primary Macro Goal</i>	<i>Growth of National Economy</i>	<i>Survival of Species</i>	<i>Sustainability of Ecological Economic System</i>

<i>Primary Micro Goal</i>	<i>Maximum Profits (Firms) Maximum Utility (Individuals)</i>	<i>Maximum Reproductive Success</i>	<i>Must be Adjusted to Reflect System Goals</i>
	All Agents following micro goals leads to macro goal being fulfilled. External costs and benefits given lip service but usually ignored.	All agents following micro goals leads to macro goals being fulfilled.	Social organization and cultural institutions at higher levels of the space/time hierarchy ameliorate myopic pursuit of micro goals at lower levels, and vice versa.
<i>Assumptions About Technical Progress Academic Stance</i>	<i>Very Optimistic</i>	<i>Pessimistic or No Opinion</i>	<i>Prudently Skeptical</i>
	<i>Disciplinary</i> Monistic, focus on mathematical tools.	<i>Disciplinary</i> More pluralistic than economics, but still focused on tools and techniques. Few rewards for comprehensive, integrative work.	<i>Transdisciplinary</i> Pluralistic, focus on problems.

Source: Costanza, 1992¹⁹⁷

Figure 2 and Table 1 take a broad perspective on environment and economy relationships. They do not deal with social dynamics of population environment linkages. The remainder of this chapter deals with concepts that provide a framework for understanding structural aspects of ecological economics.

4.1 General Systems Theory

Some have said that the general systems movement was born out of the failures of science, but it would be more accurate to say that the general systems approach is needed because science has been such a success. Science and technology have colonized the planet, and nothing in our lives is untouched. In this changing, they have revealed a complexity with which they are not prepared to deal. The general systems movement has taken up the task of helping scientists to unravel complexity, technologists to master it, and others to learn to live with it.¹⁹⁸

Systems theory, or cybernetics is the science of communication and control theory which evolved in the post WWII period from conceptual work in the fields of mathematics, organizational theory and biology. The field

¹⁹⁷ Costanza, 1992, p. 112.

¹⁹⁸ Weinberg, Gerald M., *An Introduction to General Systems Thinking*, NY: Wiley, 1975, p. 3.

provides us with a way of understanding natural and social systems and the way they interrelate. Systems theory concepts such as “equilibrium, entropy, environment, boundary, feedback, stability, self-organization, evolution, hierarchy, recursion, redundancy, and variety have significant heuristic power.”¹⁹⁹

4.1.1 Hard Systems

By the mid 1950s the field split into two streams of thought: hard systems and soft systems approaches. The goal of hard systems or operations research was the achievement of predictive certainty through quantitative analysis. Originally applied to the study of the efficiency of organizations engaged in military operation, it expanded to include highly complex programs requiring rigid controls such as space explorations. Civilian uses include engineered approaches to management, for example, corporations, government and communications systems.²⁰⁰ This approach is top-down, hierarchical and controls are centralized. It seeks to understand how to achieve control of systems. It is useful for analyzing mechanical contrivances but the results are less satisfactory when applied to social circumstances. Critics argue that this branch of systems theory “is deficient because its explanations of crisis in social systems is restricted to viewing crises as manifestations of inadequate capacity to adapt to environmental change.” They see “crises as also reflecting internal structural incompatibilities (or contradictions, as Marxists put it), particularly the incompatibility between the drive for full democracy and the structures established by elites to maintain control in their interest.”²⁰¹ For the purposes of our analysis, the

¹⁹⁹ Boothroyd, 1994, p. 141.

²⁰⁰ Boothroyd, 1994.

²⁰¹ Boothroyd, 1994, p. 141.

modernization paradigm can be viewed as a hard systems approach which attempts to engineer society; to mold it to an ideal, for instance “the American Dream”, which is realized when a society engages in mass consumption. Rather than defer to nature, the hard systems approach seeks to bend nature to our will through technological innovation.

4.1.2 General Systems

The second branch, soft systems or general systems theory sought to understand the means of survival and the evolution of living (or “open”) systems, and their analogues. General systems theory was developed by von Bertalanffy and his collaborators to promulgate the tenets of systems thinking. The goal was to develop broad concepts applicable and transferable to all disciplines, societies, organizations and governments, and to show that conceptual models fruitful in one field were transferable to other fields. They sought to adopt a flexible method of scientific inquiry that would not “restrict the scientist to one set of relationships as his object of investigation.”²⁰²

Lazlo observes:

A systems science can look at a cell or an atom as a system, or it can look at the organ, the organism, the family, the community, the nation, the economy, and the ecology as systems, and it can view even the biosphere as such. A system in one perspective is a subsystem in another. But the systems view always treats systems as integrated wholes of their subsidiary components and never as the mechanistic aggregates of parts in isolable causal relations.”²⁰³

Ludwig von Bertalanffy (1968) argued that the methods used in the analysis and explanation of physical sciences were inappropriate to organic laws. His “Theory of Open Systems” postulated that the characteristic state of a living cell is that it is an open system because it exchanges matter and energy with its environment. Theorists such as

²⁰² Laszlo, 1974, p. 14.

²⁰³ Laszlo, 1974, pp. 14, 15.

Ervin Laszlo, Stafford Beer see this stream as being self-steering "in its fullest democratic, emancipatory, and responsible sense."²⁰⁴

4.1.3 Systems Theory Relevance for Economic Modelling

In applying GST to societal problems of over-consumption, ecological degradation, social disintegration, etc., theorists have surmized that decision-making processes must be decentralized and democratized. Experience has demonstrated that resources are managed most effectively by those who depend upon them for their own use.²⁰⁵ Similarly, the negative feedback accompanying pollution means communities can be the first line of defence against environmental degradation. Unfortunately, communities usually have little say in this regard and governing bodies are often impervious to their pleas for intervention²⁰⁶. On the other hand, it is important to keep in mind that tribalism and inequitable social relations at the community level has its own set of tyrannies that can arise in decentralization. Co-management of resources therefore provides a hopeful balance. For example, communities have the capacity to monitor resource use to ensure they are not depleted and it is in their long term strategic interests to do so. Even so, under conditions of extreme poverty and lack of alternative opportunities, people may liquidate their resource stock to meet their short term practical interests so it is important to identify this possible constraint to responsible self-management.

Under prevailing conditions, the state acts as agent for TNCs and builds infrastructure with public funds to extract resources for production processes

²⁰⁴ Boothroyd, 1994, p. 142.

²⁰⁵ Weber, Peter. *Reviving Coral Reefs*, in Brown, et al, Eds., *State of the World 1993*, p. 57.

²⁰⁶ See for example *The Report of the Partnership on Sustainable Coastal Communities and Marine Ecosystems in Newfoundland and Labrador*, St. John's, Nf.: Newfoundland and Labrador Round Table on the Environment and the Economy, October, 1995.

from communities, often contrary to the wishes of those communities. There is no compelling evidence that the communities involved benefit to the same degree industry does. Often the community gets work for a period of time, but when the resource runs out the company moves on, leaving a now dependent community and sometimes a badly polluted environment behind. The system prevails and all else must conform to that system. GST tells us we must manage our activities to comply with the needs of the ecosystems they are embedded within. The logical application of this approach is for communities to have meaningful input into decision making.

Some ecological problems are detected at the global level and then only with the assistance of sophisticated technologies. For example, NASA has played a significant role in monitoring the condition of stratospheric ozone. In this way, a global communication system (satellite technology) gathers important information which is then distributed widely to allow for corrective action (system feedback). The potential to develop an effective co-management system is evident. The GST perspective tells us that we have to change the behaviour which is negatively impacting the ozone layer. The hard systems approach will view ozone depletion as a bottleneck to progress. Rather than take corrective action, this approach will try to maintain the status quo particularly if it will have a negative financial impact. Responses may include the development of a technological solution to mend the ozone hole or biotechnology to develop vegetation which can withstand intense radiation from the sun.

As previously indicated, global climate change is underway. Scientists are still uncertain of what the impacts of that change will be. The

precautionary principle has been recommended as the preferred strategy for action because it will be less damaging to err on the side of caution. If we take no direct action and climate change has significant detrimental impacts, we will not have the resources or the time to make necessary changes in our behaviour. On the other hand, if we take action now, we will avert some of the more deleterious impacts of climate change and still have a bit of time to change should more dramatic response be deemed necessary.

GST promotes the precautionary principle because this perspective views the world in terms of systems and subsystems, all of which impact on each other in often unpredictable ways. The idea is to promote the health and vigor of all systems by trying to understand the way they behave and by conducting human activities in ways that try to work with the natural tendencies of the systems they are embedded within.

The modernization paradigm promotes hard systems thinking. This perspective views negative feedback from Nature as bottlenecks to growth of the economic system. These bottlenecks can be removed through human ingenuity and technological innovation. Nature, after all is primitive and modern man is gaining on Nature at an increasingly rapid pace. Before long, the secrets of the universe will be unveiled and we will be in a position to dominate Nature and subvert her to our will. The thinking of the Hoover Institute on climate change is instructive in this regard. In a working paper entitled *Global Warming: A Boon to Humans and other Animals*, Thomas Gale Moore, Senior Fellow surmises that:

Society might wish to help natural systems and various species adapt to warmer temperatures (or cooler, should that occur). ... The optimal way to deal with potential climate change is not to strive to prevent it, a useless activity in any case, but to promote growth and prosperity so that people will have the resources to deal with any shift. It is much easier for a rich country such as the United States to adapt to any long term shift in weather than it is for poor

countries (in that poorer countries) lack the resources to aid their flora and fauna in adapting. The best preventive would be a rise in incomes, which would diminish their dependence on agriculture. Higher earnings would provide them with resources to adjust. ... William Cline of the Institute for International Economics (estimates it) would amount to roughly \$900 billion annually (to cut back on carbon emissions from fossil fuels). ... These resources would be better spent on promoting investment and growth in the poorer countries of the world. ... Global change is inevitable; warmer is better; richer is healthier.

In other words, if we have enough money we can adapt nature to suit our needs. With enough money, we can deal with any form of pollution or environmental deterioration we create. Greater economic growth (more money) is the panacea to poverty in developing nations even though the evidence thus far suggests economic growth has created conditions of greater poverty for these same people. Hard systems promotes centralization of control and consolidation of capital resulting in increased marginalization of the poor. And, if we find that climate change produces negative rather than positive results for our economic well-being, growth today will give us the resources in the future to deal with the problem.

Considering the stakes, this "wait and see" attitude is self-serving and irresponsible. Some of the technologies developed to respond to environmental problems actually create a different set of problems. As previously indicated, the newer generation of chemicals called hydrofluorocarbons (HFCs) marketed as "ozone-friendly" are not ozone depleting but they contribute to the growing problem of global warming.²⁰⁷ Even when we know that chemicals are dangerous to the environment, economic interests prevail. Methyl bromide is scheduled to be banned in the US by the year 2001 but challenges to this proposed phase out are coming from the agricultural sector. This heel dragging can be stretched out indefinitely. The US government gives the sense of movement by placing

²⁰⁷ Montzka, S.A. et al , 1996. See also Our Future's Up in the Air, Greenpeace Canada Action.

the chemical on a list of chemicals to be banned, and business interests bargain on a date using societal interests such as food security as a bargaining chip. Indeed one of the issues is food security but security is more likely to be gained by the banning of the chemical than by its continued use.

4.2 Second Law of Thermodynamics

More than fifty years ago, Frederick Soddy postulated that the first and second laws of thermodynamics must be the starting point of economics.²⁰⁸ His insights went unnoticed until they were revisited some thirty-five years later by one of the pioneers of ecological economic thought, Nicholas Georgescu-Roegen who proposed:

(T)hat the economic process is entropic in its physical coordinates; that wealth is an open system, a structure maintained in the midst of a throughput that begins with the depletion of low-entropy matter/energy and ends with the return of an equal quantity of polluting high-entropy matter/energy back to the environment; that in contrast to the reversibility of mechanical phenomena, entropic phenomena are characterized by irreversibility, a fatal weakness of the mechanistic epistemology of standard economics; and that there is a critical asymmetry between our two sources of low entropy. ... that solar energy ... is nearly infinite in total amount but strictly limited in its rate of flow to earth, whereas terrestrial low entropy (concentrated minerals in the earth's crust) is strictly limited in total amount, but can be used up at a rate of our own choosing.²⁰⁹

Thermodynamic laws tell us that "entropy is the real basis of economic scarcity."²¹⁰ The first law of thermodynamics (conservation of matter/energy) reveals that matter and energy are indestructible. The second law (the entropy law) tells us that the quality of matter/energy that gives rise to usefulness is used up in economic throughput and is not recyclable.²¹¹ Entropy increases in an isolated system. Entropy is an index of energetic usefulness. Low-entropy energy or matter is readily available or usable and

²⁰⁸ Daly, 1996, p. 185.

²⁰⁹ Nicholas Georgescu-Roegen cited in Daly, 1996, p. 185.

²¹⁰ Ophuls, 1977, p. 112. See also Daly, 1996, pp. 29-30.

²¹¹ Daly, 1996, p. 195.

high-entropy energy and matter is less useful and less available.

Neoclassical theory sees the economy as self-sustaining and self-regulating with complete reversibility as the general rule. However, economic throughput is continuously degrading energy and matter in a “unidirectional and irreversible” process because it takes in low entropy matter/energy and gives back high entropy matter/energy.²¹² The earth is entropically winding down naturally and economic advance is accelerating the process.²¹³ The transformation of energy and matter into useful products for consumption occurs at great thermodynamic costs, yet none of these costs are measured in global GNP indicators. Daly observes:

A country could exhaust its mines, cut down its forests, erode its topsoil, and exploit its wildlife and fisheries to extinction, and measured income would rise steadily as these assets disappeared. Putting the entropic flow at the center of analysis should force us to pay attention to the natural capital stocks that yield this vital flow.

Ophuls points out that energy is the currency of nature’s economy. Conventional economics takes energy into account indirectly “via the monetary cost of energy production and use. It is therefore in conflict with the basic laws governing our physical existence.”²¹⁴ Thermodynamic law tell us that our “economic “production” is actually consumption and in this simple reality lies the root of our environmental crisis.”²¹⁵

Thermodynamic laws tell us that using technological wizardry to run life support systems is extraordinarily expensive whereas nature does it in a much more cost-effective way. When we factor in all of the costs of resource depletion and use of sink capacity, our economy is extraordinarily inefficient. Energy sources such as solar and wind which are considered to be enormously

²¹² Daly, 1996, p. 193.

²¹³Daly, 1996, p. 29.

²¹⁴ Ophuls, 1977, p. 112.

²¹⁵ Rees, 1994, p. 4.

expensive become a real bargain using full cost accounting techniques. No doubt if TNCs could find a way to centralize control of renewable energy sources, they would be less inclined to fret about its costs. These sources of energy are decentralized and difficult to monopolize, which make them attractive from an ecological economics perspective. With full cost accounting, human labour would be “thermodynamically cheaper than capital or other factors of production”²¹⁶ and materials like wood and steel use less energy and capital and create less pollution than aluminium.²¹⁷

Ophuls observes that ecological economics promotes a system that:

would aim at careful husbandry of resources, dependence on natural flows and processes, decentralization, more labor-intensive production, and a combination of ultrasophisticated technology with some of the energy-saving methods that sustained our forefathers.²¹⁸

The most effective way to bring such a system into being is to acknowledge the second law of thermodynamics as being a key concept to sustainable development. Only when we have conceptually bound the economy to the ecosphere, will we begin to realize the vast untapped potential for development (qualitative) this approach yields and the immense opportunity for realization of human potential it engenders.

4.3 Ashby’s Law of Requisite Variety: Managing Complexity

A general systems perspective focuses on relationships and situations, rather than atomistic facts and events resulting in a more general and approximate understanding. Since we are surrounded in nature by “connected complexity”, knowledge of connected complexity is preferred to knowledge of “atomized simplicity”. This can best be accomplished by viewing things as systems “with properties and structures of their own”. A

²¹⁶ Ophuls, 1977, p. 113.

²¹⁷ Ophuls, 1977, p. 113.

²¹⁸ Ophuls, 1977, p. 112.

general systems view allows us to compare systems, define their relationships within larger systems, and establish a general context in order that we may better understand our purpose and place in the world.²¹⁹

Inadequate complexity management is seen by general systems theorists as the problem underlying our other social problems.²²⁰ Technological innovation, exponential population growth and the globalization of communications and markets has resulted in rapid and highly complex change. Individuals are enjoying "more technological power to communicate, transport and consume, while being freed, even encouraged, to use that power for personal ends regardless of the social consequences."²²¹ Whereas traditional societies depended upon elaborate social systems to manage relatively simple lifestyles "now societies increasingly rely on two simple institutions, the coercive state and competitive market, to manage much more individually choice-rich lives" resulting in "diminished social control over mutually destructive behaviour."²²²

Ashby's Law of Requisite Variety tells us that "the internal variety (diversity, complexity) of a managing system must correspond to the variety of the managed system if the manager is to maintain control and avoid instability."²²³ As Beer points out, "We cannot regulate our interaction with any aspect of reality that our model of reality does not include because we cannot by definition be conscious of it."²²⁴ At a practical level, Ashby's Law

²¹⁹ Laszlo, 1974, pp.13-14.

²²⁰ Boothroyd, 1994, p.142.

²²¹ Boothroyd, 1994, p.143.

²²² Boothroyd, 1994, p.143.

²²³ Rees, 1994, p. 5.

²²⁴ Beer cited in Rees, 1994, p.5.

provides a sound reason for decentralization of decision making.²²⁵ Even with the most sophisticated computer system, it is impossible to process all of the information that is needed at the center to make decisions which affect those at the periphery. This necessitates a practice of decentralized, participatory decision-making if instability is to be avoided.

Laszlo takes this idea a step further with his "ecofeedback" system for information processing.

Ecofeedback coupled with a flexible response mechanism represents dynamic self-regulation in a multi-echelon system. Systems of this kind are composed of echelons of subsystems which are themselves goal-setting decision units, coordinated at the next higher level ... Goals are not defined inflexibly from the top and imposed on the lower levels. The goal-setting of the whole system results from the interaction of subsystem goals inasmuch as they can be coordinated in a pattern that maintains the entire system. All echelons enter as decisions-making units within a network of coordination that enable the system as a whole to efficiently pursue an integrated set of objectives.²²⁶

Put into practice, this process infers participatory research and decision making processes, respect for indigenous knowledge and co-management of resources. A balance is needed whereby state policies blend with community-based management in a way that will allow conservation of resources to come under the control of a group of users who depend on it to meet their own needs. Urban structures will be required to handle a global population that is expected to reach eight to ten billion people. It will be a challenge indeed to manage rural/urban relationships democratically. Allocation of resources through the marketplace enforced by a coercive state as currently practised will result in ever greater extremes of wealth and poverty and

²²⁵ Kevin Phillips provides sobering testimony to the fact that centralized control which consolidates political and economic power leads to atrophy and decline. Phillips, K., Arrogant Capital: Washington, Wall Street, and the frustration of American Politics, Little, Brown & Company (Canada) Limited, 1994.

²²⁶ Laszlo, 1974, p. 128.

escalated social tension. Current systems used for governing social relationships are about as complex as a caveman with a club.

Complexity in an ecosystem ensures stability. Monocrop cultures for example, tend to be less resistant and less hardy; subsequently they can easily fall prey to disease or weather disturbances. High yield variety seeds (HYV) promoted by green revolution technology, do not have the same level of local adaptability that traditional seed supplies do. For instance, short stem varieties of rice do poorly in years of flooding while long stem varieties are less hardy in dry spells. Farmers traditionally minimized their risks by using several varieties so that weather conditions had less influence on yields. In Indonesia, traditional farmers typically farmed up to 600 varieties and in Bangladesh, 1200 varieties could be found.²²⁷ This gene base is lost with HYVs and seed banks are controlled by industrial nations making farmers increasingly dependent on external sources for seed supply. Economic imperatives seeking to minimize inputs and maximize outputs over as short a timeframe as possible leads to standardization and simplification processes which do not reflect the needs of biodiversity. Soil becomes devitalized as nature subsidizes short term investment cycles.

In contrast, ecological economics promotes complexity which ensures “stability and continuity of the whole system, and the survival of the whole ensures the survival of the parts.”²²⁸ For instance, by respecting and acting on indigenous knowledge, ecological economics promotes the continuation of diversity in the gene base. Farmers use their own seed which has been developed through hundreds if not thousands of years of experimentation. The seed has been developed to withstand insect infestations, disease and

²²⁷ Perelman, pp. 155.

²²⁸ Ophuls, pp. 28.

fluctuations in weather. Other inputs in rice fields might include fish which eat malaria-carrying mosquitos in addition to providing a valuable source of protein. In some areas, the use of water buffalo make more sense than tractors needing fossil fuels and costly repairs.²²⁹ Water buffalo fertilize the fields, work up the soil, provide milk and curd supplies for the family. Buffalo herding provide a valuable source of economic activity for local villagers. The socio-economic and ecological links in such a system have been developed over millennia and have provided community residents with sustainable livelihoods. Ecological economics promotes the maintenance of traditional systems. Increases in efficiencies are obtained by making qualitative improvements in the systems, rather than displacing them with an irrelevant modernization model.

4.4 Carrying Capacity/Appropriated Carrying Capacity

Carrying capacity is a systems theory concept which demonstrates the relationship between populations and their biophysical environment. Carrying capacity can be defined as the capacity of an ecosystem to support healthy organisms while maintaining its productivity, adaptability, and capacity for renewal. The concept is used in determining biophysical constraints to economic activity and hence, the relationship between economic performance and resource base. Rees suggests "For human beings, carrying capacity can be interpreted as the maximum rate of resource consumption and waste discharge that can be sustained indefinitely in a given region without progressively impairing the functional integrity and productivity of relevant ecosystems."²³⁰ Catton points out that humans

²²⁹ The energy yield of modern agriculture is negative. The loss is even higher in tropical zones. Ophuls, 1977, p. 42-43.

²³⁰ Rees, 1994, p.11.

make the concept of carrying capacity meaningless because they are able to override regulatory mechanisms restricting population growth by appropriating the allocation of biomass for other species and by mining accumulated resources in the ecosystem.²³¹

One of the major shortcomings of the concept is that it usually does not have a global perspective; another is that it does not reveal how resources are shared. Vitousek et al's study cited in Section 2.3.1 looks at carrying capacity from a global perspective. This global systems approach is important in terms of understanding how large the total human economy is relative to the global ecosystem it is embedded within. We know that pollution does not respect national boundaries and we know that pollution generated at the local level can be detected at the global level (for example ozone shield rupture).

Vitousek et al's approach reminds us that the Earth is a single system and that we share a common destiny. It is useful in helping us to understand the aggregate demand of humans on the ecosphere. By looking at the Earth as a single system, Vitousek et al identifies system limits. In other words, they see how big the system can be. From there they estimate how big the human subsystem is, (in this case, 40% of the total system). Using feedback from the environment (stratospheric ozone shield rupture, climate change, soil depletion, fisheries decline, etc) they determine we should not grow any larger because ecosystems are showing signs of stress or collapse.²³²

Whereas carrying capacity looks at what should be, appropriated carrying capacity (ACC) looks at what is. ACC of a group of people can be

²³¹ Catton, William R., Jr., Overshoot: the Ecological Basis of Revolutionary Change. University of Illinois: Illini Books, 1980, p. 15.

²³² A critique of systems approaches is that the attempt to deal with the whole can eradicate the particular. Carrying capacity is simply a tool to measure our size as the case outlined above demonstrates. This does not mean that the particularities of place and culture are overlooked. In fact, much of the feedback needed to gauge our size, for instance, will be input from a local level.

defined as the total land needed using current technology to continuously provide all the resources they currently consume and to absorb all the waste they currently discharge for an indefinite period of time. This land might currently exist, "might be borrowed from the past (eg. fossil energy), or even from the future (eg. contamination, plant growth reduction through increased UV radiation, soil degradation)."²³³

ACC is people based rather than territorial which makes it easier to hold people responsible for their own consumption patterns.²³⁴ It enhances the individual's awareness of their dependency on nature and provides a tool that can help estimate biophysical constraints. It also provides a method of analyzing economic activities from a biophysical perspective rather than a monetary one. More importantly, it gives a region or nation a means by which to determine political control over its own productivity as well as the amount of bioproductivity they import from abroad. Gonzague Pillet estimated that if Switzerland relied upon its own renewable resources, it could supply about 18 percent of its current consumption level, indicating that they currently live about 5.5 times above their solar potential.²³⁵ At this rate, only about one fifth of Switzerland's population is living within the means of their physical environment - the remainder of their capacity is imported from elsewhere.²³⁶

Because appropriated carrying capacity is really imported carrying capacity, populations are able to grow beyond their local carrying capacity without knowing and without repercussions. Trade and technology allows regions to exceed biological limits. Rees and Wackersnagel have developed

²³³ Wackersnagel, 1994, p.35.

²³⁴ Wackersnagel, 1994, p.35.

²³⁵ Pillet (1991) cited in Wackersnagel, 1994, p. 42.

²³⁶ Rees, 1994, p. 14.

an illuminating technique for measuring human impact on the Earth using the concept of an ecological footprint. To get a sense of the size of the ecological footprint of a city or urban area one could imagine a glass hemisphere being placed over the area that allowed light to enter but prevented material things from entering or exiting. The health and integrity of the human system encapsulated within the dome would be dependent upon the resources and waste sinks trapped inside the hemisphere. Before long, it would become apparent that the carrying capacity contained within the dome was insufficient to support the population enclosed as the population began to starve as their food supply was used up and to suffocate as their air supply became strained by pollutants. Now, imagine that the urban area encapsulated in the glass dome were surrounded by an ecologically diverse landscape in proportional representation to their actual abundance on the Earth, and that an adequate supply of fossil energy sufficient to support current levels of consumption using existing technology were available. If the dome were elastic, how large would it swell to support the social and economic activities currently carried on by the citizens of the area at its current material standard of living?²³⁷

Using the ecological footprint measurement, Wackersnagel and Rees estimate that the average Canadian uses nearly 4.3 hectares of land to support current consumption patterns. There are presently 1.5 hectares of land available per person on a global per capita basis and if we assume a global population of ten billion by 2040, the ecologically productive land base will have shrunk to .9 hectares per person assuming no further soil degradation.²³⁸ Using this methodology, it is estimated that “the ecological

²³⁷ Wackersnagel & Rees, 1996, pp. 9-12.

²³⁸ Wackersnagel & Rees, 1996, p. 13.

demands of average citizens in rich countries exceed *per capita* supply by a factor of three.”²³⁹ If everyone were to adopt the North American life style, we would need two additional planets to supply the resources, absorb the wastes and maintain life-support systems.²⁴⁰

The concept of an ecological footprint poses a serious challenge to the five to tenfold increase in global economic output the Brundtland Commission proposes to alleviate poverty. From a spatial perspective, this level of throughput growth is highly questionable. From a temporal perspective, it carries highly charged ethical concerns. The modernization paradigm has in effect appropriated carrying capacity from the future. Our growth ethos encourages us to liquidate resources at an ever expanding, ever more rapid rate until the stock either crashes or the entire ecosystem is put at risk. While governments pay lip service to ensuring our children inherit a healthy stock of natural resources and sink capacity, their policies nonetheless promote intense quantitative growth with little attention to the long term effects of that growth.

The unequal distribution of economic and political power vested in the North lacks the kinds of checks and balances that are necessary for long term sustainability. Global climate change poses risks for small island states and low-lying coastal areas. Poorer regions lack the economic power to undertake adaptation strategies that their richer counterparts can and they lack the political clout needed to enforce changes in technological processes which exacerbate climate change. So we have a situation in which the North has used up the sink capacity of other nations and put those nations at great risk;

²³⁹ Wackersnagel & Rees, 1996, p. 14. These estimates are low because they represent minimum land area needed for the basic energy and material flows required by the economy. In addition, they do not look at pollution beyond carbon dioxide.

²⁴⁰ Wackersnagel & Rees, 1996, p. 15.

risk which is extraordinarily expensive to deal with particularly in areas which presently lack the ability to provide even basic needs. The lifestyle of the North appropriates life sustenance systems from the poor and from the future.

4.5 Concluding Remarks

Ecological economics conceptualizes the economy as a subsystem of the ecosphere, thus demonstrating limits of the natural resource regeneration and sink capacity of earth. General systems theory forms the backbone of ecological economics thinking and is essential to understanding the way in which natural and social processes work and interrelate. The approach encourages a holistic analysis rather than an atomistic way of looking at living systems and their analogues. By looking at systems from a global perspective, we can get a better sense of the size of the human economy relative to its potential for growth. This is particularly important in view of the globalization of the economy because trade makes the concept of carrying capacity of the environment meaningless. A more insightful way of looking at economy/environment relationships is yielded by the concept of appropriated carrying capacity. This perspective provides us with a way to measure our ecological footprint and determine if we are living a sustainable lifestyle.

Ecological economics is grounded in the biophysical realities of the world. The second law of thermodynamics illuminates the ties which bind economy to environment. Rapid throughput growth in this physical sense is now becoming antieconomic, or negative because environmental costs are increasing faster than the production benefits that accrue, thus "making us

poorer, not richer".²⁴¹ Conventional economics simply ignores this biophysical reality. Economic logic tells us that we should invest in the limiting factor and that factor is increasingly being identified as the natural environment.

Encouraging steps are being taken in some countries, particularly on the energy front. Mongolian nomads, who constitute nearly half of the country's population, are using small solar energy modules for cooking, heating and lighting needs. With an average of 300 sunny days a year, the cells readily provide power that was previously supplied by wood, animal dung and candles. In Peru, a micro-hydro project was built with assistance from UK-based development agency, Intermediate Technology. Nearly all of the villagers were involved in building the project, so that the technological know-how for managing the system has been transferred. Power costs to villagers have dropped by as much as 90%. In China, windpower is beginning to play a major role in servicing remote areas. With 130,000 small and medium-sized wind-driven generators and four major windpower stations already installed, windpower will play a major role in China's energy budget. Windpower requires less investment and is more flexible in operation than grid systems.²⁴² Each of these energy projects is small to medium scale - important from an ecological economics perspective. They are decentralized, use local renewable resources, are inexpensive, flexible and easy to use. Their impact on the environment is negligible, they are inexpensive to operate and they help people to be more productive in terms of meeting their needs.

²⁴¹ Daly, 1996, p.11.

²⁴² New Internationalist, October 1996.

Chapter Five: Rounding Out the Vision

5.0 Introduction

Chapter Four provided an overview of some of the structural supports of ecological economics. We looked at systems theory, thermodynamics, managing complexity and carrying capacity concepts. These concepts share a common vision - power with. The view is egalitarian and holistic: all parts of the Earth and its inhabitants are necessary for survival. Neo-liberalism may be able to maintain itself for a time by subsidizing its supremacy with gross inequity and bigger clubs to beat back opponents but this view lacks connection with the physical world, and that world is now beginning to crumble beneath our feet. In Chapter Five, we will listen to some of the voices that are rarely heard but which offer an important perspective to contemplate. These include notions of value systems in research, spirituality and a feminist perspective.

5.1 The Challenge to Scientific Imperialism

While we may not be conscious of it, the concepts that shape our lenses for viewing reality are laden with values. For example, hard systems theory which underlies the modernization paradigm seeks to be 'objective' in order that everyone is seen to be treated 'equally'. It deals almost exclusively with empirical-analytical data that is quantifiable, in fact, "the harder the data, the more scientific the results, and the higher the status."²⁴³ Scientific, technical knowledge becomes the only legitimate kind of knowledge and people's everyday experience is demoted to 'mere anecdotal' evidence, leaving people feeling alienated and dehumanized. Experts increasingly make decisions

²⁴³ Patton, 1975:12, cited in Maquire, Patricia, *Different Lenses for Viewing Reality, Doing Participatory Research: A feminist approach*, 1987, pp. 26-27.

which shape the lives of the poor and the middle class.²⁴⁴ Freire notes:

But too often, the ordinary person is crushed, diminished, converted into a spectator, manoeuvred by myths which powerful social forces have created... The greatest tragedy of modern man is his domination by the force of these myths.²⁴⁵

This 'domination by myths' leaves people feeling impotent in terms of understanding the phenomena which guides their lives, and in terms of changing their circumstance. People become preoccupied with daily survival, unaware of the systemic causes of their powerlessness.²⁴⁶

They are excluded from the increasingly more specialized research industry, barred by requirements of the "scientific method", and intimidating concepts and jargon, money, time, skills, and experience.²⁴⁷

The general or soft systems approach which ecological economics builds upon, challenges the "political aspects of supposedly value-free dominant paradigm research", because social science knowledge often works in the "interest of dominant groups for the maintenance of the status quo."²⁴⁸ Decentralizing control so that people can participate in decisions that affect their future is fundamental to democratic life; it is enabling and empowering. As Maguire points out, "there is a political nature to all we do; all our work has implications for the distribution of power in society." Given this assumption, the systems which dominate our lives, systems which are defined as objective, neutral and value free, are indeed laden with values. The notion that everyone is "equal before the law" does not fit our experience; it is a myth but our objections are dismissed as unfounded because the system is 'objective and apolitical'. We are left chasing shadows.

²⁴⁴ Maquire, 1987, p. 44.

²⁴⁵ Friere cited in Maquire, 1987, p. 44.

²⁴⁶ Tandon cited in Maquire, 1987, p. 45.

²⁴⁷ Maguire, 1987, p. 43.

²⁴⁸ Maguire, 1987, p. 28.

General systems theory challenges this premise. Shared power is central to this view. Knowledge generation is acquired through participatory research so that knowledge becomes democratized and people share in policy making and control of development. Modern scientific research is complemented by indigenous knowledge acquired through hundreds or even thousands of years of research.

Dependency theorists such as Frank and Furtado point out that dominant-dependency relationships result from inequities in international trade and investment between technically advanced and developing nations. They identified the “inability to accumulate the capital necessary for self-directed and controlled development” resulting from these relationships.²⁴⁹ International development assistance was referred to as “assistencialism”, attacking the symptoms rather than the root “causes of poverty by ignoring dependency relationships.”²⁵⁰

Schemes aimed at integrating marginal people into development leave intact the very economic, political, and social structures which support the maintenance of poverty. ... Rather than promote ordinary and oppressed people’s increased participation in unaltered systems of domination, the critics call for radical transformation of systems and relationships based on domination.”²⁵¹

If we are to make headway in developing sustainability, we will have to confront the issue of scientific imperialism. If the voices of ordinary people are to be heard, the airwaves cannot be dominated by indifferent power structures. We have had enough experience with development economics to know that people must take control of their destinies if they are to survive. Development cannot be done on behalf of people, rather it is an ongoing process in which people realize their own full potential. This does

²⁴⁹ Maguire, 1987, p. 39.

²⁵⁰ Freire and Gutierrez cited in Maguire, 1987, p. 39.

²⁵¹ Maguire, 1987, p.39.

not mean that we should not have researchers or scientists; rather it means that we must be cognizant of whose interests their work serves.

5.2 Spiritual Dimensions of Ecological Economics

An increasing number of writers and thinkers see the root cause of our current ecological crisis to be the separation of science and religion.²⁵² The split has resulted in the privatization of religion and the use of science as a "violent employee of technology".²⁵³ This could not have been accomplished in the first place without the Occidental religions embracing a "fall/redemption model of spirituality" which is a dualistic, patriarchal model beginning its theology with sin and original sin and generally ending with redemption.²⁵⁴ Because the Western world has embraced the Occidental vision as its guiding light, this perspective is transferred just as surely as the technology it is embodied within. "Because the fall/redemption tradition considers all nature "fallen" and does not seek God in nature but inside the individual soul, it is not only silent toward science but hostile to it."²⁵⁵ This world view is hostile toward creation in general, and women in particular, viewing women as the vessel through which sin enters the world. Fox proposes that we return to a "creation-centered" spiritual tradition in order that we may remarry science and religion and in order that there can be "spiritual points of convergence among the worlds religions".²⁵⁶ This view

²⁵² Berry, Thomas, The Dream of the Earth, San Francisco: Sierra Club, 1988. Charlene Spretnak, The Politics of Women's Spirituality, Garden City, N.Y.: Anchor Books, 1982. Swimme, Brian, The Hidden Heart of the Cosmos: Humanity and the New Story, Maryknoll, N.Y., Orbis Books, 1996. Fox, Matthew, Original Blessing, Sante Fe, Bear & Company, Inc., 1983. Starhawk, The Spiral Dance: A Rebirth of the Ancient Religion of the Great Goddess, San Francisco: Harper, 1979. Adams, Carol, Ecofeminism and the Sacred, N.Y.: Continuum, 1993.

²⁵³ Fox, 1983, p. 10.

²⁵⁴ Fox, 1983, p. 11.

²⁵⁵ Fox, 1983, p. 11.

²⁵⁶ General systems theory offers a way for the different religious groups to "speak" to each other without the hostility such dialogue has incurred historically.

sees creation as a blessing rather than a sin and woman as the vessel from which the miracle of life spills forth. Creation-centered spirituality is a non-hierarchical celebration of life in all its manifestations - it is liberating, joyful and filled with hope.²⁵⁷

Creation spirituality is more in tune with the thinking of ecological economics than is the fall/redemption tradition. Perhaps the most important aspect of the ecological economics vision insofar as its utility for a model is concerned, is that nature has intrinsic value which extends far beyond utility for humans. On this point, ecological economics has closer connections with the native world view than it has with Occidental thinking.

Dominant branches of Occidental religion²⁵⁸ conceptualize the world in terms of hierarchies in which humans occupy the dominant post. This anthropocentric view makes Westerners "cosmically lonely".²⁵⁹ In terms of our relationship with the natural environment, conventional economics envisages a manager/client relationship in which humans manage and subdue planet Earth to maximize our comfort and wellbeing. In this hierarchical relationship, humans dominate and control and the planet (and all her resources) submit.

Our technological wizardry has given us a sense of omnipotence which leads us to increasingly violent and sometimes craven means of exploitation. Berry points to our ability to alter nature by turning chickens into "ever more effective egg-laying machines, cows into milk-making machines, [and] steers into meat-making contrivances, ... according to human preference" rather

²⁵⁷Fox's critique is an oversimplified presentation of the relationship of religion and nature. It is used here to give a "general sense" of the relationship.

²⁵⁸ The focus is on Western thinking in terms of a critique because much of the environmental damage we are confronted with today grew out of the Western model of industrialization and growth economics which dominates the globe today.

²⁵⁹ Fox, 1983, Afterword.

than the "inner spontaneities of these living beings as determined by their genetic coding, a coding shaped through some billions of years of experiment and natural selection."²⁶⁰

Our failure to recognize ourselves as one of many species means that we are blinded to the ecological impacts of many of our actions. For example, we are just recently becoming aware of environmental refugees - people who are fleeing degraded landscapes or environmental disasters. We have been relatively insensitive to the disruption in human lives these disasters play. Since we are so anthropocentric, we do not even notice that birds and other wildlife are also environmental refugees, fleeing clear cuts or mining camps; or that draggers disrupt and destroy the breeding and feeding grounds for fish and other ocean life; or that ozone depletion is negatively impacting the supply of plankton which is at the bottom of the food chain in the ocean. Even though we recognize that species are becoming extinct at an unprecedented rate²⁶¹, we seem oblivious to the possibility that we may suffer a similar fate. Recognition of our place in the realm of nature is essential to our very survival and this can be accomplished most effectively through spiritual rebirth.

Berry states that we need a "creative resolution of our present antagonisms." He refers to *creative resolution* rather than *peace* "in deference to the violent aspects of the cosmological process".

(T)here is a general feeling of fullness bordering on decay that is easily associated with peace. Neither violence nor peace in this sense is in accord with the creative transformations through which the more splendid achievements of the universe have taken place. ... The ideal situation for any individual or any culture is not exactly "bovine placidity." (It is, rather,) "the highest state of tension that the organism can bear creatively."

²⁶⁰ Berry, 1988, p. 203.

²⁶¹ E. O. Wilson from Harvard indicates that we are losing ten thousand species each year and that the pace of loss is increasing. Cited in Berry, 1988, p. 206-7.

This suggests a lively debate is in order - one that challenges the vision shaping the sphere of the human "mindscape".²⁶² The evolving spirituality would conceivably "perceive the natural world as the primary revelation, of the divine, as primary scripture, as the primary mode of numinous presence."²⁶³ Father Berry's words echo those of Eastman (born Ohiyesa of the Santee Sioux) in his depiction of the indigenous world view.

There were no temples or shrines among us save those of nature. ... the Indian...would deem it sacrilege to build a house for [God/"Great Mystery"] who may be met face to face in the mysterious, shadowy aisles of the primeval forest, or on the sunlit bosom of virgin prairies, upon dizzy spires and pinnacles of naked rock, and yonder in the jewelled vault of the night sky! ... [God or "Great Mystery"] needs no lesser cathedral!²⁶⁴

5.3 A Feminist Perspective

The feminization of poverty and the realization that development initiatives impact men and women differently has resulted in increased awareness of the need to look at gender as a special theme. There has been a recent profusion of literature which imparts a feminist perspective on development issues.²⁶⁵ Some of the most recognized names include Vandana Shiva, Irene Dankelman, Joan Davidson, Rosi Braidotti, Bina Agarwal, Caroline Moser, Noeleen Heyzer, Gita Sen, Caren Grown, Irene Dankelman, Caren Levy, Bina Agarwal, Maxine Molyneux, and Marilyn Waring. Key themes deal with the elevation of the status of women and the fall of the hierarchical patriarchal system which is often seen to be the root

²⁶² Berry suggests the four components of earth - landsphere, watersphere, airsphere and lifesphere are being irreversibly altered in their composition and functioning by the more recent sphere, the mindsphere. Berry, 1988, p. 44.

²⁶³ Berry, 1988, p. 105.

²⁶⁴ Eastman, 1911, pp. 1-2.

²⁶⁵ See for instance van den Homberg, Heleen, Gender Environment and Development: A guide to the literature, Amsterdam: Institute for Development Research, 1993. Moser, Caroline O. N., Gender Planning and Development: Theory, Practice & Training, London: Routledge, 1993.

cause of much of the injustice and inequity in the world today. Three guiding principles seen as necessary for saving the environment and bring about sustainable development have been set forth by the *World Women's Congress for a Healthy Planet*, (an NGO response to UNCED's Agenda 21). These include: global equity, resource ethics and empowerment of women.²⁶⁶

Some of these themes have religious undertones with powerful symbolic measures of the value of woman in which, for example, women are viewed as an extension of "Mother Earth". The female is seen as birthing, creating, nurturing, the vessel from which the fruits of the Earth spill forth. Berry sees the matricentric world view as espousing some of the most creative aspects of our civilization, aspects that unfortunately were "considered destructive and unacceptable within the religious-humanist traditions of Western society". He suggests the wisdom incorporated in matriarchal traditions of alchemy, astrology, the pagan nature rituals and the hermetic teachings "need reconsideration for the contributions they make to our understanding of the universe, its deeper modes of function, and the proper role of the human", wisdom that transcends rational processes reaching into the "archetypal world of the unconscious".²⁶⁷

Our biblical traditions tell us that women are the "instrument for the entry of evil into the world and for the breakdown in human-divine relations." In a "derivative sense", women can function in the public life of the sacred community through their association with men. Biologically, they are a "consequence of some lack of vigor in the male component of the conception process, since in its full energy conception should produce a male

²⁶⁶ van den Homberg, 1993, pp. 27-28.

²⁶⁷ Berry, 1988, p. 145.

child. In this context the whole of feminine existence becomes profoundly diminished as a mode of personal being."²⁶⁸

This "lack of worth" of the feminine gender spills over into all aspects of life. Women reproduce the labour force in their "spare time" and their paid work is undervalued vis a vis that of their male counterparts. As relates to ecological economics, it is important to point out that women have not thrived under the growth model; in fact, their fate is becoming more desperate as more aspects of society become commoditized and privatized. With women holding title to a scant one percent of the world's land,²⁶⁹ many rely increasingly on the global commons for their livelihoods. But as we have seen above, appropriation of the global commons whether by default or by design, is squeezing them out.

5.3.1 The Impact of Modernization on Women

We have come to recognize that development impacts men and women differently. Agriculture is one of the sectors where the differences are quite stark. Ancient technology co-exists with modern technology creating devastating disparities. Agribusiness tends to concentrate land and capital, primarily in the hands of wealthy farmers and it goes without saying that women are usually not wealthy farmers. As waged labour is replaced with mechanization, rural surplus labour often migrates to urban areas. Generally women are left behind to work on subsistence plots and care for families. Declining terms of trade pushes them further into poverty and there is considerable evidence that the poorer farmers are, the more coercively they

²⁶⁸ Berry, 1988 p. 150.

²⁶⁹ Dankelman, Irene and Davidson, Joan, Women and Environment in the Third World: Alliance for the Future, London: Earthscan Publications Ltd., 1988., p. 9.

are engaged in selling food²⁷⁰ dispelling the economist's notion that subsistence farmers sell that portion of their product (surplus) after their own needs are met.

Green Revolution technology consisting of hybrid seed, fertilizers, pesticides and irrigation is geared to agribusiness and has had a devastating effect on women and the environment. Soil fertility is taxed by intensive fertiliser use and irrigation can cause waterlogging, a reduction of essential minerals and salinization because of increased evaporation. Water tables have fallen in some areas because of increased irrigation and intensive fertiliser use, and local water supplies become contaminated, increasing the burden of water collection on women and children. Pesticide poisonings increase,²⁷¹ adding to the burden of women in the home as they tend the ill, and creating more resistant strains of pests in addition to weakening the metabolic balance in plants.

As crops for consumption are pushed to more fragile lands, desertification and erosion escalate. Depleted energy supplies lead to the use of manure and crop residues for cooking and other energy needs resulting in a further loss of soil nutrients and decreased land fertility. It is estimated that the annual burning of 400 millions tonnes of dung reduces world grain harvest by over 14 million tonnes.²⁷² As soil quality declines, desertification and deforestation intensifies so that women have to walk farther to collect

²⁷⁰ Whitehead, Ann, The Political Economy of Hunger, New York: Oxford University Press, 1990, p.435.

²⁷¹ WHO estimates one million cases of pesticide poisonings occur annually. Many non-target species such as livestock, fish, birds and bees are also poisoned which impacts the livelihoods of those who depend upon these species. Dankelman & Davidson, 1988, pp. 10-11 As women are primary care givers in the home, when health is negatively impacted, their burden is increased.

²⁷² Dankelman & Davidson, 1988, pp. 8.

fuelwood and other forest products.²⁷³

Agribusiness leads to the clearing of large tracts of land and the loss of forest products traditionally used by women declines as well. Forests provide food, fodder, building materials, household items (baskets, eating implements, furniture, etc.) and garden materials such as windbreaks, shade trees and fences.²⁷⁴ Trees provide rural women with a substantial portion of their families' diets. In most rural societies, women have accumulated significant knowledge about the foods and other household products that trees can supply. For instance, a survey in Sierra Leone has revealed that women could name thirty-one products that they gathered or made from the nearby bush while men named only eight.²⁷⁵ In addition to the utility trees provide for the household economy, it should be remembered they also are climate and water regulators, soil stabilizers, air cleaners and providers of food and shelter for numerous other species. These services are part of the global commons upon which women are particularly dependent.

The growth model deprives women of the use of land for sustenance, safe water and other life-supporting uses of the natural environment. The problem goes beyond being environmental. It reflects the orientation of the neoclassical model towards the commodification of all aspects of the natural environment and failure to understand the real nature of household economies and women's worth.

Earth as the "Mother" is violated and subdued and the metaphor is re-enacted in male/female relations. This manifests in the assumption of women as secondary citizens and nature as passive, a view that is embedded

²⁷³ Restoring the Balance, Women and Forest Resources, FAO, United Nations, pp.4-10.

²⁷⁴ Restoring the Balance, p.5.

²⁷⁵ Restoring the Balance, p.5.

in conventional economic theory. The result is the creation of inequities between men and women as well as the destruction of nature.²⁷⁶

5.4 Concluding Remarks

In this chapter we have briefly explored some of the implicit dimensions of ecological economics. These areas are usually not explored in the literature of ecological economics; however, it is necessary to focus on them in terms of rounding out our vision of the paradigm. Scientific imperialism must be challenged because it colors the lens through which we view reality. Participatory research and participatory development promotes equity and balance in the international system and confronts imperialist tendencies embedded in the modernization paradigm. By having many people participate in the study of the causes and possible solutions to their oppression, social cohesion is strengthened. People begin to exercise their voices and to assert their rights to greater control of their destinies. As such, it is fair to say the approach emulates the vision of *power with* and challenges the notion of *power over* embodied in scientific imperialism. Researchers working with community groups can play an important role in demystifying scientific jargon so that people are in a position to engage in informed consent as well as informed rejection of initiatives that affect their lives.²⁷⁷

The Occidental world view has been normalised within mainstream

²⁷⁶Robb, Carol S. and Casebolt, Carl J., ed., Covenant for a New Creation: Ethics, Religion, and Public Policy, Berkley, California: Orbis Books, 1991, pp. 1 - 2. It is noteworthy that virtually every economic system in the world has oppressed women. This makes the interaction of class, gender and ethnicity or culture an extremely complicated one, and one that is best being confronted by women scholars. Rosa Braidotti offers an excellent overview of the scholarship of these women attempting to respect the integrity of cultures, yet highlight the oppressions within virtually all of them. Braidotti, Rosi (et al) Women, environment and sustainable development: towards a theoretical synthesis. London: Zed Books, 1993.

²⁷⁷Orton, David, Informed Consent or Informed Rejection: An Unmasking Theory. The paper was submitted to the journal *Philosophy and Social Action*, published in India for a special issue on "theory and social action". 1990

Western thinking. Spiritual leaders who base their philosophies on ecological principles advocate remarriage of science and religion. The conceptualization of the universe as a machine metaphor which occurred during the industrial revolution has resulted in a unilinear mechanistic world view. Bacon's words on the goal of science illustrates the point: "force nature to serve you and make her your slave".²⁷⁸ This perspective is an insult to indigenous worldviews based on the Earth as Mother metaphor. The pioneers of ecological economics are increasingly coming to view the need for spiritual rebirth as a necessary precondition to achieving sustainability.²⁷⁹

The connection between the subjugation of Earth and the subjugation of women has not gone unnoticed. These connections must be explored to develop solutions which serve to emancipate nature and women. Many of the environmental problems experienced in the world are caused by processes at the national and international level but their impact is felt most forcefully at the local level by poor women who are dependent on natural resources to maintain their livelihoods.²⁸⁰ This focus on women is not intended to deny the poverty that men suffer. Rather the purpose is to highlight the growing body of evidence showing that women are made more vulnerable under the growth model.

Ecological economics has thus far been deficient in its treatment of the issue of gender and development. Probably the closest it comes to the treatment of gender is in relation to population control. Here, most writers propose technological solutions based on neo-Malthusian views. However,

²⁷⁸ Cited in van den Homberg, 1993, p. 48.

²⁷⁹ See for instance Daly, 1996.

²⁸⁰ van den Homberg, 1993, pp. 47 - 55.

the evidence weighs most heavily in favor of the neo-Marxist perspective which demonstrates that women have fewer children when they have access to adequate education, health care and old age security benefits. The structural supports of ecological economics, particularly general systems theory, imply greater equity for women. Nonetheless, it is not sufficient to imply equity. Gender is an issue that cuts across culture, economy, ethnicity and class.²⁸¹ Gender must be made explicit to ensure it receives the recognition it deserves.

Chapter Six: Conclusion: Who are the Utopians?

6.1 Limitless Growth as a Naive World View

Throughout this thesis, several issues have been identified that the modernization paradigm with its growth ethos is ill-prepared and perhaps even incapable of dealing with, in the absence of a fundamental rethinking of some of its dominant assumptions. Brundtland was able to achieve global consensus on the need to address issues of poverty and environmental deterioration in a single framework of analysis; but the achievement of this consensus came at great cost. Neoliberalism has co-opted the Commission's recommendations and vested interests now use many of the principles set forth to further their own agenda rather than to address issues of environmental deterioration and poverty as was originally intended. The Brundtland report was fundamentally flawed in any regard because it is biophysically impossible to achieve the five to tenfold increase in world industrial output called for. Brundtland offered a kinder gentler approach to development reminiscent of the basic needs practices of the 1970s but it was still only tinkering with a fatally flawed system. Growth, the primary

²⁸¹ While the paradigm I have described concentrates primarily on class, there is a need for further work to sufficiently incorporate gender and other factors.

prescription for the world's ills, is problematic on a number of fronts.

First and foremost is that growth models fail to recognize that the economy is a subsystem of the natural environment and that the health of the economy is totally dependent upon the health of the ecosphere.

Proponents of the growth economy have advanced the theory of economic imperialism in which the economic subsystem swallows the ecological whole system by internalizing externalities. However, as Daly has pointed out, the frequency with which we appeal to externalities, particularly when "the very capacity of the earth to support life" is treated as an externality, serves notice that it is "past time to change the basic framework of our thinking so that we can treat these critical issues internally and centrally."²⁸²

Over the past quarter century, researchers have gathered mounting evidence of ecosystem disruption. Brown's *State of the World* reports are particularly well documented. In the 1996 edition, Brown illustrates we have moved from consuming nature's interest to spending her capital stock.

"Evidence of the damage to the earth's ecological infrastructure takes the form of collapsing fisheries, falling water tables, shrinking forests, eroding soils, dying lakes, crop-withering heat waves, and disappearing species."²⁸³

Over the past fifty years, thresholds of sustainable yields have been surpassed in an increasing number of countries. Thirteen of the world's fifteen leading fisheries are in decline. Water use is exceeding the sustainable yield of aquifers in much of the world. The drop in water tables is measured in centimeters per year in some places, in others it is calibrated in meters per year. Major rivers are pumped dry before reaching the ocean and conflicts over shared water systems is on the rise. Sustainable yield of forest products

²⁸² Daly, 1996, p. 45.

²⁸³ Brown, 1996, p. 4.

is at risk and soil erosion is a major threat in some areas, exacerbating poverty and hunger.²⁸⁴

Some threshold crossings are global in scope. Ozone shield rupture, climate change and oceanic fisheries are all part of the global commons and any compromise in the health of these systems are felt by all the world's inhabitants. Other threshold crossings are local, but their effects are felt globally in an integrated world economy.²⁸⁵ The practice of allocating water to the highest and best use as a governing principle results in shifts from agriculture to urban and industrial use. As farmers lose access to water and as urban and industrial development takes over irrigated land, grain imports rise. A country importing a ton of grain, in effect imports 1,000 tons of water. "Grain has become the currency with which governments balance their water accounts."²⁸⁶ The loss of crop land to industrialization in Indonesia can affect food prices in other areas. Aquifer depletion in Texas impacts world grain harvest and the erosion of soil in Algeria intensifies shortages in worldwide grain stocks.²⁸⁷ World carryover of grain stocks have declined for the past three consecutive years, reaching the lowest level on record in 1996 with an estimated supply of 49 days of consumption. In 1994, China moved from being a net grain exporter of 8 million tons to a net importer of 16 million tons, aggravating global stock declines and price increases.²⁸⁸

Brown observes:

These and other trends suggest that the history of the next few decades will be defined by food, specifically by rising prices of both oceanic and landbased food products, by a spreading politics of food scarcity, and by an increasingly intense

²⁸⁴ Brown, 1996, pp. 4 - 6.

²⁸⁵ Brown, 1996, p. 6.

²⁸⁶ Brown, 1996, p.6.

²⁸⁷ Brown, 1996, p.6.

²⁸⁸ Brown, 1996, p.8.

struggle to achieve a sustainable balance between food and people.”²⁸⁹

The evidence is compelling that the Earth is incapable of sustaining our current pace of resource consumption and waste generation. In view of the circumstances, one could conclude that we are in a state of denial in that the sense of urgency appropriate to the situation is missing, or at least not in evidence. Alternatively, one could conclude that the dominant lens for viewing reality is blind to its fundamental prejudice of limitless growth.

Rather than abandon the treatise of limitless growth, conventional economic models are laced with naive optimism on the ability of technology to stave off disaster. However, technology is proving to be a Pandora’s box. Our experience with HFCs as a substitute for CFCs suggests that the cure may be as bad as if not worse than the disease. Similarly, Green Revolution technology has peaked and the destruction that it has wrought, environmentally, socially and economically will continue to be felt for decades, if not eons to come.²⁹⁰ Biotechnology has been proposed as the new liberator of food insecurity but the pronouncement may be premature. Pessimists are claiming that the introduction of exotics including biotechnology have become one of the “Mindless horsemen of the environmental apocalypse.”²⁹¹ Evidence is mounting that genetic and ecological barriers of the natural world are crumbling, creating new forms of unsustainability that are working their way “back up the chain of economic consequence, (to) bite the hand that wields it.”²⁹²

²⁸⁹ Brown, 1996, p.7.

²⁹⁰ Soil is created at a rate of about one ton per hectare per year. Erosion rates from wind and water range from 5 to 30 tons per hectare per year depending on the area. Gardner, 1996, p. 83.

²⁹¹ Bright, Chris, *Understanding the Threat of Bioinvasions*, in Brown, et al, eds., State of the World 1996, New York: World Watch Institute, 1996., p.96.

²⁹² Bright, 1996, p. 96.

Accompanying the technological stratagem is the express faith in the assumption that factors of production are highly substitutable. However, this is a specious argument because man-made capital is made productive by a complementary supply of natural capital. Sawmills depend upon forests, fishing boats upon fish and refineries upon petroleum reserves.²⁹³ Daly argues convincingly that “when we come to substitution across the roles of transforming agency and material undergoing transformation (efficient cause and material cause), the possibilities of substitution become very limited, and the characteristic of complementarity is dominant.” Current policies that maximize the productivity and accumulation of man-made capital serve only to escalate natural capital erosion and intensify antieconomic behaviour.²⁹⁴ Liquidating the stocks of natural capital to maintain the value of man-made capital becomes a challenge to the basic premise of sustainability.²⁹⁵

Ecological economists have advanced the view that exponential growth has allowed us to slip imperceptibly from a relatively empty world into a full world. Assuming a constant rate of growth, the world will go from half full to completely full in one doubling period, the same time that it took to go from one percent to two percent full.²⁹⁶ Over the next 35 to 40 years, the world’s population and its economy will again double. The full impact of this reality has not yet been absorbed by those most strategically placed to remedy the situation; rather, such strong growth of GNP, (and by extension, natural resource depletion) is cause for celebration. If we accept the

²⁹³ Daly, 1992, p. 25.

²⁹⁴ For a review of Daly's argument that manmade capital and natural capital are complementary rather than substitutes: Daly, 1992, pp. 23-36; 1996, pp. 75-87.

²⁹⁵ Daly, 1992, p. 26.

²⁹⁶ The world economy expanded from \$4 trillion in output in 1950 to over \$20 trillion in 1995. Between 1985 and 1995, it grew by \$4 trillion - “more than from the beginning of civilization until 1950.” Brown, 1996, p.3.

results of Vitousek et al's study that today's world is forty percent full, it logically follows that we must undertake radical action to turn events in our favor. Even if we challenge Vitousek's numbers, we cannot dismiss the reasoning behind them, particularly in view of the range and scale of nature's indicators that supports the findings. But the cornucopian myth we have lived by has set us on a trajectory that is proving difficult to turn around. Thus, we are slow to awaken to the new reality that the limiting factor has shifted from man-made to natural capital.

Brown points out: "Collisions with the sustainable yield limits of fisheries, aquifers, forests, rangelands, and other natural systems are occurring with increasing frequency." Political leaders and U.N. agencies are spending more of their time dealing with "these collisions and their consequences - fishery conflicts, water scarcity, food shortages, increasingly destructive storms, and swelling flows of environmental refugees".²⁹⁷ This suggests we have reached the socio-political limits that can be anticipated to occur in advance of reaching biophysical limits.

To continue to ignore the reality of limits to growth is to make a mockery of the spirit of sustainable development. Biophysical and sociopolitical feedback suggests that it would be foolhardy to continue on our present trajectory. And yet, we know we are committed to deteriorating ecosystem health and escalating social conflict for the foreseeable future. It is even more certain that the modernization paradigm with its growth ethos is prepared to give no ground on the issue of limits. The guiding principle that world leaders, institutions and business interests adhere to is that of Brundtland which denies *absolute limits* to growth and advocates a *five to*

²⁹⁷ Brown, 1996, p.4. See Postel, Sandra, Forging a Sustainable Water Strategy, in State of the World 1996, re water conflicts.

tenfold increase in world industrial output. Growth of this magnitude would surely result in total collapse of life support systems.

6.2 Practising the Politics of Self-Interest in the Name of Poverty Alleviation

The advance of the growth model on a global scale generates an intoxicating brew capable of numbing the better judgment of its beneficiaries. Neoliberalism treats growth as a substitute for redistribution under the guise of poverty alleviation. However, growth has failed to eliminate poverty, another reality that is conveniently ignored in the face of strong contradictory evidence.²⁹⁸ At least a fifth of humanity remains mired in absolute poverty. The ratio between incomes in the richest twenty percent of countries and the poorest twenty percent has widened from 30 to 1 in 1960 to 61 to 1 in 1991, and the resulting disparity has heightened global tensions between rich and poor nations.²⁹⁹

Increasing disparity is due in part to the exponential growth of technology, another fundamental issue that we have not yet acknowledged, let alone put in place institutional arrangements to deal with. The words of Marx are recalled, that poverty is a result of workers not owning the means of production and that capitalism will fail because of a fundamental flaw in its thinking - mass consumption needs consumers but if workers (consumers) are increasingly replaced by machines, thus increasing unemployment, consumption will decline precipitously, threatening the stability of the system in the process. Instead, the pace of change and the scope of displacement is being defended as a necessary restructuring of the workplace on a global scale. The sole prescription being offered by neoliberalism to employ, feed and house the dislocated is to endure the pain a little longer in return for ethereal

²⁹⁸ Daly, 1996, p. 15.

²⁹⁹ Brown, 1996, pp.3-4.

future rewards. How much longer this pain can be extended is questionable.

Daly observes that the peace between labour and capital in the North has been bought with a policy of cheap resources,³⁰⁰ a policy that is becoming difficult if not impossible to continue on a number of fronts. It also brings into focus one of the stark contradictions in the solutions put forth by neoliberalists. Confronting externalities with a policy of economic imperialism escalates labour/capital tensions. For instance, using economic instruments to price scarce resources or polluting activities increases costs to capital which are typically countered by squeezing labour or displacing it with technology, thus exacerbating Marx's "fundamental flaw" situation. But ignoring limits by continuing to invest in manmade capital as the limiting factor escalates the pace of ecological decline and with it, social instability. The stark reality is that the pie is finite and the number of people seeking a share grows by ninety million annually. The practise of socializing the costs and privatizing the benefits is therefore becoming an increasingly futile endeavour.

Ecological economics promotes policies favoring intermediate technology which is available to a broader base of people. By implementing such policies within a steady state framework, we can alleviate some of the pressure on resource use and sink constraints while simultaneously improving employment prospects. This is not to be confused with a return to the "horse and buggy days" that growth proponents use as a counter argument. It means that we will use smart technology, not low technology. One of the problems we have with high technology is that it is not high tech enough. It is an irony of sorts that the *modernization* paradigm is powered

³⁰⁰ Daly, 1996, pp. 79-80.

with *fossil fuels* that destroy the base the economy is built upon. Vested interests are preventing the emergence of alternative energy technologies even in the face of evidence that the change “could strengthen many economies.”³⁰¹ Flavin equates organizations such as The Global Climate Coalition³⁰² with a modern day “version of the flat earth society (taking an ostrich-like approach” to challenges posed by the use of fossil fuels.³⁰³

Increasingly, as Bright observes, the practice of sticking one’s head in the sand is creating new forms of unsustainability that are having a backlash effect.³⁰⁴ A notable consequence of the efforts of groups that obstruct and delay the implementation of remedial action is the potential damage to their corporate membership as their political base narrows. An unlikely coalition composed of multinational insurance and banking companies, small island states and environmental groups is taking shape that is forcing the hand of The Global Climate Coalition. Losses covered by the insurance industry have dramatically escalated since 1990 and some companies are responding by abandoning some forms of coverage. Groups like the Alliance of Small Island States (AOSIS) are compelled to act out of sheer necessity. To quote Jeremia Tabai, former president of Kiribati: “If the greenhouse effect raises sea levels by one meter it will virtually do away with Kiribati. ... In 50 or 60 years, my country will not be here.”

It is difficult to ignore the irony that financial institutions are lobbying for changes in energy technologies to avoid climate change while overlooking their own role in exacerbating environmental deterioration by

³⁰¹ Flavin, Christopher, 1996, p. 38. von Droste, Bernd & Dogse, Peter, 1992.

³⁰² The Global Climate Coalition is an organization that represents coal and oil industries, automakers, electric utilities and the National Association of Manufacturers in the U.S.

³⁰³ Flavin, 1996, p. 38.

³⁰⁴ Bright, 1996, pp. 106-107.

continuing to squeeze poor nations for interest on questionable debt. Will their coalition with small island states be based on narrow self interest in terms of ensuring they have a healthy investment climate or will they go to bat for those who have no political clout and demand equitable solutions for those who will suffer the most while benefiting the least from modernization?

The modernization of economies over the past fifty years has not improved conditions for the world's poor. What it has done is to increase disparity between the haves and the have nots by creating conditions of uneven development. People are displaced increasingly by technology and population growth means that more people are competing for fewer jobs. The scale of technology in today's workplace make it difficult for all but a few to control the levers of production. Further, increases in the rate of throughput are depleting the natural resource base, which squeeze the poor even more. Large scale technology and fossil fuel based economies are destroying life support systems and again, it is the poor who suffer most. It is clear that many of these technologies are disrupting services supplied by the global commons and some, notably members of associations such as The Global Climate Coalition are creating conditions whereby entire nations will virtually disappear. No provisions are being made for the displacement of inhabitants.

If nothing else, the obstacles posed by vested interests are exposing the monopolistic, dictatorial and unjust practices that exist in today's so-called "free market". Consumers need to have a say in the marketplace that extends beyond the brand name they will purchase. Furthermore, the social net could be mended (in some countries created) by getting rid of the international

payroll of corporate welfare bums that ransack the tax base and extract exorbitant rents from paupers barely scratching out a living. The fossil fuel industry appropriates billions of tax dollars in subsidies each year³⁰⁵ and in the process causes global environmental damage that is beyond price. The health of sources and sinks can be greatly improved by doing away with planned obsolescence as a complementary practice to more efficient resource use.

Trickle down theory is bankrupt and growth economics may grow an economy but this approach is incapable of distributing the fruits of that growth because the dynamics of capital accumulation work against distribution. Growth economics is built upon and thrives upon conditions of inequity. The model is therefore one of social injustice and such a system is bound to be challenged and strongly so at some point.

Challenges thus far have been met with stiff opposition. We see that Cuba has been able to curb population growth by improvements in distribution. Investments in health, education and old age security have brought about the desired results without strong arm tactics of a more technical nature. However, the U.S. views Cuba as the rotten apple that could infect the barrel and in strong contradiction of their "freedom and democracy" propaganda, have done everything in their power to ensure Cuba's experiment with socialism fails. But history has provided some tantalising anecdotes of the David and Goliath syndrome that the U.S. cannot ignore, including their own humiliating experience with Vietnam. When people have nothing to lose and everything to gain in struggle, even the strongest oppressors can be successfully dethroned.

³⁰⁵ Flavin, 1996, p. 37.

6.3 Contemplating Reality

Ecological economics as defined in this thesis offers a practical, workable solution to environment/development issues. By using a systems approach to development, we can readily see the relationship that exists between the environment and the economy. Vitousek et al have devised a way to measure the size of the global economy in relation to the size of the ecosphere. Their work is made practical with tools like the ecological footprint. Footprint analysis helps us to understand the size of our household economy in relation to the amount of resources we can justifiably lay claim to in order to satisfy our needs. We can estimate the amount of the ecosphere we "consume" to provide food, housing, transportation, consumer goods and services. Footprint analysis helps us to live more within our own spaces rather than "needing" strawberries from Mexico in the middle of winter that have been grown at the expense of maize for Mexicans. We can make intelligent and ethical decisions by understanding the chain of cause and effect relationships set off by the lifestyle choices we make.

When we begin to live within the means of our share of the ecosphere, we reclaim control of community development. By virtue of going through the process of reconfiguring our collective footprint, we begin to bring the economy into a steady state relationship with the environment. For instance, it makes more ecological sense to support local producers in order to reduce transportation costs. Food grown by local farmers require less energy for transportation and storage than food grown half way around the world.³⁰⁶ Locally produced food usually has greater nutritional value and the added

³⁰⁶ The techniques used for growing food are also considered using footprint analysis. For example, research shows open-field production is more ecologically efficient than heated hydroponic greenhouses. Wackernagel & Rees, 1996, pp. 108-109. It is important to note that this is not an argument against trade. Ecological economics advocates "fair trade".

benefit of allowing the buyer to know how it has been grown³⁰⁷ in addition to the labour conditions under which it has been produced. This allows purchasers to reward sustainable practices and discourage unsustainable and socially unjust ones. It also deals with the issue of scale. Smaller scale technologies are more affordable so that workers are better able to control the levers of production and thus benefit from the fruits of their labour.³⁰⁸ More jobs are created as workers replace machines.

The reclaiming of community development is the beginning of grassroots democracy. When people take control of the environmental, political and economic decisions that affect their lives, they are less likely to endure the resource depletion and toxic pollution that accompanies outside control. Grassroots democracy will result in development strategies that reflect a great diversity of models, representing the cultural and ecological diversity to be found around the world. Grassroots democracy in the South takes the form of social movements that are essentially livelihood struggles. These movements often link "poverty, indigenous peoples' and women's issues, environmental destruction and consumer issues."³⁰⁹ These movements often dissipate after emergency situations have passed, thus a significant challenge in this regard is to sustain the momentum generated in order that lasting change may take place.³¹⁰

It is time for agencies of international stature to seriously entertain discussion of the wisdoms of cultures who for thousands of years have lived

³⁰⁷ For instance if pesticides and other chemical inputs have been used.

³⁰⁸ Some technologies require economies of scale to make them affordable. For instance, steel mills or railways are more cost-effective when produced on a large scale. It is beyond the scope of this paper to go into the structuring of such facilities; however, it is worth noting that the ecological economics perspective would promote worker owned factories and plants.

³⁰⁹ van den Hombergh, Heleen, *Gender, Environment and Development*, Amsterdam: Institute for Development Research, 1993, pp. 95-97.

³¹⁰ van den Hombergh, p. 99.

off their land and maintained its viability. This requires putting aside notions of scientific imperialism and acknowledging that wisdom and skills acquired outside the Western model have value. Indigenous technologies have evolved in relation to biological and cultural systems through thousands of years of experimentation. Promoting the retention of these technologies is not to be confused with romantic notions of preserving the past. Pragmatism dictates that we stop throwing away systems that work by replacing them with unsustainable systems driven by profit motives rather than social welfare.

Equally important is the revisiting of matriarchal traditions and the validation of women's contributions. This is being accomplished in part through organizations such as the DAWN network (Development Alternatives with Women for a New Era). DAWN reflects principles grounded in the ecological economics paradigm, promoting a perspective which "aims to be holistic; linking social, economic, cultural, political and environmental factors."³¹¹ Numerous social movements such as DAWN, India's Chipko movement and Kenya's Green Belt Movement are indicators that the paradigm shift toward ecological economics is already underway and that this world view is a workable model. Efforts are needed to widen the scope of these activities and to connect them on a global scale in order to provide a countervailing force to the modernization project.³¹²

Connecting on a global scale demands that the voice of the South be heard loud and clear. The words of Fidel Castro are germane:

Stop the transferring to the Third World lifestyles and consumer habits that

³¹¹ van den Hombergh, 1993, pp. 43-44.

³¹² Redclift, Michael, Sustainable Development: Exploring the Contradictions, London: Methuen, 1987. Merchant, Carolyn, The Death of Nature: Women, Ecology and the Scientific Revolution, New York: Harper Collins Publishers, 1989. Shiva, Vandana, Staying Alive: Women, Ecology and Development, London: Zed Books, 1989.

ruin the environment. Make human life more rational. Adopt a more just international economic order. Use science to achieve sustainable development without pollution. Pay the ecological debt instead of the foreign debt. Eradicate hunger and not humanity. ... Tomorrow will be too late to do what we should have done a long time ago.³¹³

The realization of global equity rests upon our ability to share power as well as wealth. Social self-determination is a necessary precondition for self-reliant communities, cultural integrity, realization of creative and problem-solving capabilities, and "individual development and fulfilment outside of acquisitive materialism. A liberation from dependence or oppression is a liberation of our essential humanity."³¹⁴ Living in a social environment that values the realization of human potential is a strong motivational force in energizing citizens and communities to be able to meet their basic needs while maintaining the health of ecosystems.³¹⁵

I have only touched upon notions of scientific imperialism, spirituality and gender in my thesis but these elements clearly must take a position of prominence on the research agenda. A considerable body of information has been amassed in these areas; however, it is necessary to connect it in a meaningful way to the ecological economics literature.³¹⁶ Other research needs include full cost accounting techniques and measurement tools that can be readily implemented in order to get a more accurate reading of progress toward sustainability. It goes without saying that a great deal of work

³¹³ Castro, Fidel, Tomorrow is Too Late: Development and the environmental crisis in the Third World, Melbourne, Ocean Press, 1993.

³¹⁴ Gardner, Julia and Roseland, Mark, *Thinking Globally: The Role of Social Equity in Sustainable Development*, Alternatives Vol. 16, No. 3, 1989, p. 29.

³¹⁵ Gardner & Roseland, 1989, p. 29.

³¹⁶ It would be useful for widely-read journals such as Ecological Economics: The Journal of the International Society for Ecological Economics to put more focus on social issues. Recently, the Society ran a special issue entitled *Women, Ecology and Economics*, Feb. 1997, Vol 20, No. 2. This is a start; however, an integrative approach to social analysis is needed if the readership is to gain an understanding of the broader issues. This is essential to gaining institutional support for change.

is needed to develop renewable energy supplies as well as mechanisms for bringing them to the marketplace and for sharing them with the South.

The growing number of social movements addressing these issues is a clear signal that we are on the cusp of a paradigm change. At an increasing number of junctures, conventional economics is coming to a dead end and is running out of viable options to maintain social and ecological stability. Thus it is becoming impossible to ignore the reality that the modernization paradigm is a utopian world view that has run its course. The ecological economics approach offers a better reflection of today's social and material reality. It offers a means for communities around the world to adopt sustainable lifestyles for the present as well as for the future.

Bibliography

Adams, Carol, Ecofeminism and the Sacred, N.Y.: Continuum, 1993.

Adams, W. M., Green Development: Environment and Sustainability in the Third World, N.Y., Routledge, N.Y., 1990.

Ahmad, Y.S.E. Sarafy and E. Lutz, Environmental Accounting for Sustainable Development, Washington D.C., World Bank, 1989.

Berry, Thomas, The Dream of the Earth, San Francisco: Sierra Club, 1988.

Blomqvist, Wonnacott, Wonnacott, An Introduction to Macroeconomics, Toronto, McGraw-Hill Ryerson Limited, 1983.

Boff, Leonardo, Faith on the Edge: Religion and Marginalized Existence, San Francisco: Harper & Row, 1989.

Boff, Leonardo, When Theology Listens to the Poor, San Francisco: Harper & Row, 1988.

Boothroyd, Peter, Ed., Population - Environment Linkages: Toward a Conceptual Framework, Halifax, N.S.: Dalhousie University, 1994.

Bopane, Blase, Guerrillas of Peace: Liberation Theology and the Central American Revolution, Boston, Ma.: South End Press, 1985.

Boulding, Kenneth, Three Faces of Power, Newbury Park, California: Sage Publications, Inc., 1989.

Boulding, K. E., Beyond Economics, Ann Arbor: Univ of Michigan Press, 1968.

Boulding, Kenneth, The World as a Total System, Beverly Hills, Ca.: Sage Publications, 1985.

Braidotti, Rosi (et al) Women, environment and sustainable development: towards a theoretical synthesis. London: Zed Books, 1993.

Branford, Sue & Kucinski, Bernardo, The Debt Squads: The US, the Banks and Latin America, London: Zed Books, 1988.

Brown, Lester R. et al, eds., State of the World 1993, A Worldwatch Institute Report on Progress Toward a Sustainable Society, New York, World Watch Institute, 1993.

Brown, Lester R. et al, eds., State of the World 1996, A Worldwatch Institute Report on Progress Toward a Sustainable Society, New York, World Watch Institute, 1993.

Brydon, L. & Chant, S., eds., Women in the Third World: gender issues in rural and urban areas, New Brunswick: Rutgers University, 1989.

Burbach, Roger & Flynn, Patricia, Agribusiness in the Americas, New York: Monthly Review Press, 1980.

Butler, James, H., Scientific Uncertainties in the Budget of Atmospheric Methyl Bromide, Atmospheric Environment, Vol 30 (7) i-iii.

Butler, J.H., & Rodriguez, Methyl Bromide in the Atmosphere. The Methyl Bromide Issue, C. H. Bell, N. Price and B. Chakrabarti (eds.) New York, N.Y.: John Wiley & Sons, 1996.

Cahn, Jonathan, 1993, Challenging the New Imperial Authority: The World Bank and the Democratization of Development, Harvard Human Rights Journal 6: Spring 1993 159 - 94.

Cardoso, F. H., Dependency and Development in Latin America, Berkeley: University of California Press, 1979.

Carson, Rachel, Silent Spring, Riverside Press, Cambridge, Mass., 1962.

Castro, Fidel, Tomorrow is Too Late: Development and the environmental crisis in the Third World, Melbourne, Ocean Press, 1993.

Catton, William R., Jr., Overshoot: the Ecological Basis of Revolutionary Change. University of Illinois: Illini Books, 1980.

Cernea, Michael, M., 1987, Farmer Organizations and Institution Building for Sustainable Development, Regional Development Dialogue, 8 (2): Summer 1987., 1 - 19.

Chambers, Robert, 1987, Poverty, Environment and The World Bank.: The Opportunity for a New Professionalism, Prepared for Strategic Planning and Review Department, World Bank.

Chambers, Robert, Rural Development: Putting the Last First, Essex: Longman Scientific & Technical, 1983.

Chossudovsky, Michel, The Third World Structural Adjustment Programme, Halifax, International Development Studies Programme, Saint Mary's University, Working Paper No. 91.3, 1991.

Christensen, P. , Driving Forces, Increasing Returns and Ecological Sustainability. In Ecological Economics: The Science and Management of Sustainability, ed. R. Costanza. New York: Columbia Univ. Press, 1991.

Clowe, Michael, Why are We in the Environmental Mess?: A Sociological Perspective, Lecture at Halifax Regional Library, Sept. 28, 1989.

Corson, Walter H., ed. Global Ecology Handbook: What You Can Do About the Environmental Crisis. Boston: Beacon Press, 1990.

Costanza, R., ed. Ecological Economics: The Science and Management of Sustainability. New York: Columbia Univ. Press, 1991.

Costanza, Robert, The Ecological Economics of Sustainability: Investing in Natural Capital, in Population, Technology, and Lifestyle, Washington: Island Press, pp. 106-118, 1992.

Cronon, William, Changes in the Land: Indians, Colonists, and the Ecology of New England. Toronto: McGraw-Hill Ryerson Ltd., 1983.

- Daly, Herman, Steady-State Economics, Washington, D.C.: Island Press, 1977.
- Daly, H., *Comments on Population Growth and Economic Development*. Population and Development Rev. 12:585-593, 1986.
- Daly, H. 1989. Sustainable Development: From Concept and Theory Towards Operational Principles. Presented at the Hoover Institution Conference. *Steady-State Economics*, (2nd. ed. H. Daly, 1991.). Washington: Island Press.
- Daly, H. , Boundless Bull. Gannett Center Jour: 113-118, 1990.
- Daly, H., *From Empty World Economics to Full World Economics: Recognizing an Historic Turning Point in Economic Development*. In Environmentally Sustainable Development: Building on Brundtland, ed. R. Goodland, H. Daly and S. El Serafy. Washington, D.C.: The World Bank, 1991.
- Daly, Herman, Beyond Growth: The Economics of Sustainable Development. Boston: Beacon Press, 1996.
- Dankelman, Irene and Davidson, Joan, Women and Environment in the Third World: Alliance for the Future, London: Earthscan Publications Ltd., 1988.
- Dinham, Barbara & Hines, Colin, Agribusiness in Africa, Trenton, N.J.: Africa World Press, 1984.
- Dos Santos, T., *The Structure of Dependency*, American Economic Review 60(21) May 1970.
- Ehrlich, Dr. Paul R., The Population Bomb (Revised), N.Y.: Balentine Books, 1971.
- Ehrlich, P. R., and A. H. Ehrlich, The Population Explosion, N.Y., Simon and Schuster, 1990.
- Ehrlich, P.R., *The Limits to Substitution: Meta-Resource Depletion and a new Economic-Ecological Paradigm*. Ecological Economics 1:9-16, 1989.
- Esteva, Gustavo, *Development*, The Development Dictionary: A Guide to Knowledge as Power, ed. Sach, Wolfgang, Zed Books Ltd., London 6-23, 1992.
- Faber, Michael, *Conciliatory Debt Reduction*, 5th Dudley Seers Memorial Lecture, Institute of Development Studies, University of Sussex, 1988.
- Flavin, Christopher, Brown, Lester R. et al, eds. *Facing Up to the Risks of Climate Change. State of the World 1996: A Worldwatch Institute Report on Progress Toward a Sustainable Society*. New York: W.W. Norton & Company, 1996.
- Fox, Matthew, Original Blessing. (1990 edition) Sante Fe, Bear & Company, Inc., 1983.
- Frank, A. G., *The Development of Underdevelopment*, Monthly Review, Sept, 1966, 17-3.0
- Franklin, Ursula, The Real World of Technology, Toronto, CBC Enterprises 1990.

- Franklin, Ursula, Martius, Will Women Change Technology or Will Technology Change Women, No. 9, Ottawa, Canadian Research Institute for the Advancement of Women, 1985.
- Fuller, R. Buckminster, Operating Manual for Spaceship Earth, E. P. Dutton, New York, 1978.
- Gardner, Julia and Roseland, Mark, Thinking Globally: The Role of Social Equity in Sustainable Development, Alternatives Vol. 16, No. 3, pp. 27-34, 1989.
- George, Susan, How the Other Half Dies: the Real Reason for World Hunger, Markham, Ontario: Penguin Books Canada Ltd., 1976.
- George, Susan & Paige, Nigel, Food for Beginners, Oxford: Writers and Readers Publishing, 1982.
- Georgescu-Roegen, N., The Steady-State and Ecological Salvation: A Thermo-Dynamic Analysis. Bioscience. 27 (4):266-270, 1977.
- Gillies, David, Human Rights, Democracy, and Good Governance: Stretching the World Bank's Policy Frontiers, Paper prepared for the President, International Centre for Human Rights and Democratic Development, Montreal and delivered at Dalhousie University, 1992.
- Goldsmith, et al, Blueprint for Survival. Tom Stacey Ltd., London, pp. 14 - 15, 1972.
- Goodland, R. H., Daly, Herman and El Serafy, Salah, eds., Environmentally Sustainable Economic Development: Building on Brundtland. Washington: The World Bank, 1991.
- Goodland, Robert, Daly, Herman, El Serafy, Salah, Eds., Population, Technology and Lifestyle: The Transition to Sustainability, Washington: Island Press, 1992.
- Gore, Al, Earth in Balance. Boston: Houghton Mifflin, 1992.
- Goulet Denis, A New Moral Order: Studies in development ethics and liberation theology, Maryknoll, N.Y., Orbis Books, 1974.
- Greenpeace, Letter to World Bank Executive Directors on Energy Lending and Climate Change. July 1, 1994.
- Our Future's Up in the Air: Du Pont leads the pack in ozone destruction Greenpeace Canada Action, Vol 3, No. 1 Winter/Spring 1992.
- Hall, C.A.S., Sanctioning Resource Depletion: Economic Development and Neo-Classical Economics. The Ecologist 20(3):99-104, 1990.
- Hardin, Garrett, The Tragedy of the Commons, Science, Vol. 162, pp. 1243-8.
- Hetne, Bjorne, Development Theory and the Three Worlds, Longman Scientific & Technical, Essex, 1990.
- Illich, Ivan, Shadow Work, Marion Boyers Inc., New Hampshire, 1981.
- Jacobs, M., The Green Economy. London: Pluto Press, 1991.

- Jeffers, P.M. & Wolfe, N.L., *On the Degradation of Methyl Bromide in Sea Water*, Geophysical Research Letters, vol. 23, #14, July 1, 1996 pp. 1773 - 1776.
- Jevons, W. , The Theory of Political Economy 2nd ed. London: Macmillan, 1897.
- Jiang, Y, et al, *Decadal Evolution of the Antarctic Ozone Hole*, J. Geophys. Res., Vol 101, No. D4 (April 20, 1996) 8985 - 8999.
- Kendall, Henry W. & Pimentel, David, *Constraints on the Expansion of the Global Food Supply*, Ambio: A Journal of the Human Environment, 1994.
- Kirchner, J. G. Leduc, R. Goodland and J. Drake. 1985. *Carrying Capacity, Population Growth, and Sustainable Development*. In Rapid Population Growth and Human Carrying Capacity: Two Perspectives., ed. D. Mahar. Staff Working Papers #690 (Population and development Series #15). Washington: The World Bank.
- Lappe, Frances Moore and Collins, Joseph, World Hunger: 12 Myths, London: Earthscan Publications Ltd., 1986.
- Laszlo, Ervin, The Systems View of the World: the Natural Philosophy of the New Development, 1972.
- Lopez Trujillo, Alfonso, Liberation or Revolution? an examination of the priest's role in the socioeconomic class struggle of Latin America, Huntington, Ind.: Our Sunday Visitor, 1977.
- Macpherson, C.B., The Real World of Democracy, Clarendon Press, 1966.
- Maguire, Patricia, *Different Lenses for Viewing Reality*, Doing Participatory Research: A feminist approach, Amherst, Mass: The Center for International Education, University of Massachusetts, 1987.
- Malthus, T., An Essay on the Principle of Population 2nd ed. London: J. Johnson, 1803.
- Marx Karl & Engels, Friedrich, The Communist Manifesto, Tirana: Nentori Publishing House, 1981, originally published in 1848.
- Marx, Karl & Engels, Frederick, Selected Works in Two Volumes, London: Lawrence & Wishart Ltd., 1950.
- Marzani, Carl, On Interring Communism and Exalting Capitalism, Monthly Review Press, New York, 1990.
- Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, and William W. Behrens III, The Limits to Growth, New York: Potomac Associates, New American Library, 1972.
- Merchant, Carolyn, The Death of Nature: Women, Ecology and the Scientific Revolution, New York: Harper Collins Publishers, 1989.
- Montzka, S.A. et al *Decline in the Tropospheric Abundance of Halogen from Halocarbons: Implications for Stratospheric Ozone Depletion*, Science, Vol 272 (May 31, 1996, p. 1318-22.

Mosley, Paul, Jane Harrigan and John Toye, Aid and Power: The World Bank and Policy-based Lending. Vol 1. London: Routledge, 1991.

Newbery, David M. The Debt Crisis. *Development, Journal of SID* , 1989:1: 34-37.

Ophuls, William, Ecology and the Politics of Scarcity: Prologue to a Political Theory of the Steady State. W. H. Freeman and Company, San Francisco, 1977.

Pearce, D. E. Barbier, and A. Markandya. 1990. Sustainable Development: Economics and Environment in the Third World. Aldershoot: Edward Algar,1990.

Pearce, D., A. Markandya, and E. Barbier, Blueprint for a Green Economy. London: Earthscan, 1989.

Pearce, D., and R. Turner, Economics of Natural Resources and the Environment. New York: Harvester Westscheaf, 1990.

Perelman, Michael, Farming for Profit in a Hungry World: Capital and The Crisis in Agriculture, New Jersey: Allanheld, Osmun & Co. Publishers, Inc., 1977.

Phillips, K., Arrogant Capital: Washington, Wall Street, and the frustration of American Politics, Little, Brown & Company (Canada) Limited, 1994.

Pillet, G., Towards an Inquiry into the Carrying Capacity of Nations: What Does Over-Population Mean? Ecosys. S.A. Report to the Coordinator for International Refugee Policy. Berne, Switzerland: Federal Department of Foreign Affairs, 1991.

Pinstup-Andersen, Per, World Food Trends and Future Food Security, Food Policy Report, The International Food Policy Research Institute, March1994, Washington.

Postel, Sandra, Forging a Sustainable Water Strategy, in State of the World1996,A Worldwatch Institute Report on Progress Toward a Sustainable Society pp. 40 - 59, 1996.

Prebish, R. The Economic Development of Latin America and its Principal Problems, New York, United Nations, 1950.

Rathgerber, Eva, M. WID, WAD, GAD: Trends in research and practice,Pearson Notes, Dalhousie University, Vol 4 No. 3 Summer 1989.

Redclift, Michael, Sustainable Development: Exploring the Contradictions, London: Methuen, 1987.

Rees, W. 1990. Sustainable development and the Biosphere: The Ecology of Sustainable Development. The Ecologist. 20:1:18-23.

Rees, W.,. Understanding Sustainable Development: Natural Capital and the New World Order. Vancouver: Univ. of British Columbia, School of Community and Regional Planning, 1992a.

Rees, William E., Boothroyd, Peter, Ed., Ecological Principles Relevant to Population Growth and Carrying Capacity in Population-Environment Linkages: Toward a Conceptual Framework. Halifax, Dalhousie University, 1994.

- Rees, W. 1992b. Ecological Footprints and Appropriated Carrying Capacity: What Urban Economics Leaves Out. Paper presented to Urban Development Stream. Globe '92 Conference, 16-20 March, 1992, Vancouver, B.C., Canada. Vancouver: Univ of British Columbia, School of Community and Regional Planning.
- Rich, Bruce, Mortgaging the Earth: The World Bank, Environmental Impoverishment, and the Crisis of Development, Boston: Beacon, 1994.
- Restoring the Balance. Women and Forest Resources, FAO, United Nations, pp. 4-10.
- Rifkin, Jeremy, Biosphere Politics, New York: Crown Publisher, 1991.
- Robb, Carol S. and Casebolt, Carl J., ed., Covenant for a New Creation: Ethics, Religion, and Public Policy, Berkeley, California: Orbis Books, 1991.
- Ruether, Rosemary Radford, Liberation Theology: Human Hope Confronts Christian History and American Power, N.Y.: Paulist Press, 1972.
- Sachs, Wolfgang, ed. 1992. The Development Dictionary: A Guide to Knowledge as Power, Zed Books, N.J., 1992
- Sanyal, Bishwapriya, Ideas and Institutions: Why the Alternative Development Paradigm Withered Away, *Regional Development Dialogue*, Vol. 15, No. 1, Summer, 1994, pp.23-35.
- Schumacher, E.F., Small is Beautiful: A Study of Economics as if People Mattered, London: Penguin Group, 1973.
- Schuurman, Frans J., Beyond the Impasse: New Directions in Development Theory, N.J.: Zed Books, 1993.
- Seers, Dudley, The new meaning of development, *International Development Review*, no. 3, pp 2-7, 1977.
- Seers, D., The birth, life and death of development economics, *Development and Change*, vol 10, pp. 707 - 19, 1979.
- Sen, A., Development as capability expansion in K. Griffin and J. Knight, eds. Human Development and the International Development Strategy for the 1990s, Macmillan, Basingstoke, pp. 41-58, 1990.
- Sen, Amartya, Poverty and Famine. An Essay on Entitlement and Deprivation, Oxford: Oxford University Press, 1981.
- Sen, Gita and Grown, Caren, Development, Crises and Alternative visions: Third World Women's Perspectives, New York: Monthly Review Press, 1987.
- Shiva, Vandana, ed., Close to Home: Women Reconnect Ecology, Health and Development Worldwide, New Society Publishers, Philadelphia, PA, 1994.
- Shiva, Vandana, Staying Alive: Women, Ecology and Development, London: Zed Books, 1989.
- Smith, Adam An Inquiry Into the Natures and Causes of the Wealth of Nations, New York: Modern Library Inc., originally published in 1776.

Special Issue: Women, Ecology and Economics, Ecological Economics: The Journal of the international Society for Ecological Economics, Feb. 1997, Vol 20, No. 2.

Spretnak, Charlene, The Politics of Women's Spirituality, Garden City, N.Y.: Anchor Books, 1982.

Sutcliffe, Bob, Development After Ecology, The North The South and The Environment: Ecological Constraints and the Global Economy, Bhakar, V. and Glyn, Andrew (eds), London: Earthscan Publications Limited, 1995.

Swimme, Brian, The Hidden Heart of the Cosmos: Humanity and the New Story, Maryknoll, N.Y., Orbis Books, 1996.

Todaro, Michael P., Economic Development in the Third World, New York, Longman Inc., 1989.

van den Hombergh, Heleen, Gender, Environment and Development: A guide to the literature Amsterdam: Institute for Development Research, 1993.

Veltmeyer, Henry. *Liberalisation and Structural Adjustment in Latin America: In Search of an Alternative*, Economic and Political Weekly, September 25, 1993, pp. 2080 - 1086.

Vitousek, Peter M., et al. *Human Appropriation of the Products of Photosynthesis*. BioScience. 34(6)(1986): 368-73.

von Droste, Bernd & Dogse, Peter, *Sustainable Development: The Role of Investment in Goodland, Robert, Daly, Herman, El Serafy, Salah, eds., Population, Technology and Lifestyle: The Transition to Sustainability*. Washington: Island Press, pp 90 - 117, 1992.

Wackersnagel, Mathis, Boothroyd, Peter, ed. *Comparing Three Thinking Tools for Policy Analysis*. Population-Environment: Toward a Conceptual Framework. Halifax: Dalhousie University, 1992.

Wackernagel, Mathis & Rees, William, *Our Ecological Footprint: Reducing Human Impact on the Earth*. Gabriola Island: New Society Publishers, 1996.

Warnock, John, W., The Politics of Hunger, New York: Methuen Publications, 1987.

Weber, Peter. *Reviving Coral Reefs*, Brown, Lester R., Ed. State of the World 1993, pp. 42-60, 1993.

Weinberg, Gerald M., An Introduction to General Systems Thinking, NY: Wiley, 1975,

The Report of the Partnership on Sustainable Coastal Communities and Marine Ecosystems in Newfoundland and Labrador, Newfoundland and Labrador Round Table on the Environment and the Economy, St. John's Nf., October, 1995.

World Resources 1987: An Assessment of the Resource Base that Supports the Global Economy, World Resources Institute. New York: Basic Books, Inc., 1987.