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SUSTAINABLE DEVELOPMENT: ECONOMIC MYTHS AND ECOLOGICAL REALITIES

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Introduction

This paper develops one perspective on prospects for a sustainable future in Canada and the rest of the developed world. It is inspired by the recent publication of **Our Common Future**, the report of the United Nations' "World Commission on Environment and Development" (WCED 1987). The UN study has stimulated an unprecedented level of public debate on environment and development-related matters, wherever it is available, much of which focuses on the intriguingly hopeful concept of "sustainable development."

Before addressing sustainable development directly, I would like to say a few things about Western society's perceptions of "the way things are" respecting people, development, and the environment. The following reasons for doing so also provide the premises of the paper:

1. While we think we act from factual knowledge, much individual action and government policy on development and environment is based on unconscious belief, on what Stafford Beer (1981) might call our "shared illusions;"
2. This collective perception of reality is the real problem. Our culturally "shared illusions" stand in the way of sustainable development;
3. It follows that a fundamental change in society's perceptions and attitudes is a prerequisite for environmental harmony.

Let us be clear that by "perception," I am not referring to the garden variety beliefs and opinions that are amenable to change with the next edition of the National News or the **Globe and Mail**. Rather, I mean the unconscious "facts" and unquestioned assumptions out of which we more or less automatically react in the conduct of our day-to-day affairs. These culturally-transmitted perceptions shape our social relationships, our political systems, and the nature of economic enterprise. In short, I am talking about the deep-rooted beliefs and perceptions that constitute society's common philosophy and worldview. (The academically inclined may prefer the term "cultural paradigm.")

Whatever name we give it, it is this shared experience of reality that determines where we are "coming from" as a society. Since it also influences where we are going, it is worth some reflection here.

Scientific Materialism: Shallow Soil for Sustainable Development¹

The worldview that presently dominates is rooted in 19th century scientific materialism (Waller 1980). Building on the experimental "natural philosophy" of the previous 200 years, the

late 1880's saw the deep entrenchment of scientific rationality and its companion, social utilitarianism, as the primary beacons of human progress.

Descartes had set the stage in the 17th Century with his division of reality into the separate and independent realms of mind and matter. This "Cartesian" division encouraged people to see themselves as separate and distinct from a physical reality "out there," and provided the perceptual framework for all subsequent scientific inquiry. But it was Bacon who gave modern science its **raison d'être** by arguing that knowledge gained through science should be put to work. "From this perspective, knowledge is regarded not as an end but as a means, expressed and applied in technology, by which humans assume power over the material world" (Jones 1988, p. 236).

The resultant flowering of science and technology made possible the industrial revolution and unprecedented levels of material production. Not surprisingly, scientific method became associated with a glowing material future,² while traditional thinking and values were scorned as obsolete and reactionary. Indeed, science came to be equated with the only true knowledge. "Facts" that have no authority of science behind them, are written off "as having no epistemological status at all" (Jones, 1988, p. 237). The scientific worldview had succeeded in separating material knowledge from values, and asserted the primacy of the former over the later (Skolimowski 1981), p. 3).

This materialistic rational empiricism remains the dominant paradigm of Western society. To judge from economic behavior, we see the external world, the biosphere, mainly as a warehouse to be plundered in satisfaction of the material needs and wants of humankind. Certainly, too, reductionist science remains our only acceptable analytic mode. Society's prevailing ecological myth sees "the environment" in terms of isolated, individual resources or, at best, as a mechanical construction, whose component parts are bendable to human will and purpose.

Even the organization of governments reflects this analytic perspective. Environmental management is institutionally segregated into Departments of Fisheries, Forests and Land, Water, Energy and Mines, etc., with little regard to interdependent properties of the whole. Ironically, this often leaves our federal and provincial Departments of Environment with little to do!

The Assumptions of Economics

Modern economics springs from similar conceptual roots. The founders of the neoclassical school, impressed with the spectacular successes of Newtonian physics, strove to create economics as a sister science, "the mechanics of utility and self-interest" (Jevons 1879, cited in Georgescu-Roegen 1975). The

major consequences of this mechanical analogue is a traditional view of economic process as "a self-sustaining circular flow between production and consumption within a completely closed system." By this perception, "everything...turns out to be just a pendulum movement. One business "cycle" follows another... If events alter the supply and demand propensities, the economic world returns to its previous position as soon as these events fade out." In short, "complete reversibility is the general rule, just as in mechanics (Georgescu-Roegen 1975, p. 348, emphasis added).

An important corollary of this equilibrium model is that mainstream economics essentially ignores the self-evident, continuous exchange of material resources (resources and waste disposal), and the unidirectional flow of free energy, between the economic process and the biophysical environment.³

A second corollary of equilibrium theory is that continuous growth becomes theoretically possible (see Simon and Kahn 1984). Indeed, latter day economists seem to believe "not only in the possibility of continuous material growth, but in its axiomatic necessity" (Georgescu-Roegen 1977). This "growmania" (Mishan 1967) "has given rise to an immense literature in which exponential growth is taken as the normal state of affairs" (Georgescu-Roegen 1977). Meanwhile, any damage to environmental processes caused by this explosive human activity is assumed to be inconsequential or reversible.

That growth is entrenched as the measure of progress is evident from a glance at the business pages of any daily newspaper. The annual percept increase in gross national product (GNP) is still taken as every nation's primary indicator of national health. Rates of under 3% are considered sluggish, and most politicians and economic planners do not feel at ease until real growth in GNP tops 4% per annum. While such rates may seem modest, even a 4% increase implies a doubling of economic activity in a mere 17 years!

With its fixation on growth, the new conservatism⁴ of such countries as the US, Britain, and Canada increasingly demands that people accept the rigorous discipline of the marketplace as the primary wellspring of values and social well-being.⁵ Meanwhile, businessmen and technocrats have become the heroes of the new age and prominent role models for youth. The competitive ethic provides the accepted standard for individual self worth, with success measured in terms of conspicuous consumption and the accumulation of personal property. In some circles it is fashionable to be both socially unconcerned and aggressively oblivious to environmental destruction. While individual rights are loudly proclaimed, there is telling silence over matters of social responsibility.

It is noteworthy in this context, that capitalist states depend on the increasing size of the national economic pie to ensure that the poor receive enough of the national wealth to survive. Indeed, it is not exaggerating to say that economic growth is the major instrument of social policy. by sustaining hope for improvement, it relieves the pressure for policies aimed at more equitable distribution of wealth.

The Ecological Reality

There are two ecological problems with common economic expectations. First, the expanding economic system is inextricably linked to the biosphere. Every economy draws on the physical environment for non-renewable resources and on ecosystems for

renewable resources, and **all** the products of economic activity (i.e., both the waste products of the manufacturing process and the final consumer goods) are eventually discharged back into the biosphere as waste.

The ultimate regulator of this activity, and one that modern economic theory essentially ignores, the second law of thermodynamics (the entropy law): **In any closed isolated system, available energy and matter are continuously and irrevocably degraded to the unavailable state.**⁶ (See Georgescu-Roegen 1975, 1977.) The effect of this law is to declare that all so-called economic "production" is really "consumption"!

Since modern economies are partially dependent on stocks of non-renewable material and energy resources, the Second Law declares that they necessarily consume and degrade the very resources which sustains them. The substitution of one depleting resource for another can only be a stopgap on the road to scarcity. Even resource recycling has a net negative impact on remaining stocks of available energy and material. In short, much economic activity contributes to a constant increase in global net entropy (disorder), through the continuous dissipation of free energy and matter. Contrary to the assumptions of neoclassical theory, there is no equilibrium of any sort in the material relationship between industrial economies and the environment.

This means that the growth of many national economies (e.g., Japan, the US) can be sustained only by continuous resource imports from elsewhere, and only in the short run. The global economy, for all practical purposes, is a closed system, a reality that is little affected by shuffling resources around (world trade). Thus, contrary to the implicit assumptions of neo-classical economics, **sustainable development based on prevailing patterns of consumptive resource use is not even theoretically conceivable.**⁷

The second ecological difficulty with the growth-dependent economy stems from the functional dynamics of ecosystems themselves. Ecosystems, like economic systems, depend on fixed stocks of material resources. However, the material resources of ecosystems are constantly being transformed and recycled throughout the system via food-webs at the local level, and biogeochemical cycles on a global scale. In addition, evolution and succession in Nature tend toward greater order and resilience.

The material cycles and developmental trends of ecosystems thus appear at first glance to defy the thermodynamic law. **Ecosystems seem to be inherently self-sustaining and self-organizing, and therefore to contribute to a reduction in global net entropy.** This is possible only because ecosystems, unlike economic systems, are driven by an external source of free energy, the sun. Through photosynthesis, the steady stream of solar energy sustains essentially all biological activity and makes possible the diversity of life on Earth.

Material recycling, the self-renewing property of ecosystems, is therefore the source of all renewable resources used by the human economy. Moreover, since the flow of solar radiation is constant, steady, and reliable, **resource production from the ecological sector is potentially sustainable over any time scale relevant to humankind.**

But only potentially. Even ecological productivity is ultimately limited, in part, by the rate of energy input (the "solar flux") itself. Ecosystems therefore do not grow indefinitely. Unlike our present economy, which expands through intrinsic positive feed-

back, ecosystems are held in "steady-state" or dynamic equilibrium, regulated by limiting factors and negative feedback.

Why is this significant? First, human beings and their economies are now a dominant component of all the world's major ecosystems. Since these economies are growing and the ecosystems within which they are embedded are not, the consumption of ecological resources everywhere threatens to exceed sustainable rates of biological production. Second, over-exploitation is exacerbated by pollution, which impairs the remaining productivity of ecosystems.⁸ (Recent reports that acid rain may be reducing rates of tree growth by as much as 25% in parts of eastern Canada serve as a timely example.) In short, **modern industrial economies both directly undermine the potential for sustainable development through over-harvesting, and indirectly compromise future production through residuals discharge.** It takes no special genius to realize that such trends are unsustainable.

The point of all this is not to argue for abandonment of scientific rationality or even the growth paradigm. Science, technology, and the human ingenuity to use them, are among the key factors required for sustainable development. However, I do want to stress that our current worldview, however successful in the past, is a dangerously shallow perception of present reality. In fact, the foregoing analysis shows many of its basic assumptions to be wrong. While this was of little consequence when the scale of human activity was limited, it is at the heart of the environment-development conundrum today. Only when we admit this possibility will the development question shift from: how to promote growth, to: how to achieve sustainability.

Sustainable Development: Can We Get There From Here?

According to the World Commission on Environment and Development, **sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.** There is nothing very threatening--or substantial here. However, **Our Common Future** goes on to define needs as the "essential needs of the world's poor, to which overriding priority should be given." It also recognized the "limitations imposed by the state of technology and social organization on the environment's ability to meet those needs" (WCED 1987, p. 43). These latter considerations raise painful questions for modern society.

To expand on the issues involved, let us define sustainable development as **any form of positive change which does not erode the ecological, social, or political systems upon which society is dependent.** Planning for sustainable development must therefore explicitly acknowledge ecological limits on the economy, and to be politically viable, have the full understanding, support, and involvement of the people affected. This in turn suggests the need for political and planning processes that are informed, open, and fair.⁹

Social equity will inevitably become a central consideration. The World Commission reported that the 26% of the world's population living in developed countries consumes 80-86% of nonrenewable resources and up to 34-53% of food products (WCED) p. 33). Emerging ecological and social constraints suggest that reducing the present gap in standards of living between the rich and poor (between and within nations) may well require that the rich reduce both present consumption and future expecta-

tations so that the poor may enjoy a fairer share of the world's resources.¹⁰

Ecologically and socially concerned citizens accept such notions as self-evident, but the more profound implications of sustainable development seem invisible to the mainstream worldview. For example, Canada was the first nation to respond with its own policy initiative to the work of the World Commission. The National Task Force on Environment and Economy was established in October 1986 to initiate dialogue and recommend action on environment-economy integration in Canada. Its subsequent report (CCREM 1987) is regarded by government and industry as a milestone document, but with suspicion by environmentalists and other critics.

Stepping to the right of the World Commission, the Task Force defined sustainable development as "development which ensures that the utilization of resources and the environment today does not damage prospects for their use by future generations." Its report goes on to state that at the core of the concept is the requirement "that current practices should not diminish the possibility of maintaining or improving living standards in the future." Also: "Sustainable development does not require the preservation of the current stock of natural resources or any particular mix of...assets." Nor does it place "artificial" limits on economic growth, provided that such growth is "economically and environmentally sustainable" (CCREM 1987, p. 3).¹¹

This definition is self-contradictory and thus difficult to interpret rationally. First, as previously emphasized, the present generation cannot use any nonrenewable energy or material resource (e.g., oil, natural gas, phosphate ore) without eliminating the prospect for its use by future generations. Thus, the main part of the definition is simply invalid. Second, the Task Force is reluctant to admit the possibility that living standards for some may have to be reduced that others might live at all. It avoids this issue entirely. Third, and consistent with the foregoing, the Task Force clings to the growth ethic, implying that an expanding economy is the preferred, if not the only solution, to social inequity. Fourth, the Task Force disallows the possibility that the preservation of certain "mixes" of ecological resource systems may well be essential to sustainability.

In the final analysis, then, the Task Force definition of sustainable development could be used to defend practically any pattern of economic activity, including the status quo (which, one suspects, was the general idea).

To be fair, the Task Force does provide numerous recommendations for improved economic planning and environmental assessment; for demonstration projects in sustainable development; for more research into ecological problems; for better government-industry cooperation in the integration of environment and economy, etc. However, in failing to recognize its own epistemological assumptions, the Task Force was constrained from stretching beyond such commonplace adjustments.

One problem is that the Task Force report (and, to a lesser extent, **Our Common Future**) was written from within the materialist growth paradigm. This paradigm is the ecological equivalent of rose-coloured glasses. With our vision pleasantly impaired, we will always ask first that Nature continue to meet our growing demands; it is literally beyond imagining that we should seriously adapt to Nature's constraints.¹²

Now do not get me wrong. There may well be a grand idea in the Task Force that is struggling to get out. But the fact there is

a struggle is my central point. The idea we need cannot be born of the prevailing worldview; it is missing too many essential elements. If we are serious about sustainable development, we cannot get there from here, at least not directly. We have to start from a different paradigm.

TOWARD A NEW PARADIGM

I would like now to sketch some of the errant elements I believe are central to any ecologically sound approach to sustainable development. To promote understanding, I will use a metaphor drawn from the current paradigm and a model we all know, capital investment.

Environment as Capital

In the simplest case, if you have money to invest and manage it wisely, you expect your capital to grow. Indeed, the objective of this form of "development" is to accumulate capital (money, equipment, physical plant), to be better off after making your investment than before. Certainly no one sets out to deliberately lose his/her financial shirt.

Try now to conceive of various living species and ecosystems processes as forms of capital. It is easy to think of species we harvest this way, since we all know that a given stock of fish, trees, or cattle is capable of generating variable rates of return (growth and reproduction) depending on the goals and skills of management. But we are much less aware of the valuable hidden services performed by ecosystems processes mainly because they are performed so well. One example would be the inherent capacity of local ecosystems and the biosphere to absorb, neutralize, and recycle organic and nutrient wastes. These are free services that we might otherwise have to pay for, and as such can be considered as a return on our "investment" in the ecological capital doing the chore.¹³

Clearly, any human activity dependent on the consumptive use of ecological resources (forestry, fisheries, agriculture, waste disposal, urban sprawl onto agricultural land) cannot be sustained indefinitely if it consumes not only the annual production from that resource (the "interest"), but also cuts into the capital base. In this simple truth lies the essence of our environmental crisis. We have not only been living off our ecological interest but also consuming the capital, and the rate at which we are doing so is increasing year by year. This is the inevitable consequence of exponential growth. Some examples:

1. Most major world fisheries peaked far short of their potential productivity in the early 1970's, and many, including BC salmon and Atlantic cod, are in a continuing state of decline from over-fishing and habitat destruction;¹⁴
2. Historic forestry practices in B.C. have greatly reduced the last major temperate rain-forest, and our present "economic" clearcut methods leave an ecological disaster of denuded slopes and eroded soils. Meanwhile, tropical forests, habitat to half the world's species, have been reduced by 40%, and are being cut at the rate of 10-20 million ha. (1-2%) per year;
3. The prairie soils of the North American breadbasket have lost half their organic content and natural nutrients under mechanized agriculture. Soil erosion from cultivated land typically claims 22 metric tons/ha./year, about ten times the rate of soil building (see Pimental, et al. 1976, SCC. 1986);

4. Abetted by deforestation, over-grazing, and inappropriate land use, the world's deserts claim an additional 21 million ha. of previously habitable land/year;
5. Acid rain is sterilizing thousands of lakes, destroying fisheries, and threatening forest and agricultural productivity in much of the Northern hemisphere;
6. Carbon dioxide production from the burning of fossil fuels and destruction of forests has long exceeded the capacity of the oceans and terrestrial plants to absorb the excess. Atmospheric CO₂ has risen 25% in the industrial age and is expected to double from preindustrial levels in the next century, contributing significantly to the greenhouse effect and potentially disastrous global warming.

Admittedly, interpreting such trends is difficult and their ultimate significance controversial.¹⁵ However, viewed in the same light as rising standards of living, the decline of the biosphere provides a novel perspective on the origins of our unprecedented wealth. These intersecting curves reveal that since the beginning of the steam age, we have been busily converting ecological capital into financial and material capital.

This means that much of our wealth is illusion. We have simply drawn down one account (the biosphere) to add to another (the bank). It might even be argued that we have been collectively impoverished in the process. Much potentially renewable environmental capital has been permanently converted into machinery, plant, and possessions that will eventually wear out and have to be replaced (at the cost of additional resources-- that irritating Second Law again!).¹⁶

To put it another way, we have long been enjoying a free ride for which we now have to ante up. Forest products and food are undervalued in the marketplace to the extent the prices we pay do not include the costs of resource maintenance. Our paychecks and corporate profits are excessive to the extent that the resource base which produced them has been run down. That new CD player and the family's second car represent capital that was not plowed back into silviculture, soils management, and waste control. In simplest terms, the "good life" for some humans has been subsidized at the expense of all other life, and ultimately of our children and their descendants.

Living on the Interest

This suggests that for the foreseeable future, sustainable development is only possible if we are willing to live on the interest of our remaining ecological endowment. Fortunately, this is still generous enough, and with careful husbanding it should be possible to restore and even build up our capital base.

Success in this endeavor will obviously require a rewrite of the prevailing environmental myth and humankind's role in the scheme of things. To begin, the new eco-paradigm must dissolve our separateness and reunite humankind with the biosphere.

Let us be clear that while better environmental management may be an essential interim step, we are not merely talking about tougher environmental regulation or improved impact assessment. History has shown that restrictive measures to control inappropriate activities are simply inadequate. This is because regulation must be imposed to protect some social value that is perceived as secondary if not inimical to the interests of the regulatee. Corporations oriented to maximizing profits do not voluntarily incur the costs of pollution control. Moreover, if the

general interests of society (or at least the politician) are more closely associated with profit than environment, regulations are not enthusiastically enforced.

True sustainable development cannot be forced. Rather, it is the natural product of a society that "comes from" a profound sense of being in, and of, the natural world. As noted at the outset, sustainable development requires a shift in fundamental social attitudes and values, a change in worldview. People must acquire in their bones a sense that violation of the biosphere is violation of self.

From this perspective, it would be psychologically and socially unconscionable for anyone to advance a development or resource management proposal whose long-term effect would be to reduce our ecological capital. Just as today, no sane person sets out purposefully to go financially bankrupt, no one would dream of launching an ecologically bankrupt scheme. On the contrary, development would be planned and implemented, without force or coercion, in ways that would maintain or increase the renewable resource base. "Return on investment" would acquire a double meaning. Both ecological and financial criteria have to be satisfied in the cost/benefit calculus.

Think for the moment how different things would be today had enhancing our ecological capital been taken for granted as the guiding principle of resource development in British Columbia for the last 100 years. There would be no concerns that sawmills in the interior may run out of timber; no fight between loggers and conservationists over the last uncut valley in the southern half of the province; South Moresby would have been declared a National Park long ago; commercial and sport fishermen would not be locked in a bitter dispute over declining shares of a diminishing resource (and the costly salmon-enhancement program would not have been necessary). It might have cost more along the way, but paradoxically, we would be richer today.

To ears conditioned by the hard-nosed rhetoric of modern business and politics, this softer path to development will sound utterly ridiculous, vaguely threatening, or merely irrelevant. But remember, from within in the current paradigm, it is difficult to recognize any vision not supported by conventional values and assumptions. The orthodox mind can only deny the evidence and insist the Earth is flat.

This is a critical point. To acknowledge it is to admit the possibility of an alternative vision and future. With self-awareness, comes the realization that there is nothing fixed or sacred about our present way of being. Materialist society, its Rambo economics, and even the compulsive consumers of the "me" generation, are all creation of malleable culture, not of any physical law. **We made them up.** If they are no longer adapted to the changing reality, we can remake them ourselves, in an image that is.

While re-education will be a long and difficult process, it may have unexpected rewards. Human beings are multi-dimensional creatures, at once aggressively competitive and socially cooperative. But Western society plays up the former, while suppressing the latter; a perverted liberalism idolizes the individual, while Conservative economics deprives him/her of the community necessary to make him/her whole. The new paradigm may enable us to restore the balance in a rediscovery of self. At the least, our new consciousness should catalyze a shift in emphasis from the quantitative to the qualitative, from the material to the

tangible, from growth to development, in the lives of people and communities.

The eco-paradigm is an inherently cooperative one. It springs from a felt responsibility to the whole planet and can only be expressed through socio-political effort at all levels of social organization. Although there must be leadership, no region, province, or nation can go it alone for long.

Sustainable development thus gives new meaning to McLuhan's "global village." The media that made it possible may finally have a message that makes it worthwhile. We are engaged in no less an enterprise than restoring the habitat for all of humankind, and this will require no less than total commitment and unity of purpose.

Listen for a collective sigh of relief, the arms race, which we never could afford, which consumes so much of our ecological capital,¹⁷ can only be seen as a perverse anachronism when viewed from the eco-paradigm. Giving up on war would free no less than 6% of gross world product for the sustainable redevelopment of the planet!

Now, of course, I am really staring off to ecotopia. It simply cannot happen, right? Perhaps, but if you cannot share this vision, take a long look from where you stand and ponder the alternative.

Notes

1. Expanded from a similar section in Rees (1987).
2. By method I refer to reductionist analysis, the breaking down of an observed reality into its components, in the belief that by learning the behavior and relationships of the disconnected parts we can come to understand the whole.
3. Since the 1960's, environmental economics has developed as a minor tributary in partial response to this problem. However, the effect on macro-economic planning has been negligible.
4. Some might argue that neo-conservatism is actually old capitalism's last gasp. Confronted by unmanageable social, economic, political, and ecological problems, society responds with characteristic bravado by trumpeting an historically comforting illusion.
5. For Canadians, the Mulroney-Reagan trade agreement is perhaps the best recent example, since it is designed explicitly to foster a market-driven North American economy.
6. They are not destroyed, but converted to low-grade or dispersed forms that cannot be used by people.
7. I recognize that in post-industrial economies, some forms of economic growth (e.g., the information and service sectors) require few material resources. However, as developing countries strive to catch up, the global emphasis is still on resource-dependent material growth.
8. Think of pollution as one manifestation of the degradation and dissipation of matter and energy associated with industrial economies. Pollution is the entropy law at work.
9. These requirements fly in the face of such currently popular conservative trends as deregulation, privatization, and uncritical worship of the market economy.
10. The alternative, bringing the third world up to first world living standards, would require an ecologically improbable five to ten-fold increase in world industrial output (WCED 1987, p. 213).
11. No one advocates "artificial" limits to growth, but surely there are circumstances in which we might need *real* ones!
12. In the words of Stafford Beer (1981): "...we cannot regulate our interaction with any aspect of reality that our model of reality does not include...because by definition we cannot be conscious of it."
13. For a discussion of this concept, see Gosselink et al., (1947), and Westman (1977).
14. This is not only a common property problem. Clark (1973) has shown that while it may be ecologically disastrous, it is economically rational and more efficient, if by so doing s/he obtains a higher return from investing the proceeds than by husbanding the resource.
15. For example, some problems such as soil erosion, may continue for decades with only minor impact on productivity (one can take \$100 a year from a bank account for as many years as the balance exceeds \$100), and optimists will always argue that new technology will ultimately save



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