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Introduction

This paper is the first of a three-part series which attempts to outline a bioregional paradigm for a global ethic as an alternative to the dominant development paradigm (for preliminary definitions of the two paradigms, see Evanoff 2009). The series offers a critique of the central notion of the dominant development paradigm that continued economic growth will eventually help developing countries "catch up" with the developed countries in terms of material affluence. The first paper in the series, presented here, argues that this goal is not only unachievable but also undesirable because it undermines the ability of the environment to sustain both human and non-human flourishing and reduces both natural and cultural diversity. The second paper in the series suggests that the dominant development paradigm exacerbates rather than overcomes social inequalities both within and between cultures. The third paper contends that the dominant development paradigm fails to promote genuine well-being in terms of both human health and quality of life for all but a wealthy minority. The series concludes that a bioregional alternative to the dominant development paradigm is better able to meet the goals of a global ethic based on ecological integrity, social justice, and human flourishing (proposed in Evanoff 2005).

The impossible dream

Within the dominant development paradigm there is basic conver-

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gence on a core set of values which serve to structure global society and orient human action in particular ways. Chief among these are the notions that continuous economic expansion and technological progress are both possible and desirable, and that increased levels of consumption lead to greater human well-being. The success of the economy is accordingly measured by how rapidly the production of goods and services can be expanded. Daly writes,

> Economic growth is currently the major goal of both capitalist and socialist countries and, of course, of Third World countries . . . . Economic growth is held to be the cure for poverty, unemployment, debt repayment, inflation, balance of payment deficits, pollution, depletion, the population explosion, crime, divorce, and drug addiction. In short, economic growth is both the panacea and the *summum bonum* (1991, p. 183).

Governments throughout the world continue to pursue the goal of increasing economic growth despite the fact, as will be demonstrated in this paper, that such growth is unsustainable. The assumption made by defenders of the dominant development paradigm is that developing countries will eventually be able to "catch up" with developed countries in terms of material affluence. In the dominant development paradigm quality of life is defined in terms of the high consumer lifestyles currently prevalent in developed countries; social justice is to be achieved by giving everyone in the world the opportunity to attain such lifestyles; and environmental sustainability is to be assured through technological innovations which allow new resources to be developed once current resources have been used up.

The obvious question which must be asked is whether the earth has the necessary resources and sinks to provide a growing world population with the same standard of living which currently prevails in developed countries. How much energy would be consumed, how quickly would resources be depleted, and how much pollution would be generated if every person in the world eventually achieved those same affluent lifestyles? Already it is clear that the root cause of nearly all our current environmental problems lies in a global economic system which is geared towards the overproduction of inessential consumer goods for a rich minority of the earth's population while the basic needs of the majority go unfilled. Such overconsumption can only be supported by drawing down both the renewable and nonrenewable resources of the earth and generating pollution at levels which exceed the earth's capacity to absorb it. Daly (1993) describes the doctrine of unlimited growth as an "impossibility theorem" and proposes that instead of pursuing a high-growth economy we should be working towards the creation of a steady-state economy.

Steady-state economics

The idea of a steady-state economy was first proposed by Mill (1857, pp. 320-326) and given further impetus by Georgescu-Rogen's (1971) contention that economic systems, as much as other natural systems, are bound by the Second Law of Thermodynamics, which means that over time they tend towards higher states of entropy. Using resources faster may increase prosperity in the short term, but the faster resources are consumed, the sooner prosperity collapses. Ultimately, of course, the earth and the universe as a whole are tending towards entropy, but it is still possible to maintain relative equilibrium by not consuming energy resources faster than the sun, which is the ultimate source of all energy on earth, makes additional resources available.

Daly's (1991) steady-state economy, accordingly, would limit production and consumption to truly sustainable levels by not using non-renewable resources faster than renewable substitutes can be found, not using renewable resources faster than they can be naturally replenished, and not generating pollution faster than the earth is able to absorb it. All of these suggestions sound eminently reasonable and provide a good working definition of what a sustainable economy would truly be like, yet all of them are being violated in our present economic system. Critics argue that a steady-state economy would result in decreasing standards of living and increasing poverty and, therefore, that continued economic growth is necessary to improve everyone's quality of life.

A steady-state economy does not necessarily imply a zero-growth economy, however (*cf.* Daly 1988, pp. 91–93; Jacobs 1991, pp. 54–56). Steady-state economics distinguishes between qualitative and quantitative changes in the economy. While it is opposed to undifferentiated growth, i.e., growth which represents merely an expansion in quantity, it is not opposed to qualitative improvements, i.e., genuine development, within the limits of sustainability. Certain non-material goods, such as knowledge and technological advances, can be seen, unlike material goods, as having nearly infinite possibilities for expansion. What needs to be held constant are stocks, which include not only natural resources and sinks, and but also a constant population and a constant stock of artefacts. Sustainability involves not only the ability to sustain a certain level of economic activity, but also the ability to sustain the natural resources which support that economic activity. The emerging field of ecological economics seeks to understand exactly what such a truly sustainable economy would be like and how it might be achieved (see Costanza 1991; 1997; Krishnan, Harris, and Goodwin 1995; Daly 1996; 2007; Booth 1998; 2004; Edwards-Jones, Hussain, and Davies 2000; Daly and Farley 2004).

With Daly the bioregional paradigm disputes the view that the overconsumptive lifestyles currently indulged in by an affluent minority can in fact be universalized in a world of environmental limits. Wackernagel and Rees (1996, p. 14), the orginators of ecological footprint analysis, show that while the global per capita amount of ecologically productive land has decreased from 5.6 hectares in 1900 to 1.5 hectares in 1994 (through urbanization, desertification, and the like), per capita land appropriation in the developed countries has risen from 1.0 to 3.5. Vitousek *et al.* (1986) have calculated that at present humans are already expropriating approximately 40% of the earth's photosynthetic production. The significance of these figures is not only that people in developed countries are using more than twice their fair share of ecologically productive land, but also that the present population of the earth could not be sustainably supported at the same levels of affluence found in developed countries. At least two additional planets would be needed to support the earth's present population at levels of consumption currently found in the developed world. About five and a half planets would be needed if everyone were to have the same lifestyles as residents of the United States of America (Global Footprint Network 2009).

These figures simply do not square with the stance taken by the United Nations' Bruntland Report, which suggests that the global economy must grow five to ten times if developing countries are to catch up with the developed countries (World Commission on Environment and Development 1987, p. 15) and contends that improvements in technology and existing social institutions can make such growth sustainable. While the report has the laudable goal of wanting " . . . to relieve the great poverty that is deepening in much of the developing world," it seeks to achieve this goal not by reducing overconsumption in the North or redistributing wealth to the poor in the South, but rather by calling for a "new era of economic growth" (1987, p. 1). The report defines sustainable development as development that " . . . meets the needs of the present without compromising the ability of future generations to meet their own needs" (1987, p. 8). Although this definition of "sustainable development" has become fairly standard, it is essentially a reformist concept that does nothing to challenge the dominant paradigm of continued economic growth nor existing political and economic power structures.

The limits to growth

The notion that exponential economic growth will inevitably come into conflict with environmental limits was first set forth in *The Limits to Growth* (Meadows *et al.* 1972). In this report, prepared for the Club of Rome, a group of researchers at the Massachusetts Institute of Technology used computer models to predict what would happen if current trends in resource depletion, pollution, food production, population growth, and economic activity continued into the 21st century. The report suggests that if no effort is made to change our present course, the world economy will peak in the year 2035 and then enter into a sharp decline as natural resources are depleted. Pollution levels will peak somewhat later, around the middle of the 21st century (because the effects of pollution do not appear until long after the actual pollution has been generated). Food production will enter into a sharp decline and population levels will fall as people begin to die from a lack of food and medical services. Updated versions of the original report (Meadows, Meadows, and Randers 1992; Meadows, Randers, and Meadows 2004), have largely confirmed the results of the earlier study but argued that present levels of economic growth have already pushed us "beyond the limits" of ecological sustainability.

The picture of the future painted by the limits-to-growth literature is the exact opposite of the rosy picture painted by the advocates of unlimited economic growth, who have an almost religious faith in the ability of technological advances which do not yet exist to ultimately save us from ecological disaster and the collapse of civilization. Early critics of the limits-to-growth perspective (Kahn, Brown, and Martel 1976; Simon 1981) argued that nothing should be done to curb current rates of growth since economic expansion inevitably contributes to human progress. Simon contended that since substitutes for scarce resources can always be found, there is no meaningful sense in which resources can be said to be "finite." As copper supplies diminish, for example, silicon fibers can be used as a replacement for copper wires in telephone cables. Scarcity stimulates human progress and human ingenuity has always been able to respond effectively to any shortage of resources. Kahn and his associates are more circumspect in suggesting that growth curves will begin to naturally level off within the next 200 years. While they think that a future steady-state economy is likely, they contend that it will be at fairly high levels of affluence on a global scale.

Faith in the ability of technology to solve environmental problems has been further developed by the proponents of ecological modernization theory — the view that increasing economic growth leads to technological improvements which can effectively solve environmental problems in both developed and developing countries (Mol 2003; for a critical response see York and Rosa 2003). Industrial ecologists (see, for example, Graedel and Allenby 1995; Ayres and Ayres 1996) have also suggested that increases in technological efficiency can reduce both resource consumption and the production of waste. By recycling everything within the industrial system, "dematerializing" products (miniaturization), and improving "industrial metabolism" (energy efficiency), production levels would be high enough to eventually enable people in the third world to enjoy first-world lifestyles. The entire system would be fueled by a yet-to-be-developed hydrogen energy source. Tibbs casts the imperative of industrial ecology in moral terms:

> The scale of industrial production worldwide seems set for inexorable growth. All countries clearly aim to achieve the levels of material prosperity enjoyed in the West, and they intend to do it by industralizing. Since their wish represents market growth to Western companies, and is directly in line with current democratic and economic rhetoric, it seems politically inevitable. Leaving aside environmental concerns, simple equity argues it is also morally unavoidable (1992, p. 5).

Ultimately no matter how efficient and "dematerialized" the economy becomes, however, simultaneous increases in population and per capita wealth will continue to place enormous demands on the environment, which may cancel out any environmental gains made through increased efficiency. Automobile companies may be able to produce cars which use half as much gasoline and emit half as much pollution of as current models, for example. But if a growing economy results in twice as many cars being sold and driven, there will be no overall decrease in either resource consumption or pollution emissions. Paradoxically, increases in efficiency in fact often lead to reduced demand for a particular resource, which results in lower prices, which in turn stimulates greater demand for that resource on the part of people who have previously not had access to it. This phenomenon, known as Jevons Paradox (Polimeni *et al.* 2008), plays itself out in the global economy by allowing developing economies to expand consumption of a particular resource at the same time that consumption of that resource is reduced in developed countries through efficiency gains (see also Alcott 2008). Thus, in the real world, technological improvements typically lead to increased, rather than reduced, consumption of a given resource.

One often-overlooked feature of the limits-to-growth literature cited at the beginning of this section is that it explicitly incorporates technological advances into its computer models and intentionally omits negative variables such as war, social strife, natural disasters, and the like. The limits-to-growth perspective errs, if at all, on the side of optimism. The researchers point out that even if we could double the present energy supply, recycle 75% of other resources, use advanced technology to reduce pollution to one-fourth its present level, and double agricultural production, economic collapse could be only delayed but not avoided within the next century. The only way to achieve true sustainability, according to the authors, is to stabilize population levels and implement a steady-state economy. In the absence of such measures, it can be expected that there will be increased conflict over resources (see also Gedicks 1994; Dobkowski and Wallimann 1998; 2002; Homer-Dixon 1999; Klare 2001), leading ultimately to environmental, social, and economic collapse (see also Lyons, Moore, and Smith 1995; Smith, Lyons, and Sauer-Thompson 1997; Cocks 2003; Mason 2003; Rees 2003).

Beyond the limits

Despite continuing attempts on the part of business and political elites to promote a pro-growth ideology and dismiss the limits-to-growth perspective, the latter is, in Athanasiou's words, " . . . holding up better than its many critics predicted . . . [and] now so strongly corroborated by empirical observation that it is well on its way to becoming the mainstream view" (1996, pp. 61–62). Consider the following statistics related to the five indicators discussed in the limits-to-growth literature:

Energy. Grant (2005, pp. 25–27) estimates that at current rates of consumption oil reserves will be depleted within 60 years; if demand for oil increases at the projected 1.9% per year, however, the time decreases to less than 40 years. Oil production will peak sometime between 2015 and 2025, with dwindling supplies and increased demand leading to dramatic price increases; those who cannot afford the higher prices will simply need to do without. Discoveries of new oil peaked approximately 40 years ago and it is unlikely that major new discoveries will be made. Renewable energy accounts for just 6% of present energy consumption, with solar power representing just 1/1500th of the total. Trainer (2009) contends that while the development of renewable energy will undoubtedly be necessary to provide for basic necessities in the future, it is unlikely to be able sustain current levels of consumption, let alone allow an increasing world population to attain high consumer lifestyles. (For more on "peak oil" and the unlikelihood of developing adequate alternative energy sources to support a consumer society see Heinberg 2003; 2004).

Pollution. By the middle of this century it is likely that CO_2 levels will reach 600 ppm (part per million), up from a level of 270 ppm in the pre-industrial period, mostly due to human-related actions such as deforestation and the burning of fossil fuels. Temperatures are expected to rise by from 3.5° to 7°C, causing sea levels to rise by one to two meters (Gowdy 1998, pp. 65–66). According figures from the Intergovernmental Panel on Climate Change, cited by Trainer (2009, p. 19), CO_2 emissions must be reduced to one gigatonne per year (Gt/y) by 2100 just to stabilize CO_2 levels below 450 ppm (although, as Trainer notes, problems related to climate change are already occurring at current levels of 380 ppm). If world population reaches 9 billion by 2100, each individual would be permitted to use only about 150 kg of fossil fuel per year at equal rates of consumption. At present people in developed countries consume about 6 tons of fossil fuel per year, which means that they would need to reduce their consumption to about 2–3% of the present rate (i.e., reduce consumption by 97–98%). The Kyoto Protocol's call for reductions in the range of 5–7% is clearly inadequate, not to mention the fact that CO_2 levels have actually increased, rather than decreased, since the signing of the protocol.

Food production. Montgomery (2008, p. 18) writes that while we are currently using 1.5 billion hectares of land to produce food for 6 billion people, which is about 0.25 hectares of land per capita, the amount of available cropland is expected to decline to less than 0.1 hectares of land per person by 2050. Mason (2003, p. 42) indicates that topsoil losses currently amount to more than 20 billion tons per year, mostly due to erosion, and that millions more of acres of land are being destroyed as a result of overcropping, salination, and other problems. If current trends continue approximately two-thirds of the world's arable land will be damaged and one-third seriously depleted by 2030. Moreover, since most agricultural production currently depends on oil, not only for plowing and harvesting but also for fertilizer and transportation, current farming methods are unsustainable. One estimate cited by Mason (2003, p. 9) suggests that without oil, crop yields would fall dramatically and enough food could be produced to feed only 2 billion people.

Population. The world's population doubled during the period 1750 to 1900 and doubled again from 1900 to 1950. In 1900 there were 1.7 billion people on earth, but by 1990 there were 5.3 billion. The amount of time it takes for world population to double is also getting shorter — in 1800 it took more than one hundred years; now it takes only thirty-eight years (Dobkowski and Wallimann 1998, p. 6). While it is impossible to accurately predict future population growth, it is possible to consider the impact that an increasing number of people will have on the earth's resources. Kates, Turner, and Clark (1990, p. 14) estimate if the world's population reaches 10 to 12 billion by 2050, agricultural production will need to be increased three to four times and energy consumption six to eight times. Trainer (2009, p. 19), expecting there to be 9.4 billion people on earth in the year 2070, suggests that if each of them were to have the same standard of living as people in rich countries would have at an annual growth rate of 3%, the total economy would be need to be 60 times greater than it is now — a figure which is clearly unsustainable.

Industrial output. Despite the figures just noted, increasing economic growth continues to be pursued as a policy goal by nearly every country of the world. On the one hand, both capitalist and Marxist views of development are premised on the idea of continued economic growth, and we do not yet have consensus on an alternative economic system which can provide for the needs of all the earth's inhabitants in an ecologically sustainable manner. On the other hand, people in both developed and developing countries continue to be seduced more by the trinkets and toys of a high-consumer lifestyle than by the need to conserve the resources necessary simply to sustain life. In any event, the future we are being led towards by the pied pipers of economic growth is explicitly not one of greater material prosperity for all, but rather one which ultimately results in the collapse of both the environment and civilization as we have known it.

There is, of course, no guarantee that humanity will be able to make the transition to a genuinely ecological society, and in fact there may be good reasons for thinking that attitudes, policies, and practices will simply not be able to change quickly enough to avert disaster. Nonetheless, it is still possible to consider what Trainer refers to as " . . . the general form a society must take if it is to be sustainable, whether we like it or not, and whether or not we think it is achievable" (1998, p. 99, italics omitted). Trainer's views on what such a society would be like are consistent with the goals of the bioregional paradigm:

> If the limits-to-growth analysis of our global predicament is valid, there are four crucial and inescapable implications for the nature of a sustainable society: (1) it must have materially simple life-styles; (2) there must be a very high level of local economic self-sufficiency; most of the things people need must be produced by local labor, land, expertise, and capital; (3) there must be much more cooperation and much less competition than there is in present society; and (4) above all, there must be no economic growth; it must be a steady-state economy. These principles mean fundamental change in life-styles, in the geography of settlements (that is, we must mostly build villages), and in the economy (1998, p. 95).

Arguments against techno-optimism

Whether or not the earth has sufficient resources and sinks to support a growing population at first-world standards of living is, of course, a question that is better settled by science than by ethics. There are no precedents to guide us in our present situation and thus there is a measure of uncertainty as to what may actually happen in the future. Even allowing for the possibility that future technological innovations may ultimately prove the limits-to-growth thesis wrong, the primary question which must still be asked from an ethical view is how we should respond in the light of the uncertain evidence that is presently available. One suggestion would be to adopt a version of the precautionary principle which is similar in form to Pascal's Wager. If we assume that technology will indeed be able to make sufficient advances to ward off the possibility of economic collapse due to declining resources and increased pollution, we lose nothing by following a more prudential course now. If, however, the promised technological advances are not forthcoming and the economy does collapse, we will lose everything by not following a more prudential course now. At minimum we should not plunge ahead with new risks, such as continuing to emit high levels of CO_2 into the atmosphere, until the technologies to deal with them have been developed first.

Several additional arguments can be made against relying on future technological advances to eventually save us from our present problems. First, the idea that past achievements indicate inevitable future success relies on an outmoded Western view of progress which has been increasingly criticized on the grounds that its promises are both unachievable and undesirable (Norgaard 1994). Further, it commits a fallacy of induction in its assumption that human progress is in principle unlimited. There is no inherent reason why rates of progress should follow continuous upward trends. It is entirely possible for resources to be used up in one flashy but short-lived burst of unsustainable economic activity, in which case exponential growth will be an entirely transient phenomenon in human history (*cf*. Hubbert 1993).

It is noteworthy that the figures cited by techno-optimists to support their contention that human welfare is increasing in no way contradict figures documenting environmental degradation (see the debate in Myers and Simon 1994). Reid (1995, p. 5) offers evidence to demonstrate how increases in human population, fossil fuel and other resource consumption, industrial production, agriculture, desertification, salination, pollution, and military expenditure can in fact be directly correlated with decreases in forests, fishstocks, farmland, soils, habitats, species, biodiversity, environmental services, and human diversity. Indeed, it can be argued that the more rapid and spectacular the progress, the faster the decline of natural capital. Past progress, therefore, is no guarantee of future progress.

Second, the future orientation of the techno-optimists serves to divert attention away from our current problems. The apocalypse is not a future event but a present reality. The pie-in-the-sky-by-and-by visions of the techno-optimists can only be sustained by remaining blind to all of the environmental destruction and human suffering that the pursuit of unlimited economic growth is *already* causing. The multifaceted nature of our current eco-catastrophe suggests major structural flaws in the system which cannot be patched up with mere techno-bandaids. If technology alone is the answer, one can legitimately wonder why our problems are getting worse rather than better despite the stupendous amount of technological change that has occurred in the past century. While the limits-to-growth literature indeed paints a bleak view of future if we do nothing to change our present course, its ultimate aim is not to promote pessimism (the idea that "nothing can be done") but responsible action.

Techno-optimism evades responsibility, however, by asking us to place our faith in the *deus ex machina* of future technological advances that are unknown and do not yet exist. This faith rests on what Shrader-Frechette (1981) refers to as the "Myth of Superabundance" (the earth has unlimited resources) and the "Myth of Scientific Supremacy" (science and technology can solve any problem). The limits-to-growth position, to the contrary, is that economic production should be brought *now* within the parameters of sustainability made available by existing technology rather than waiting for future technological advances to save us from ecological collapse. Present resource levels, sink availabilities, technological conditions, agricultural capacities, population levels, etc. make possible certain sustainable and equitable forms of culture but exclude others.

Third, even if progress of the sort envisioned by the techno-optimists is indeed possible, it can only be realized through the systematic destruction of nature. Rather than make do with resources that are locally available and use them in efficient and sustainable ways, we simply move from exploiting one resource to exploiting another, leaving in our wake a decimated planet that may or may not be able to continue supporting human life. Simon, for his part, does not see this as a problem — at one point he speculates on the possibility of moving to other planets when our own has been used up and to other solar systems when the sun finally burns itself out. If, however, we cannot learn to live within the ecological means of a planet that has produced the specific conditions to make life possible not only for humans but also for countless other species, how can we possibly learn to survive on planets which have evolved in ways that are not especially suited for life?

Even if our actions do not result in the eventual collapse of civilization or the extinction of the human species, there is still the questionable morality of the impact that our techno-industrial way of life is having on other lifeforms. While the natural rate of extinction is approximately 1–10 species per year, human activities are currently causing approximately 25,000 species to go extinct annually (Primack 1993, chap. 4). It is estimated that by the year 2020 approximately one-fifth of all plant and animals species could be extinct. The figure could increase to more than half by the mid-21st century (Wilson 1992, p. 278). The claim that human needs can *only* be met through such destruction is simply false. In the context of the modern industrial paradigm biodiversity is being reduced not to satisfy genuine human needs but rather to satisfy inessential wants that are largely based on unexamined presuppositions about what constitutes a "good life." Environmental concerns are entirely compatible with meeting human needs and establishing just societies but only by creating new forms of culture which bring our aspirations for a "good life" into line with what the environment can sustainably support. The problem is not simply how to preserve biodiversity, but rather how to create forms of culture which allow for both human and non-human flourishing.

Fourth, technofix solutions are often politically regressive because they shift attention away from the fundamentally social nature of the problems of poverty, injustice, and environmental degradation. By arguing that such problems can best be solved through technological improvements, the truly radical social, economic, and political changes that would be necessary to bring about a genuinely just and sustainable society can be avoided. Nearly every problem we presently face could be solved using existing technologies if the appropriate changes in our social system were made, *viz.*, reducing overconsumptive lifestyles, distributing wealth more equally, eliminating profitable but unnecessary production, establishing democratic control over the economy, and so forth. It is precisely because such changes would disrupt existing power relations and distributions of wealth that attempts are made to divert attention away from them through promises of technological advances.

Even though it may be possible for the visions of the techno-optimists to be realized through unforeseen technological developments, in the present context they have the appearance of being little more than an apologia for the status quo. There is obvious appeal in a vision of the future which sees high levels of material affluence being achieved by the whole of humanity, but also the lurking suspicion that such a vision is simply postponing the day of reckoning. In any event, techno-optimism does little to actually resolve problems in the here-and-now and may actually serve to divert attention away from alternative solutions which could be immediately implemented with existing technology through social (rather than technological) changes in how resources are distributed and how goods are produced and consumed.

Bioregionalism and appropriate technology

It should not be construed from the arguments offered here, however, that the bioregional perspective is against technology per se. Indeed, many of the models which have been developed by ecologically minded social scientists to assess nature's ability to support a given population at a given standard of living explicitly take both technology and social organization into account. An early example is Duncan's (1959) "ecological complex," which sees four factors — population, organization, technology, and the environment — as interacting with each other in reciprocal ways to make certain forms of society either viable or unviable. More recently Norgaard (1994, p. 27) has proposed a coevolutionary model based on five variables — knowledge, values, organization, technology, and environment — each of which changes in relation to other variables in the system; the appropriateness of technological changes cannot be assessed apart from how they affect and are affected by the other factors. Unlike the Bruntland report, which ignores environmental limits to growth and suggests that growth is constrained only by prevailing forms of technology and social organization (World Commission on Environment and Development 1987, pp. 8 and 43; *cf.* MacNeill, Winsemius, and Yakushiji 1991, which argues that the "limits to growth" should be reconstrued as the "growth of limits"), the ecological models that have been proposed are more comprehensive in that they also factor in environmental limits.

It can be readily agreed with the techno-optimists, however, that the ability of the earth to supply humans with both resources and sinks for industrial activity is not fixed and can be extended by technological advances, resource substitution, and other measures. There is also ample room for improving efficiency levels with regard to resource consumption and for developing better methods for dealing with waste and pollution. Industrial processes which rely on less energy input and maximize human labor efficiency can produce more products with fewer resources (*cf.* Weizsäcker, Lovins, and Lovins 1997). As has been argued, however, gains in efficiency should not be used as an excuse to simply expand economic output. Rather, if the gains which are achieved through increased efficiency are not to be lost, efforts must still be made to reduce overall production and consumption.

The key problem lies in finding forms of technology which are not predicated on expanding economic activity at the expense of nature but rather on developing forms of culture which maintain both human and non-human flourishing. If scarcity is the mother of invention, as Simon argues, placing stricter controls on resource use and pollution generation would not impede but would rather *stimulate* technological innovation since qualitative improvements could only be brought about by improving technological efficiency, not through the continued technological exploitation of nature.

Together with *The Limits to Growth*, the bioregional paradigm suggests that global collapse can be avoided if concerted efforts are made not only to improve technology and reduce population levels, but also to give up the pursuit of economic growth and the "catch-up" model of development and to move towards a sustainable, steady-state economy along the lines suggested by Daly. Bioregionalism is by no means opposed to technological innovation, nor does it advocate a return to Neanderthal lifestyles. To the contrary, it seeks to avert the future collapse of both the economy and civilization while at the same time providing for the basic needs of the world's people in an ecologically sustainable fashion. While a steady-state economy would discourage a minority of the earth's people from indulging in luxurious, overconsumptive lifestyles, it would also insure that everyone on the planet has access to adequate housing, food, health care, and education — needs which many of the world's people are unable to meet even in the present high-growth economy.

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