1 Sustainable Development vs Sustainable Ecosystem

Infinite Earth, Infinite Wants, 'Sustainable Development'

Opening the 1947 Bretton Woods Conference, which set the world on a trajectory of globalization and 'free trade,'[1] the then U.S. secretary of the treasury Henry Morgenthau envisioned 'the creation of a dynamic world economy in which the peoples of every nation will be able to realize their potentialities in peace and enjoy the fruits of material progress on an earth infinitely blessed with natural riches.' Morgenthau called on all present to accept the 'elementary axiom ... that prosperity has no limits. It is not a substance to be diminished by division.'[2]

Morgenthau's declaration was followed up early in 1949 by President Harry Truman's inaugural address, which in turn 'inaugurated the "development age."'[3] Truman declared, 'We must embark on a bold new program for making the benefits of our scientific advances and industrial progress available for the improvement and growth of underdeveloped areas.' He continued,

> For the first time in history, humanity possesses the knowledge and skill to relieve the suffering of [impoverished] people. The United States is preeminent among nations in the development of industrial and scientific techniques. The material resources which we can afford to use for assistance of other peoples is limited. But our imponderable resources in technical knowledge are constantly growing and are inexhaustible ... Our main goal should be to help the free peoples of the world, through their own efforts, to produce more food, more clothing, more materials for housing, and more mechanical power to lighten their burdens ... Experience shows that our commerce with other countries expands as they progress industri-

ally and economically ... Greater production is the key to prosperity and peace.[4]

In Truman's view, the application of technology and skill would transform an otherwise finite earth into an infinite resource that could be drawn upon indefinitely to meet humanity's material wants and needs. Even in the context of rapid population growth, Truman envisaged ever-increasing levels of material prosperity for industrialized and 'developing' countries alike.

In 1986 the General Assembly of the United Nations endorsed Truman's position by declaring development to be an inalienable human right.

In our day the application of science and technology continues to be regarded by many as the means of transforming the earth's crust into an unlimited resource,[5] although now the term 'sustainable development' is frequently invoked in mainstream government and business discourses to soften the proposal – an acknowledgment, at least, that economic growth to this point has proven problematic for the environment. 'Sustainable development,' however, is ambiguous, or polysemous – not quite one of 'the great empty vessels of contemporary political discourse,'[6] perhaps, but a 'motherhood' term nonetheless. As Carley and Christie write, 'There is still substantial disagreement on what [sustainable development] means and how to achieve it.'[7]

Broadly speaking, and at the risk of some oversimplification, there are two antithetical meanings or approaches to sustainable development. The first, the dominant, economically inspired meaning and approach, stems directly from the United Nations' World Commission on Environment and Development (Brundtland Commission), which, in its landmark report, *Our Common Future* (1987), defined 'sustainable development' as policies that 'meet the needs of the present without compromising the ability of future generations to meet their own needs.'[8] An essential component of Brundtland's program was its insistence that 'sustainable development' must entail 'a new era of economic growth'[9] – indeed, 'a five- to tenfold increase in world industrial output' over the next fifty years,[10] a target affirmed by the Secretary General of the Commission two years after publication of the report, who wrote that to achieve sustainability 'a fivefold to tenfold increase in economic activity would be required over the next 50 years.'[11] For the Brundtland Commission, moreover, this 'new growth' was to be based 'on policies that sustain and expand the environmental resource base.'[12] To be sure,

Brundtland did caution that 'Such growth has serious implications for the future of the world's ecosystems,'[13] one inference of which being that growth in the future must be planned more carefully than growth in the past.

Important though that qualification is, there is nonetheless a remarkable consistency, and continuity, of Morgenthau's vision of an infinite earth, Truman's call for 'development' through the application of science and technology and world trade, and Brundtland's call forty years later to expand the world's environmental resource base to achieve a five- to tenfold increase in world economic output over a fifty-year period.

Governments and corporations alike, by and large, accepted with open arms Brundtland's recommendation to sustain economic growth, and in publicity they have emphasized that they are indeed adherents to the program of sustainable development. In its report of 2001 on sustainable development, the Royal Dutch Shell Group, for example, exclaimed, 'We will grow the value of Shell by delivering robust profitability and leveraging our competitive edge. Our success will ensure highly competitive returns to shareholders and give us the financial flexibility to take advantage of new commercial opportunities. Profits are also a vital part of our ability to contribute to society and meet the economic, environmental and social requirements of sustainable development.'[14] In this document, focused on growth and profitability, Shell deployed the phrase 'sustainable development' fifty-five times.[15]

Likewise, in 2002 the International Association of Oil and Gas Producers published *Industry as a Partner for Sustainable Development*, in which the term 'sustainable development' appeared twenty-one times. According to the association,

> The world has moved on in the past decade and so have we. One of the drivers has been the demonstrable relationship between economic growth and greater social well-being and quality of life ... As public awareness grows, our business success is linked to performance in the areas of environmental protection and community affairs. Consequently, concerns in these areas, including assessments on potential social impacts of our activities, are factored into our decision-making processes ... We are companies and we are mandated to comply with the rule of law and regulations and to work in partnership with local authorities and communities to ensure sustainable benefit to all.[16]

In a similar vein, the World Bank's 1992 World Development Report,

Development and the Environment, attributed environmental deterioration mainly to poverty, not economic growth; hence its remedy for a deteriorating environment was not conservation but sustained economic growth – and growth not just in the poor South but in the rich North too. As summed up by former World Bank economist Herman Daly, albeit with irony, 'How else could the South grow if it could not export to Northern markets and receive foreign investments from the North? And how could the North provide foreign investment and larger markets for the South if it in turn did not grow?'[17]

Even a decade later, the World Bank was still championing continuous economic growth as the means to combat environmental degradation. In its 2003 World Deveopment Report, *Sustainable Development in a Dynamic World*, the bank declared that 'rising income can facilitate but not guarantee better environmental and social outcomes by permitting countries simply to "grow out of" pollution or civil conflict.'[18] It continued, 'Even the next 15 years (2003–2018) could bring a record period of economic growth in developing countries. Driven by growth in China and India, income in the low- and middle-income countries will almost double – accounting for more than a third of the 60 percent increase in world output. This period offers the opportunity to lay the foundation for inclusive growth – which will require confronting barriers to change.[19]

However, in its document, possibly for the first time, the bank did acknowledge disquiet on the part of many environmentalists regarding 'overconsumption.' But this concern was alluded to only briefly and in the context of the bank sceptically raising its own questions: 'But what kind of consumption qualifies as overconsumption,' it asked, and 'why is it harmful, and what should be done about it? ... On these questions, there is little clarity.'[20] The unwavering thrust, indeed, of the bank's report on 'sustainable development' was to endorse continual economic growth.

The Canadian government, too, in its 'sustainable development strategies' envisages continued economic growth, and while this is certainly not the only feature of its strategies, it is a major one. Note, for example, the consistency (albeit different emphases) regarding markets and growth in the following extracts from position papers from, respectively, Industry Canada and Environment Canada:

> Industry Canada's third Sustainable Development Strategy (SDS III), for 2003–06, has a vision of Canada as a leader in the development, commercialization and adoption of sustainable development tools, practices and technologies throughout the economy. This vision reflects the Department's mandate to help Canadians be more productive and competitive in the knowledge-based economy and thus improve their standard of living and quality of life. It also subscribes to the view that sustainable development, along with productivity, employment and income growth, is an integral part of growing a dynamic economy.[21]

> The updated Strategy [of Environment Canada] focuses on building a future shaped by a strong knowledge base that puts human and natural capital on an equal footing with economic capital, informs public debate and ensures integrated decision making. The Strategy calls upon the strategic use of market forces to ensure that good economic policy becomes good environmental and social policy. It emphasizes partnerships and governance models that enable horizontal decision making at the government, community and corporate levels. And, finally, the Strategy requires leadership by example in our departmental operations.[22]

In fact, by year's end 2004 so entrenched was the economic growth thrust of Canada's 'environment' strategy that the country's newly appointed minister of the environment, Stéphane Dion, was recommending to Cabinet colleagues that his department be renamed the Department of Sustainable Economy.[23]

In the dominant business and government perspective, then, 'sustainable development' is in large measure a code phrase for sustaining economic growth. This growth entails, in part, tapping new markets and new resource bases. It is, in large part, Morgenthau's doctrine of an infinitely expandable earth all over again.

The advisability and/or feasibility of expanding the resource base indefinitely is, of course, a major bone of contention between those that interpret sustainable development as privileging 'economic' ideas and goals, such as Royal Dutch Shell, Brundtland, the World Bank, and the government of Canada, and many ecologists and environmentalists. According to the environmental group Friends of the Earth, for instance, 'To achieve sustainability we ... need to reduce the total burden we place upon the environment to a sustainable level by cutting back on the amount of environmental resources, distribute access to those environmental resources fairly, and use them to increase quality of life.'[24] In 2003, Friends of the Earth responded directly to Royal Dutch Shell's publication on sustainable development with a document enti-

tled 'Shell Record Profits at Expense of People, Planet.' There, Friends declared,

> Shell today boasted record profits for the first quarter of 2003, as well as the 'highest hydrocarbon production in recent history.' While Shell's directors and shareholders will be celebrating the figures, the profits may generate less enthusiasm among poor, vulnerable communities around the world whose health and local environment is suffering as a result of Shell's ageing and polluting refineries and depots. Shell's underlying profits in the first three months of the year almost doubled to a record 3.91 billion US dollars. Net income is up a massive 136% on the same period last year, to $5.3 billion. The news comes just one week after its Annual General Meeting was dominated by representatives from communities around the world who are suffering as a result of living next to the company's polluting refineries.'[25]

Friends of the Earth is certainly not alone among environmental advocates in maintaining that an ecologically sound economy can by no means tolerate indefinite economic growth. Lester R. Brown, president of the Earth Policy Institute, writes that 'an economy is sustainable only if it respects the principles of ecology.'[26] He adds, 'The larger the economy becomes relative to the ecosystem, and the more it presses against the earth's natural limits, the more destructive this incompatibility [between economy and ecosystem] will be.'[27] Brown provides no hint that human skills and technology can transform the earth's crust into an infinite resource.

Likewise, ecologist Robert Goodland cites evidence indicating that the economy, even at the time of the Brundtland Report, was too large vis-à-vis the ecosystem. He estimates that the human economy then used, directly or indirectly, 40 per cent of the net primary product of terrestrial photosynthesis (plant growth). Disregarding future desertification, urban sprawl, soil erosion, blacktopping of agricultural land, and pollution, this means that with only a single doubling in world population (in the absence of fundamentally altered consumption patterns – for example, a marked increase in vegetarianism – within just thirty-five years humans would be using 80 per cent of plant growth.[28]

Ecological economist Herman Daly has drawn perhaps the clearest distinction between the two views of sustainable development. Whereas business and corporate interests touting sustainable development equate 'development' with 'growth,' Daly insists that 'development' and 'growth' are by no means synonymous. For him, rather, 'development'

means *qualitative* improvement, including, but not limited to, improvements in resource efficiency, whereas 'growth' means *quantitative* increase in resource use. For Daly, in fact, 'sustainable development' implies *no growth* 'beyond environmental carrying capacity.'[29] He adds, 'The whole idea of sustainable development is that the economic subsystem must not grow beyond the scale at which it can be permanently sustained or supported by the containing ecosystem.'[30] 'Development,' then, for Daly entails 'moral growth,' not quantitative increase; in his view, 'future progress simply must be made in terms of the things that really count rather than the things that are merely countable.'[31]

For Greenpeace, likewise, government and corporate rhetoric on 'sustainable development is, more often than not, merely a public relations scam: 'Governments pay lip service to environmental protection, while supporting economic growth – at least for the rich countries – above all else. The gap between rich and poor continues to increase in both developing and industrialised countries, and there are billions without access to the basics required to improve their lives. While people in industrialised countries buy more, and multinationals grow richer, natural environments – particularly those in developing nations – degrade rapidly.'[32] Interestingly, however, to more effectively prod governments and corporations into positive action on climate change, Greenpeace partnered with the World Business Council for Sustainable Development (WBCSD),[33] which describes itself as 'a coalition of 170 international companies united by a shared commitment to sustainable development via the three pillars of economic growth, ecological balance and social progress.'[34]

In any event, we see that 'sustainable development' carries different, often antithetical, meanings for those intent on sustaining economic growth as opposed to those who see a growing economy as a major threat to ecosystem vitality. The term 'sustainable development,' then, is emblematic of at best a precarious, if not indeed a false, synthesis in our day between ecology and economics, between environment and development.

Origins of 'Sustainable Development'

How and why did the rhetoric of 'sustainable development' arise and grow to such prominence over the last two decades? Certainly environmental discourses and the appreciation of pristine nature are of long standing and are readily detected even in writings from antiquity – in

works by Lucretius, Aristotle, Theophrastus, and Virgil, for example. In the England of the 1800s, likewise, Romantic poets such as William Wordsworth and Percy Bysshe Shelley were paying homage to periwinkles and skylarks even as William Blake was denouncing the 'dark Satanic mills' of the Industrial Revolution; meanwhile, Gilbert White was making acute observations about the interdependence of all wildlife at Selborne. In the New World of the 1800s, too, the poetry of Walt Whitman and Ralph Waldo Emerson provided sublime accompaniment to the paeans to nature of Henry David Thoreau and George Parkins Marsh – counterpoints all to the then-dominant discourse of 'subduing, conquering, transforming, and controlling nature to man's purposes.'[35] In the early 1900s, U.S. president Theodore Roosevelt, by setting aside 150 million acres for national forest reserves and establishing five national parks and fifty-one refuges for wild birds, manifested the then-current progressive, conservationist outlook.[36] (On the other hand, it must be noted, the early twentieth-century American conservation movement was in large measure utilitarian, 'conservation' even being defined by the Chief Forester of the United States in 1905 as 'the development and use of the earth and all its resources for the enduring good of men';[37] as intellectual historian Donald Worster notes, one of the less laudable aspects of the conservation movement was a concerted effort to eradicate wolf, puma, and grizzly populations, and other 'noxious' wildlife.)[38] Given all this, both positive and negative, we must nonetheless agree with Neuzil and Kovarik when they note that an environmental awareness certainly existed long before 1962.[39]

Nonetheless, 1962 was a watershed year in terms of environmentalism. In the years leading up to 1962, notes former U.S. vice president Al Gore, '"environment" was not even an entry in the vocabulary of public policy.'[40] Exactly why environmental awareness and concern had dwindled to such an extent is subject to conjecture; perhaps two world wars, the Great Depression, the Cold War, and the economic boom of the 1950s, coupled with mass media's continual propagation of consumerism and lifestyles, induced people to focus on other, seemingly more pressing matters. Very likely the Darwinian revolution, positing an amoral nature 'red in tooth and claw,' had debased nature in the eyes of many to such an extent it was no longer to be admired, revered, or preserved.[41] Or perhaps, with Harry Truman, people actually believed that science and technology could transform the earth into an infinite repository of want-satisfying resources. Regardless of reasons Rachel Carson's *Silent Spring*, published in 1962, awakened the United States and much

of the rest of the world to a renewed environmental awareness, thereby inaugurating the modern environmental movement. This was, according to Alex MacGillivray, 'the green manifesto that made ecology a household name'; it was 'by general consent, the first – and remains the only – manifesto on environmental issues.'[42] The story of Carson's book, and the tribulations of its author, are emblematic of certain themes in this present work.

Rachel Carson (1907–64) received bachelor's and master's degrees in zoology, the latter from Johns Hopkins University. For a time she taught university biology. In 1936 she became the first woman to take and pass the test for the U.S. civil service. Hired initially as a junior marine biologist with the U.S. Bureau of Fisheries, she rose through the ranks to become the chief editor of publications for the U.S. Fish and Wildlife Service. Evenings and weekends, though, she was an author – of three books, including the bestselling tome *The Sea Around Us*.[43] The remarkable success of that volume enabled her to forsake her civil-service post for full-time writing.

In her acknowledgments, Carson relates that she wrote *Silent Spring* in response to a letter from a friend, Olga Owens Huckins, which ascribed the deaths of birds in a sanctuary at Cape Cod to indiscriminant aerial spraying of the chemical, DDT. DDT had, in fact, concerned Carson as early as 1945 when she unsuccessfully proposed an article on the topic to *Reader's Digest*. Over the ensuing years she amassed a substantial dossier on the substance.

DDT (dichlorodiphenyltrichloroethane) was developed in 1939 and was widely used as a pesticide by the U.S. Army in the South Pacific during World War II to prevent typhus and malaria. So effective was the chemical in averting disease, its developer, Paul Muller, won the Nobel Prize in medicine and physiology in 1948. After World War II, on account of its low cost (22 cents per pound) and its seeming safety, this 'miracle compound' and related herbicides and pesticides were adapted widely for civilian use – particularly for agricultural applications. In the United States, DDT useage soared, peaking in 1959 at 35 million kg.[44] According to researchers at Case Western Reserve University, both governments and the chemical industry aggressively promoted its use. The U.S Public Health Department held demonstrations purporting to show DDT's safety and effectiveness.[45] Soon, public places and private backyards alike were routinely sprayed. The pesticide industry burgeoned – $200 million of pesticides were sold in 1958, the year Carson began her manuscript, and by 1962, the year of its publication, sales had soared to about $500 million.

In the first chapter of *Silent Spring*, entitled 'A Fable for Tomorrow,' Carson asked her readers to imagine 'a town in the heart of America where all life seems to live in harmony with its surroundings.' She painted images of white clouds, of bloom in the spring, of green fields in the summer, of a blaze of colour in the fall with foxes barking in the hills and deer silently crossing fields half hidden in the morning mists.[46] But then, she wrote, an evil spell settled on the community, a blight crept over the area, and everything began to change: domestic animals grew sick and expired; people grew ill; children were suddenly stricken and died in a few hours; the few birds that remained alive trembled violently and could not fly; apple trees came into bloom but there were no bees to pollinate them. 'In the gutters,' she continued, 'under the eaves and between the shingles of the roofs, a white granular powder still showed a few patches; some weeks before it had fallen like snow upon the roofs and lawns, the fields and streams.' Carson finished her fable by remarking, 'No witchcraft, no enemy action had silenced the rebirth of new life in this stricken world; the people had done it themselves.'[47]

Rachel Carson termed her story a fable. But it was not fiction. Like all fine myths, it generalized a multitude of actual occurrences: from Hinsdale, Illinois, to the Appalachian region of West Virginia, from the campus of Michigan State University to Whitefish Bay, Wisconsin, from Toledo, Ohio, to Syracuse, New York, birds *had* been silenced. 'Over increasingly large areas of the United States,' she summarized, 'spring now comes unheralded by the return of birds, and the early mornings are strangely silent where once they were filled with the beauty of bird song.'[48]

Rachel Carson described how DDT entered the trophic, or nutritional, structure, accumulated in the fatty tissue of animals, and rose up the food chain in ever-increasing concentrations (a process called *biomagnification*). She proposed that genetic damage, cancers, reproductive incapacities, and birth defects ensued. Carson claimed that although former scourges to human health – disease organisms such as smallpox, cholera, and plague – had been largely eradicated, the new hazards were ones that 'we ourselves have introduced,' namely, 'radiation in all its forms,' and the 'never-ending stream of chemicals,' of which pesticides like DDT are a part.[49] 'Their presence,' she declared, 'casts a shadow that is no less ominous because it is formless and obscure, no less frightening because it is simply impossible to predict the effects of lifetime exposure to chemical and physical agents that are not part of the biological experience of man.'[50]

The term 'ecology' does not appear often in Rachel Carson's book, although central ideas denoted by the word (the web of life, holistic analysis, interdependence, dynamic change, interacting populations, and so on) indeed permeate her thought. Her amplification of the term, however, is particularly compelling: 'There is also an ecology of the world within our bodies. In this unseen world *minute causes produce mighty effects*; ... a change at one point, in one molecule even, may reverberate throughout the entire system to initiate changes in seemingly unrelated organs and tissues.'[51] These remarks are poignant because, in the early spring of 1960, Carson was diagnosed with breast cancer. In April she underwent radical mastectomy, and continued to be treated through radiation until her death on 14 April 1964.

Portions of *Silent Spring* initially appeared in serial form in the *New Yorker*, and received immediate, serious attention: President John F. Kennedy ordered the Science Advisory Committee to study the effects of pesticides. The committee's report, issued in 1963, vindicated Carson, as it called for the eventual elimination of the use of persistent toxic pesticides and for greatly augmented federal research. In 1965 the President's Advisory Committee published *Restoring the Quality of Our Environment*, cataloguing pollution problems and their effects on human and environmental health. In 1969 the U.S. Congress passed the Environmental Policy Act, and in 1970 President Richard Nixon created the Environmental Protection Agency (EPA). In 1972–3, also, there was a flurry of activity: the use of DDT was banned in the United States, and many credit this action as being instrumental to the resurgence of such nearly extinct species as the peregrine falcon, the bald eagle, and the osprey. As well, the Endangered Species Act, the Clean Air Act, and the Clean Water Act were passed to establish regulatory safeguards and enable environmentalists to use the courts to protect wildlife, air, and water. But perhaps most significantly, Carson and her book implanted an awareness of certain environmental issues. Her book, certainly, was an instance in which a 'minute cause' produced a 'mighty effect.'

Prior to its publication in book form, however, *Silent Spring* provoked the chemical industry to rise up in arms. The Velsicol Chemical Corporation, for example, demanded that Carson's publisher, Houghton Mifflin, halt publication on account of purported inaccuracies and remarks disparaging two of the company's products. Carson's character was impugned through informal gossip. Her motives, competence, integrity, and sanity were all questioned. She was referred to derisively as 'a spinster,' 'a priestess of nature,' 'a fanatic,' and 'hysterical.' Upon publication, chemical giant Monsanto distributed a pamphlet to the various media

parodying her book; entitled *The Desolate Year*, it described a world without chemical pesticides as being devastated by famine, disease, and insects. A major environmental public relations firm, whose clients included Monsanto, Dow Chemical, and the Agricultural Chemical Association, distributed damning reviews of the book to the press.[52] Meanwhile, chemical companies threatened to withdraw advertisements from publications carrying favourable reviews,[53] so great was the conflict in Carson's day between business and the environment, between economics and ecology.

While in some respects Carson won a great victory over powerful opposition, at another level she was far from victorious. Although use of DDT was banned in the United States, production for export continued apace. Moreover, as noted by Al Gore, the use of 'narrow spectrum' herbicides and pesticides, even more 'potent' (i.e., deadly) than DDT, escalated, and some tie this increase to alarming growth in the incidences of breast and testicular cancers. Even more basically, however, the thrust of Carson's book, which transcends the particular issues of DDT and other pesticides, has in practice been disregarded by large segments of the public, industry, and government.[54] Carson, most basically, disputed a main tenet of modern civilization, namely, 'that man ... [is] properly the center and the master of all things, and that scientific history [is] primarily the story of his domination.'[55] This orthodoxy, dating at least to the writings of Francis Bacon (1561–1626), if not indeed to Protagoras (c. 480–410 BC),[56] remains our culture's 'common sense, even though ecosystem tragedies should have made readily apparent to all the problematic nature of the doctrine. Carson, though, was explicit and insistent in denouncing this dominant world view. She concluded her book with these words: 'The "control of nature" is a phrase conceived in arrogance, born of the Neanderthal age of biology and philosophy, when it was supposed that nature exists for the convenience of man. The concepts and practices of applied entomology for the most part date from that Stone Age of science. It is our alarming misfortune that so primitive a science has armed itself with the most modern and terrible weapons, and that in turning them against the insects it has also turned them against the earth.'[57]

The contrast between the position of Rachel Carson and that of Harry Truman could hardly be more stark.

'Sustainable Development': Fragile, or False, Reconciliation?

In 1972 the United Nations held the first international conference on the environment (the Stockholm Conference), declaring: 'In our time,

man's *capability* to transform his surroundings, if used wisely, can bring to all peoples the *benefits of development* and the opportunity to enhance the quality of life. Wrongly or heedlessly applied, the same power can do *incalculable harm* to human beings and *the human environment*. We see around us growing evidence of man-made harm in many regions of the earth.'[58] With this statement the UN proposed, in effect, a fundamental antithesis between environment and development, which is to say (at least with a narrow rendering of 'development') between ecosystem and economy, and by implication between ecology and economics. Although the term, 'sustainable development,' had yet to be invented, its basic thrust – meeting today's needs without sacrificing the capacity of future generations to meet theirs – was set forth, probably for the first time in an official policy document, as an approach to resolving both the world's economic woes and its burgeoning environmental crises. The UN Declaration continued, 'The natural resources of the earth, including the air, water, land, flora and fauna and especially representative samples of natural ecosystems, must be safeguarded *for the benefit of present and future generations* through careful planning or management, as appropriate.'[59]

A decade and a half later, with the report of the UN's World Commission on Environment and Development (Brundtland Commission), the proposal that economic growth and environmental health can be reconciled through careful planning and management was officially assigned the term 'sustainable development.' Remarking that 'many present development trends leave increasing numbers of people poor and vulnerable, while at the same time degrading the environment,'[60] the Brundtland Commission asked how 'development' could possibly serve the world in the next century, in which twice as many people would be relying on the same resource base. The issue, as the commission saw it, was to devise policies and revise activities that would bring about *development* that would be *sustainable* into the indefinite future for the entire planet.[61] As noted above, an essential aspect of its 'solution' was an expansion of the Earth's resource base to help bring about 'a new era of economic growth.'

Since 1987 the term 'sustainable development' has become a catchphrase of governments, transnational corporations, and some environmentalists. In 1994, for example, the Canadian Parliament established the National Round Table on the Environment and the Economy as 'an independent advisory body'[62] with a mandate 'to explain and promote sustainable development.'[63] Sustainable development, moreover, is an

explicit goal of Canada's Environmental Assessment Act. As well, tabled in Canada's Parliament every three years are 'sustainable development strategies,' described as 'important tools that help guide departments and agencies within the Government of Canada in systematically integrating the principles of sustainable development into their policies, programs, legislation and operations.'[64]

Internationally, sustainable development is said to form a cornerstone of both public policy and corporate decision-making. In late August 2002, for example, the World Summit on Sustainable Development, held in Johannesburg, South Africa, assembled heads of state and leaders from government, industry, and civil society to reaffirm the commitment to sustainable development that had been made at the Earth Summit in Rio de Janeiro ten years earlier.[65] At the close of the conference, however – fifteen years after Brundtland's initial call for sustainable development and a decade subsequent to the Rio Conference – the UN issued a press release that began 'In the face of growing poverty and increasing environmental degradation, the World Summit has succeeded in generating a sense of urgency.'[66] It would seem from this statement, and more importantly from evidence cited immediately below regarding environmental deterioration, that attempts to safeguard the earth's ecosystems for future generations have met with at best limited success. It is suggested here, therefore, that the meanings businesses and governments assign sustainable development – predominantly that of expanding the earth's resource base to sustain economic growth – may well be a large part of the problem. Environmentalist Donella Meadows expresses the problem this way: 'A society that refuses to consider the idea that there are limits to growth is not going to bring forth a physical economy that fits within the constraints of the planet. A society that thinks there's an 'away' to throw things into is going to find itself choking on its own waste.'[67]

As a society and a culture, by and large, we continue to reject the idea that there are limits to growth. Corporate and governmental proposals for sustaining economic growth find ready support in the writings of many academics. Even Mark Sagoff, a philosopher of environmental ethics at the University of Maryland, declared baldly: 'It is simply wrong to believe that nature sets physical limits to economic growth – that is, to prosperity and the production and consumption of goods on which it is based.'[68] We will return on several occasions to Sagoff in the course of this book.

Likewise Julian Simon, until his death in 1998 a professor of business, also at the University of Maryland, insisted, 'The term "finite" is not only inappropriate but is downright misleading when applied to natural resources, from both the practical and philosophical points of view ... The more we use, the better off we become – and there's no practical limit to improving our lot forever.'[69] Sagoff and Simon, and others,[70] provide philosophical or theoretical support for the corporate/governmental program of sustaining economic growth indefinitely by insisting that the earth is infinite in its capacity to satisfy humans' material wants. They justify this claim essentially through a single line of argument, namely that resources, materials, the capacity of the planet to absorb wastes, are all a function of human knowledge and technology, which in principle can grow forever; furthermore, the price system effectively guides human innovation to counter scarcities.

We will have occasion in later chapters to critique this proposition, both in terms of the purported lack of constraint on human knowledge and technology, and the alleged efficacy of prices in guiding human endeavours in environmentally benign ways. For now, however, it suffices to turn to environmental indicators that fly in the face of the doctrine of an infinite earth, given centuries during which humans have applied knowledge and technology as guided by the price system.

Ecosystem Crises

Species Extinctions

At one time, at least in the context of the New World, the presumption that the earth is capable of sustaining economic growth indefinitely, although inaccurate, would at least have been understandable. When Europeans like Samuel de Champlain and John Cabot began exploring North America in the fifteenth century, cod were so plentiful at the Grand Banks off Newfoundland that they could be 'scooped out of the sea with buckets.'[71] Similarly, as late as 1854 a resident of New York State could write: 'There would be days and days when the air was alive with [passenger pigeons], hardly a break occurring in the flocks for half a day at a time; flocks stretched as far as a person could see, one tier above another.'[72] By the time of Morgenthau's speech in 1947, of course, the passenger pigeon – a bird that once numbered perhaps 5 billion – was extinct. The New World, evidently, was not large enough to sustain them! And today, as all Newfoundlanders know only too well, the cod-fishery is dead.

In fact, species extinctions have reached alarming proportions. According to the United Nations Environment Programme, 'global biodiversity is changing at an unprecedented rate, the most important drivers being land conversion, climate change, pollution, unsustainable harvesting of natural resources and the introduction of exotic species.'[73] Whereas the rate of extinctions during the past 600 million years averaged perhaps one species per year, present extinction rates, according to Oregon State University biologist Bruce Coblentz, are 'hundreds or even thousands of times higher.'[74] Estimates are that currently as many as five plant species become extinct every day; extinction rates of animal species are even higher. According to the World Conservation Union (IUCN):

- 15,589 animal or plant species are known to be threatened with extinction
- 1.9 million animal or plant species have been described out of an estimated 5–30 million species that exist
- One in every four mammals and one in every eight birds is facing a high risk of extinction in the near future
- One in three amphibians and almost half of all tortoises and freshwater turtles are threatened
- The total number of threatened animal species increased from 5,205 in 1996 to 7,266 in 2004[75]

The IUCN further estimates that by the mid-1990s, 12.5 per cent of vascular plants and 34 per cent of fish were threatened with extinction; of the 11,000 threatened species, 18 per cent were 'critically endangered.'[76]

From a biocentric viewpoint, loss of biodiversity is a tragedy of immense proportions. Even from an anthropocentric point of view it is hugely problematic. As ecologist David Suzuki has emphasized, 'Life itself has created the conditions hospitable to all creatures,' and species diversity enables life to continue and to diversify.[77] Environmental philosopher Mark Sagoff, however, citing biologist David Ehrenfeld, has dismissed the ecosystem importance of species extinctions with the following argument: 'There is no credible argument, moreover, that all or even most of the species we are concerned to protect are essential to the functioning of the ecological systems on which we depend. If whales went extinct, for example, the seas would not fill up with krill ... [Indeed] the species most likely to be endangered are those the biosphere is least likely to miss. "Many of these species were never common or ecologically influential; by no stretch of the imagination can we make them out to be vital cogs in the ecological machine."'[78] Sagoff here presumes an ecosystem is like a machine, a dubious analogy addressed later on in this book. But even apart from that, he misses the main point. Granted, few species by themselves are vital for the effective functioning of the biosphere. When thousands of such species become extinct, however, biodiversity is reduced to such an extent that ecosystems become damaged irreparably.

Degradation of Arable Land

According to the United Nations Environment Programme, 23 per cent of all the earth's useable land (land excluding mountains and deserts) has been significantly degraded, the major causes being deforestation, overgrazing, agricultural mismanagement, urban growth, and industrialization.[79] About 2 billion hectares of soil (15 per cent of the earth's land – an area larger than the United States and Mexico combined) have been degraded through human activities. The UN Environment Programme notes that land is not only 'finite, fragile, and non-renewable,' but also that it 'aids in the preservation of terrestrial biodiversity, regulation of the hydrological cycle, carbon storage and recycling.'[80] The UN Environment Programme concludes that despite attempts to decrease soil erosion, 'there is no clear indication that the rate of land degradation has decreased.'[81]

Global Warming, Greenhouse Effect

According to the Intergovernmental Panel on Climate Change (IPCC), the 1990s was the warmest decade, and 1998 the warmest year, since measurements began in 1860. The IPCC calculates that average global surface temperature increases since 1900 of 0.3 to 0.6 degrees Celsius are attributable directly to human activities. These temperature increases have been accompanied by large decreases in snow cover and a rise in the sea level of ten to twenty centimetres.[82]

Temperature increases have been accompanied by significant increases in greenhouse gas emissions, particularly CO_2. Since 1750, atmospheric concentrations of carbon dioxide have risen by 31 per cent, and more than half of this increase has occurred within the last fifty years. Based on projected increases in CO_2 emissions, the IPCC

anticipates that global average temperatures will rise by 1.4 to 5.8 degrees Celsius between 1990 and 2100. The average sea level is predicted to increase between 9 and 88 cm. Snow cover, sea ice, ice caps, and glaciers are expected to shrink. Moreover, 'even after greenhouse gas concentrations are stabilized, climate change will persist for many centuries, with surface temperature and sea level continuing to rise in response to past emissions.'[83] It is also anticipated that global warming will cause lengthened growing seasons in mid- to high-latitude regions, shifts in plant and animal ranges, and declines in animal and plant populations. Also endangered are glaciers, coral reefs, boreal and tropical forests, polar and alpine ecosystems, prairie wetlands, and remnant native grasslands. There is an increased risk of flooding for tens of millions of people due not only to rising sea levels, but also increased precipitation. Increases in the occurrence of droughts, floods, heat waves, avalanches, and windstorms are projected. Crop yields are expected to decline in most tropical and subtropical regions, and water is anticipated to become increasingly scarce in the subtropics.

Toxins in Air and Water

Unfortunately, there are no measures of the accumulation of toxins in the environment. Farmers worldwide, however, apply 2.5 million tons of pesticides, mainly synthetic chemicals, to crops annually. These pesticides 'are orders of magnitude more toxic than 50 years ago.'[84] According to the United Nations, contaminated water kills an estimated 2.2 million people a year and the effects of air pollution take 3 million lives annually around the world.[85] In Ontario, air pollution kills an estimated 1,900 people annually and costs the medical system about $1.1 billion annually.[86] Persistent organic pollutants (POPs) are long-lived toxins that collect and concentrate in the food chain. One of the major environmental achievements in the decade following the Rio Conference (1992) was the signing in Stockholm in May 2001 of the Convention on Persistent Organic Pollutants. The treaty bans production of ten POPs and specifies reduced emissions of two industrial by-products. The production of other POPs, such as polyvinyl chloride (PVC), however, continues apace. Nearly 25 million tons of PVC, associated with cancer, were produced in 1999. It is noted that every stage of the life cycle of PCV, from manufacture to disposal, creates 'dangerous chemicals, including some POPs.'[87]

Efforts have been made recently to measure the presence of chemical

toxins in the human body. According to the U.S. Centers for Disease Control and Prevention, as published in its *Second National Report on Human Exposure to Environmental Chemicals* (January 2003),[88] pesticides were present in all the people tested. In releasing the report, experts speaking on behalf of the Department of Health and Human Services made the following points, among others:

- Overall, for specific chemicals, we have a mixed picture, some encouraging findings and some of concern. For lead, some encouraging data.
- Chlorpyrifos is an organophosphate pesticide that has been used heavily in the United States. Retail sales of chlorpyrifos for residential use were stopped in December 2001 ... Our data show that levels of chlorpyrifos in children are about twice as high as those in adults.
- The report presents serum levels of dioxins, furans and coplanar PCBs, polychlorinated biphenyls. In terms of their toxicity, furans and coplanar PCBs are dioxin-like compounds. All of these chemicals persist in the environment and in the human body for years. Most people who were tested for these compounds had levels of dioxins, furans and coplanar PCBS that were below the detection limits of our analytical method. These findings are encouraging and consistent with other data, indicating exposure to these chemicals has been declining in the past two decades.
- Phthalates are chemicals found in many consumer products including vinyl flooring adhesives, detergents, lubricants, food packaging, soap, shampoo, hairspray, nail polish, and all kinds of flexible or soft plastics. Animal testing has shown reproductive toxicity for some phthalates. The second report presents levels of seven separate metabolites or breakdown products of phthalates. One metabolite, monoethyl phthalate, tracks exposure to dimethyl phthalate, commonly used in personal care products such as soap, shampoo and cosmetics. The second report documents that levels of monoethyl phthalate were lower among children than among adolescents or adults. Another metabolite, mono 2 ethylhexel [ph] phthalate, tracks exposure to Dy 2 [ph] ethylhexel phthalate, which is commonly found in flexible or soft plastic products. Levels of mono 2 ethylhexel phthalate showed a different trend and were higher among children than among adolescents or adults. No generally recognized guidelines that indicate threshold values for adverse effects are yet available for levels of these phthalate metabolites.
- DDT was widely used in the United States until EPA banned its use in 1973. However, DDT is still being produced and used in limited quanti-

ties in other countries. Both DDT and DDE – a major metabolite – persist in people and persist in the environment. The second report presents data showing serum levels of DDE that are three times higher in Mexican Americans than in either non-Hispanic whites or non-Hispanic blacks. Additionally, DDE levels were clearly measurable in people aged 12 to 19 years, even though people in this age group were born after DDT was banned in the United States. The national toxicology program has classified DDT as reasonably anticipated to be a human carcinogen. As yet, no generally recognized guidelines that indicate threshold values for other adverse effects are available. On the encouraging side, compared with levels found in several small studies of DDT exposure in selected groups in the United States before 1990, the DDT and DDE levels in the report are clearly lower.[89]

While the U.S. government agency reporting results found reasons both for encouragement and for concern, the activist organization Pesticide Action Network North America (PANNA) found little reason for optimism. It noted that the test results showed that

All but five of the 23 pesticides and pesticide metabolites evaluated in this report were found in at least half of the study subjects. Among those tested for pesticide residues in both blood and urine, the average person had 13 pesticides in his or her body. Two chemicals found in nearly all the test subjects were TCP, a metabolite of the insecticide chlorpyrifos (found in 93% of those tested), and *p,p*-DDE, a breakdown product of DDT (found in 99% of those tested). Based on these data – which present results from testing for only a fraction of the pesticides that individuals are actually exposed to – it is clear that most people in the U.S. carry a significant body burden of pesticides and pesticide metabolites.[90]

Turning now to Canadian data, in December 2004 Pollution Watch (a joint undertaking of Environmental Defence and the Canadian Environmental Law Association) issued a report on trends in toxic emissions. Based on data released by Environment Canada, the study, *Shattering the Myth of Pollution Progress in Canada*, revealed the following:

- From 1995 to 2002 the amount of toxic pollutants reported released and transferred increased by 49%. Air releases increased by 21% and water releases increased by 137%.
- While air releases of chemicals designated as toxic under the *Canadian Environmental Protection Act* (CEPA) and carcinogens have decreased (4% and 22% respectively), air releases of pollutants associated with reproductive and developmental harm have increased 10% from 1995 to 2002.
- Releasing chemicals into the air is still the main method of dealing with waste in Canada. In fact, of all chemicals generated at company sites, 71% ended up in the air in 2002, a total of 3,868,302,111 kilograms.
- In 2002, 7,007,091 kilograms of carcinogens were released into the air in Canada. About 176,030 kilograms were released into the water. [The four largest emitters of carcinogens into the air were: Vitafoam Products Canada Limited (Toronto facility), Inco Limited (Sudbury facility), Weyerhauser Canada Limited (Miramichi, New Brunswick), and Stelco Inc. (Hamilton).]
- In 2002, almost 1 billion kilograms of chemicals (968,107, 576 kilograms) known to cause reproductive and developmental harm were released into the air, the majority of this amount being carbon monoxide. A significant amount of the carbon monoxide is emitted into the environment is from cars and trucks – a source not tracked by NPRI. ... Once carbon monoxide was factored out, 14,386,091 kilograms of air releases known to cause reproductive or developmental harm remained. [In the list of the top 15 polluters, Shell Canada facilities appear three times, accounting for 1,564,007 of emissions, or 10.8 percent of the Canadian total].[91]

Ozone Depletion

Ozone in the earth's upper atmosphere shields organisms from the sun's ultraviolet rays, exposure to which is associated with skin cancer, cataracts, and immune-system problems. Significant decreases in the ozone layer covering over Antarctica were detected in the 1970s by a team of British scientists. Subsequently, an 'ozone hole' was also found over the Arctic. Depletion of stratospheric ozone has been attributed mainly to the release of CFCs (chlorofluorocarbons), but also to bromine compounds and nitrogen oxides. CFCs are used in refrigeration, air conditioning, aerosols, solvents, and some types of packaging; nitrogen oxides are a component of aircraft emissions and other combustion processes.[92]

Although world production of ozone-depleting chlorofluorocarbons fell by 87 per cent between 1988 and 1997,[93] current average ozone losses are 6 per cent in northern mid-latitudes, resulting in increases in ultraviolet radiation of 7 per cent.[94] According to the United Nations

Environment Programme, the thinning of the ozone layer not only threatens human health, but also affects flora and fauna and the planet's climate.[95]

Ironically, while ozone in the stratosphere shields organisms from harmful ultraviolet rays, ground-level ozone, created by the interaction of fuel emissions and sunlight, is a life-threatening pollutant. Yale University researchers, investigating air pollution and morbidity data for ninety-five large U.S. urban centres, attribute 3,767 premature deaths in the year 2000 to short-term exposures to ozone.[96] The authors add: 'This value is probably an underestimate of the total mortality burden from such an increase in ozone because it accounts for only the short term effects.'[97]

Population Growth

It took one hundred years for the world's population to double from 1.25 billion to 2.5 billion (between 1850 and 1950), but less than forty years for it to double again. By October 1999, it exceeded 6 billion. Some project that the world's population may stabilize at 8 to 14 billion over the present century.

It is thought that about 20 per cent of people now live in 'absolute poverty.' It is also estimated that each year half a million women die from complications of pregnancy and childbirth, that 4 million babies die annually in the developing world during their first week of life, and that diarrhoea kills about 2.2 million people each year, most of them children under five. It was a principal contention of the Brundtland Commission that population growth, environmental degradation, and poverty are inextricably linked.

Herman Daly and John Cobb have eerily depicted our present plight as 'living by an ideology of death': 'We human beings are being led to a dead end – all too literally. We are living by an ideology of death and accordingly we are destroying our own humanity and killing the planet.'[98] Unfortunately, their depiction is all too apt.

The antithesis of the 'ideology of death,' as developed partially in this book, is a culture of ecology.

Culture of Ecology

The disparate, indeed antithetical, interpretations of sustainable development noted previously point to the current bifurcation of economic and ecological thinking. Matters were not always thus, however, and the present book proposes (contrary to writers such as Lynn White Jr) that Western economic thought *in its foundations* (the Greek, Hebrew, and medieval writers) was actually profoundly environmentally sound. The book proposes further that the antithesis between 'environment' and 'development' arose only with the Enlightenment, and it investigates the writings of Thomas Hobbes and Adam Smith particularly to detect how this dichotomy arose.

At present, the antithesis between economics and ecology is even manifest in two dichotomous economic approaches to environmental matters. First, the dominant, orthodox approach, known as environmental economics, essentially applies mainstream economic principles and modes of analysis to environmental concerns; ecology becomes, in effect, a branch or an application of neoclassical economic theory. The main recommendation of environmental economists is to subject, so far as possible, human-environment interactions to market forces and price indicators. Sometimes these price indicators are to be 'adjusted' to reflect environmental impacts, but the belief persists among environmental economists that the system of relative prices, once adjusted, will be in principle sufficient to remedy, so far as is desirable (or 'efficient'), environmental degradations.[99] This approach, the present book argues, is quite problematic.

Second, the heterodox, marginalized approach, loosely known as ecological economics, places much less faith in the efficacy of the price system, and may even propose transforming economics itself in accordance with principles of ecology. Ecological economics, however, is very 'pluralistic.' According to Peter Söderbaum, who has written an overview of the field, 'The open-minded attitude [of the ecological economics movement] implies that even a neo-classical environmental economist can refer to her or himself as an ecological economist,'[100] a position validated by Richard Norgaard and other contributors to an anthology devoted to ecological economics.'[101] The scope of the term 'ecological economics' creates difficulties for summarizing or typifying the field. Nonetheless, chapter 5 attempts to do so, and elements drawn from ecological economics undoubtedly will constitute important components of a culture of ecology, defined as systems of symbolism, interpretation, and praxis largely conforming to ecological principles. The culture of ecology, then, encompasses economic as well as other discourses and practices, and implies that these all must become more harmonious with ecological principles.

Systems theorist Ludwig von Bertalanffy once remarked that the

human being 'is a denizen of two worlds': a material world in which each person functions as 'a biological organism with the physical equipment, drives, instincts, and limitations of [the] species,' and a second, higher world wherein each one 'creates, uses, dominates, *and is dominated by* ... the universe (or universes) of symbols.'[102] The question, or problematic, for a culture of ecology generally, or for an ecological economics in particular, in the context of von Bertalanffy's insight, is this: Just how can the symbolic, communicatory, verbal, textual 'world' become more consistent with and supportive of the material, biotic 'world,' inextricably linked as they are?

One need not be a scientist (although scientific confirmations are important and abundant) to realize that our experience of external reality is not in accord with the 'dominant paradigm' (or system of meanings) instilled in us day by day and hour by hour by instruments of mass enculturation. It is within the common experience of most of us that the natural environment is deteriorating: Beaches are more often than not closed to swimming; air-quality advisories are continual and routine in the summer months; UV readings warn people to stay out of the sun; boil-water advisories make people apprehensive about the quality of even their municipal (chemically treated and filtered) drinking water; the asphalting of a favourite nature trail and the disappearance of a wetlands in the name of 'development' give people first-hand experience of disappearing ecosystems. In brief, we know experientially that the predominant discourses of business, governments, advertisers, economists, and most often journalists are inconsistent with ecosystem vitality. We do not live in an eco-culture.

These anti-environmental discourses, however, are largely the ones we live by. As Donella Meadows remarked, 'A paradigm is upheld by the constant repetition of ideas that fit within it.'[103] This book asks, in part, why do anti-ecological discourses generally, and neoclassical economics as a prime example in particular, persist in our era when our habitat is so obviously under siege?

As well as attempting to answer that question, the book proposes an alternative – a paradigm shift from the propositions and logics of mainstream (neoclassical) economics and its accompanying cultural supports (advertising, business news, government economic statements and strategies, etc.) to a culture of ecology, that is, a way of thinking and communicating, and ultimately of acting, that is more in tune with our habitat; this entails a shift, in turn, from 'sustainable development,' as the term is most commonly interpreted, to 'sustainable ecosystems.'

The culture of ecology is a vast topic for the simple reason that we are so far removed from ecologically sane thinking and acting. The present book, therefore, is but a beginning. It focuses on mainstream and heterodox economics. Although the discursive subject matter, namely economics, treated here is not the whole story, it is an important beginning, as the economy and the ecosystem are fundamentally in conflict.

Lessons from *Silent Spring*

Some aspects of our approach to current discourses and activities are already manifest in the story of Rachel Carson's book. I will close the chapter by reviewing these.

'Minute causes, mighty effects.' When Rachel Carson penned these words with reference to the human organism as an ecosystem, breast cancer was already ravaging her body. In her book, she also described what has come to be known as *biomagnification*: the manner whereby accumulations of toxic substances pass up the food chain in ever-increasing concentrations. That biological principle has few, if any, correlates in mainstream economic thinking, but it forms a cornerstone of the ecological mindset.

The dialectic of science and technology. Every innovation has both benefits and costs. Promoters tend to publicize the benefits but ignore or downplay the costs. Publicizing the latter, therefore, often falls to those who are quite diminutive compared with the powerful interests in society; this is especially the case if the costs are diffused widely but the initial benefits are concentrated and accrue to the innovator through patents and other monopoly rights. As a related point, once an innovation is in place, the public may grow accustomed to its services, and it may be difficult to wean them from it or to convince them of the harms, particularly if those harms are diffuse or abstract (for example, species extinctions and global warming). Carson's book demonstrates, however, that the general public *can* be made aware and become concerned, at which point public opinion becomes a powerful, corrective force.

The notion of discourse. Discourse is the communication of, or conversations within, a paradigm. Discourses are embedded with systems of assumptions, meanings, vocabularies, images, evidence, and criteria for evidence, propositions, beliefs, values, even heroes and mythic stories.

Rachel Carson told a mythic story – one, unfortunately, all too closely based on reality. The debates that take place within the context of a discourse tend to argue the fine points, not the fundamentals.

The notion of dominant and marginal (orthodox and heterodox) world views or discourses, and the rivalry between (among) them. Marshalling evidence is one way of supporting a discourse and undermining a rival one, but this is certainly not the only way. Mockery, satire, the courts, and publicity are others. One of the jobs of the public relations industry is to make or keep a discourse or way of thinking predominant, sometimes irrespective of its truth,[104] and to discredit or otherwise marginalize an oppositional paradigm or discourse, again irrespective of its validity or truth.

Anthropocentrism as an element of the dominant world view/discourse. Anthropocentrism is the position that humans are 'the measure of all things,'[105] a view quite antithetical to an ecological understanding whose major tenet is the mutual interdependence of all things.

The apparent antimony between economics and ecology, and between business and the environment. In view of their common prefix, *eco*, meaning household or habitation, the apparently antithetical relation between economies and ecology is highly ironic, as well as being of monumental importance. As we will see below, their antithetical relationship results, in part, from different time horizons, the former being very short term compared to the latter.

The notion of paradigms. Developed first by the historian of science Thomas Kuhn, paradigm theory holds that within cultures (including scientific cultures) there is a generally accepted way of viewing things which, when challenged by phenomena it cannot account for, is eventually overthrown and replaced. Nonetheless, those with a vested interest in the old paradigm will endeavour to retain it, modifying it if possible, to better fit the newer circumstances.

The political economy of knowledge and discourse. Some 'ways of seeing,' or paradigms, are profitable to those with wealth and power, and others much less so. Indeed, according to the eminent economic historian Harold Innis, change in the dominant paradigm ('monopoly of knowledge') can coincide with the replacement of one group of power holders by another. In any event, money is often – indeed, it is continuously

– spent to persuade people to think in ways advantageous to those dispensing the cash. Likewise, monetary and other pressures, especially in so-called democracies, inhibit thought and discussion inimical to vested interests (whereas in so-called totalitarian regimes threats are more often physical).[106]

The disjuncture between our knowledge/perception and the objects of our knowledge/perception. In semiotic terms, there is a dialectic of signifier and signified, or as journalist Walter Lippmann once expressed the same point, between the world outside and the pictures in our heads.[107] DDT was previously thought to be a miracle compound, even as it was imperceptibly poisoning unintended species, including humans.

The interaction between ways of thinking and ways of doing. Our thought systems guide our actions, and our actions have real-world consequences; these real-world consequences, in turn, impinge upon and modify our thoughts and perceptions. At one time DDT was thought of as a miracle compound, and hence was used indiscriminately in public and private spaces; when DDT was identified as a lethal chemical with unintended consequences, its use was banned.

The importance of rhetoric, or persuasion. It is not always the truth that wins, at least in the short run, and citizens should always be attuned to rhetorical ploys. Rachel Carson was herself skilled in rhetoric, as the title of her book and the parable she told well illustrate. One of the ploys of rhetoriticians, Walter Lippmann noted many years ago, is the use of 'binders,' by which he meant motherhood terms so broad as to be devoid of meaning; 'sustainable development' in our day is one such binder that this book hopes to expose as being virtually empty of environmental content.