

Global Ecology

A New Arena of Political Conflict

Edited by

WOLFGANG SACHS

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9. The Shaky Ground of Sustainability

Donald Worster

The first thing to know when starting to climb a hill is where the summit is, and the second is that there are no completely painless ways to get there. Failing to know those things may lead one to take a deceptively easy path that never reaches the top but meanders off into a dead-end, frustrating the climber and wasting energy. The popular environmentalist slogan of 'sustainable development' threatens to become such a path. Though attractive at first view, it appeals particularly to people who are dismayed by the long arduous hike they see ahead of them or who don't really have a clear notion of what the principal goal of environmentalism ought to be. After much milling about in a confused and contentious mood, they have discovered what looks like a broad, easy path where all kinds of folk can walk along together, and they hurry toward it, unaware that it may be going in the wrong direction.

Back in the 1960s and 1970s, when contemporary environmentalism first emerged, the goal was more obvious and the route more clear before they became obscured by political compromising. The goal was to save the living world around us, millions of species of plants and animals, including humans, from destruction by our technology, population, and appetites. The only way to do that, it was easy enough to see, was to think the radical thought that there must be limits to growth in three areas – limits to population, limits to technology, and limits to appetite and greed. Underlying this insight was a growing awareness that the progressive, secular materialist philosophy on which modern life rests, indeed on which Western civilization has rested for the past 300 years, is deeply flawed and ultimately destructive to ourselves and the whole fabric of life on the planet. The only true, sure way to the environmentalist goal, therefore, was to challenge that philosophy fundamentally and find a new one based on material simplicity and spiritual richness.

I do not say that this conclusion was shared by everyone in those years who wore the label environmentalist, but it was obvious to the most thoughtful leaders that this was the path we had to take. Since it was so

painfully difficult to make that turn, to go in a diametrically opposite direction from the way we had been going, however, many started looking for a less intimidating way. By the mid-1980s such an alternative, called 'sustainable development', had emerged. First it appeared in the *World Conservation Strategy* of the International Union for the Conservation of Nature (1980), then in the book, *Building a Sustainable Society*, by Lester R. Brown of Worldwatch Institute (1981), then in another book, *Gaia: An Atlas of Planet Management*, edited by Norman Myers (1984), and then most influentially in the so-called Brundtland Report, *Our Common Future* (1987). The appeal of this alternative lay in its international political acceptability and in its potential for broad coalition among many contending parties. As Richard Sandbrook, executive vice-president of the International Institute for Environment and Development, explained: 'It has not been too difficult to push the environment lobby of the North and the development lobby of the South together. And there is now in fact a blurring of the distinction between the two, so they are coming to have a common consensus around the theme of sustainable development.'¹

Lots of lobbyists coming together, lots of blurring going on – inevitably, lots of shallow thinking resulted. The North and the South, we were told, could now make common cause without much difficulty. The capitalist and the socialist, the scientist and the economist, the impoverished masses and the urban élites could now all happily march together on a straight and easy path, if they did not ask too many potentially divisive questions about where they were going.

Like most popular slogans, sustainable development begins to wear thin after a while. Although it seems to have gained a wide acceptance, it has done so by sacrificing real substance. Worse yet, the slogan may turn out to be irredeemable for environmentalist use because it may inescapably compel us to adopt a narrow economic language, standard of judgement, and world view in approaching and utilizing the earth.

My own preference is for an environmentalism that talks about earth ethics and aesthetics rather than about resources and economics, that places priority on the survival of the living world of plants and animals on which our own survival depends, and that focuses on what nature's priceless beauty can add to our emotional well-being. I will return to that theme later, but first let us examine the shaky ground of sustainable development. So far we have not had a probing moral analysis of this slogan, despite all those books and reports mentioned above. Although I myself cannot offer any full analysis of it in so short a space, I do want to draw attention to the important subject of language and ask what is implied in that magic word of consensus, 'sustainability'.

Probing the slogan

The first and perhaps most difficult problem, one that seldom gets addressed, is the time frame that ought to be assumed. Is a sustainable society one that endures for a decade, a human lifetime, or a thousand years? It is not enough merely to say 'sustainable for a long time', or even 'for the next generation', if we want to establish targets for our institutions. On the other hand, no one really expects sustainable to mean 'forever'; that would be a utopian expectation that no society has ever achieved. The anthropologist Marvin Harris argues, in his provocative study of human culture, *Cannibals and Kings*, that all through both prehistory and history we can find only a few human societies that were able to sustain their technology, organization, economic patterns, and institutions for even a few centuries. Again and again, societies ran out of the critical resources on which they depended or they degraded their supporting environment to the point of crisis, requiring a revolutionary response. Whether due to population increase or environmental ignorance or excessive demands, they commonly ended by consuming their natural base. Harris goes so far as to argue that all the world's cultures have had their origin in that repeated failure of sustainability: a new culture emerged whenever people managed to get out of their resource trap and invent a new infrastructure, based on a different set of resources or a different approach to resource use. Thus, innovation, both technological and cultural, has been the outcome of ecological depletion, and without such depletion there would have been little cultural change over time. If at the outset of our history as a species we could have achieved a perfect sustainability, we would still be living in a hunting and gathering state; but then such an achievement would have required the strict adherence to a profoundly conservative social order, and probably an insufferably boring one, incapable of all the creativity as well as all the disasters of subsequent history.²

If we cannot expect to achieve a *perfect* sustainability that lasts forever, what then can we hope for and work toward? What *degree* of sustainability should we settle on? No one, to my knowledge, has yet made a definitive answer.

Besides suggesting no clear time frame, the ideal of sustainability presents us with a bewildering multiplicity of criteria, and we have to sort out which ones we want to emphasize before we can develop any specific programme of action. Among the dozens of possible sets of criteria, three or four have dominated public discussion of late, each based on a body of expertise, and they share little common ground.³

The field of economics, for example, has its own peculiar notion of what sustainability means. Economists focus on the point where societies achieve a critical take-off into long-term, continuous growth, investment, and profit

in a market economy. The United States, for instance, reached that point around 1850, and has ever since been growing endlessly, despite a few recessions and depressions. By that standard any and all of the industrial societies are already sustainable, while the backward agrarian ones are not.⁴

Students of medicine and public health, on the other hand, have a different notion of the word; sustainability for them is a condition of individual physiological fitness, a condition to be measured by physicians and nutritionists. Thus, they focus on threats of water and air pollution or on food and water availability, or they talk about the threat of diminished genetic stock to the practice of medicine and the supply of pharmaceuticals. Despite the existence of many threats today, most health experts would say that human health has made great strides over the past few centuries in every part of the earth. By their criteria the human condition is far more sustainable today than it was in the past – a fact that explosive population growth and longer lifespans for most societies demonstrate. By the standard of physiological fitness people living in industrial societies are doing far better than our ancestors or our contemporaries in the non-industrial societies.

Still another group of experts, the political and social scientists, speak of 'sustainable institutions' and 'sustainable societies', which apparently refer to the ability of institutions or ruling groups to generate enough public support to renew themselves and hold on to power.⁵ Sustainable societies are then simply those that are able to reproduce their political or social institutions; whether the institutions are benign or evil, compassionate or unjust, does not enter into the discussion. By this reasoning, the communist regimes of Eastern Europe and the Soviet Union have not proved to be sustainable and are being swept into the ashheaps of history.

These are all leading, important uses of the word found among various fields of expertise, and undoubtedly they all can be given very sophisticated (and far more precise than I have indicated) measurements. In contrast, we also have some simpler, more popular notions of the word. One of the clearest, most pithy, and least arcane definitions comes from Wendell Berry, the American writer and trenchant critic of all expertise. He called specifically for a more sustainable agriculture than we have today, by which he meant an agriculture that 'does not deplete soils or people'.⁶ That phrase expresses, as so much of Berry's work does, an old-fashioned agrarian way of thinking, steeped in the folk history and local knowledge of his rural Kentucky neighbours. Like everything Berry writes, it has a concise, elemental ring, and the great virtue of recalling to our attention that people and the earth are interdependent, a fact that those specialized academic approaches by economists and the rest generally ignore.

In Berry's view the only truly sustainable societies have been small-scale agrarian ones; no modern industrial society could qualify. His own model,

which is based on the livelihood and culture of the Jeffersonian yeoman farmer, must be seen as part of the economic past; it has virtually disappeared from modern American life. One might ask, as Berry's critics regularly do, whether he is offering us more of a myth than a reality: did such non-depleting rural communities ever really exist in the United States, or are they only idealizations or indulgences in a false nostalgia? But even if we accept Berry's distinction between 'sustainable agrarian' and 'unsustainable industrial', it is still not clear what the preconditions for sustainability, or the measurement of its success, would be. What meaning can we give to the idea of 'people depletion'? Is it a demographic or a cultural idea? And how much self-reliance or local community production does it require, and how much market exchange does it allow? For that matter, what is referred to in Berry's notion of soil depletion? Soil scientists point out that the United States has lost, on average, half of its topsoil since white, European settlement began; but then many of them go on to argue that such depletion is not a problem so long as we can substitute chemical fertilizers. Once more we are back in the muddle of whose expertise, language, and values are to define sustainability. Berry would answer, I suppose, that we should leave the definition to local people, but national and international policy makers will want something more objective than that.

All those definitions and criteria are floating around in the air today, confusing our language and thinking, demanding far more of a consensus of meaning before we can achieve any concerted programme of reform. To be sure, there is a widespread implication in the environmental literature I have cited that sustainability is at bottom an ecological concept: the goal of environmentalism should be to achieve 'ecological sustainability'. What that means is that the science of ecology is expected to cut through all the confusion and define sustainability for us; it should point out which practices are ecologically sustainable and which are not. Once again we are back in the business of looking for a set of expert, objective answers to guide policy. But how helpful really are those experts in ecology? Do they have a clear definition or set of criteria to offer? Do they even have a clear, coherent perception of nature to provide as a basis for international action?

How helpful are the experts?

Ecologists traditionally have approached nature as a series of overlapping but integrated biological systems, or ecosystems. In contrast to most economists, for whom nature is not a relevant category of analysis, they have insisted that those systems are not disorganized or useless but self-organizing and productive of many material benefits that we need. The role of ecologists then, as we have generally come to understand it, is one of

revealing to laymen how those ecosystems, or their modifications into agro-ecosystems, undergo stress from human demands and of helping us determine the critical point when that stress is so severe that they collapse.

If we accept that expert tutoring, the ecological idea of sustainability becomes, quite simply, another measure of production, rivalling that of the economists: a measure of productivity in the economy of nature where we find such commodities as soils, forests, and fisheries, and a measure of the capacity of that economy to rebound from stresses, avoid collapse, and maintain output. Unfortunately, compared to economists, the ecologists have recently become very uncertain about their own advice. Their indices of stress and collapse are in dispute, and their expertise is in disarray.

A few decades ago ecologists commonly believed that nature, when left free of human interference, eventually reaches a balance or equilibrium state where production is at a steady rate. The origins of this idea go back deep into the recesses of human memory, deep into the past of every civilization before the modern. For Westerners in particular the idea of nature as a balanced order has ancient Greek, medieval Christian, and 18th-century rationalist antecedents, and it survived even the profound intellectual revolution wrought by Charles Darwin and the theory of evolution through natural selection. From the time of its emergence in the late 19th century the science of ecology echoed that longstanding faith in the essential orderliness of nature, and until recently almost all ecologists would have agreed that sustainability is a matter of accommodating the human economy to that constancy and orderliness. Now, that is no longer the case.⁷

During the first half of this century the dominant figure in Anglo-American ecology was an American, Frederick Clements, who came out of Nebraska and was a student of the native prairies of the mid-continent. Clements founded what has been called the dynamic or climax theory of vegetation, which holds that, although the organization of plant life is constantly changing on the earth, going through a process called succession, eventually harmony, stability, and order evolve in the landscape. That point was called the climax stage, and according to Clements, it would endure until some major disturbance occurred through a change in the climate. He compared the order of vegetation at that stage to a 'super-organism', suggesting that in terms of the integration of its parts, the coherence of the whole, the climax is like a single but highly complex organism. To disturb such an order is, in effect, to kill that organism.⁸

Throughout the geological history of the grasslands, the great killer had been drought and other abrupt shifts in climate. But in the late 19th and early 20th century another disturber of order entered: Euro-American farmers, armed with ploughs, destroying the tall-grass prairies and planting the land to wheat and corn. Then, during the 1930s, severe drought returned to the country and, in combination with extensive overploughing, created

one of the worst environmental disasters in human history, the Dust Bowl of the Great Plains, a period of severe wind erosion, out-migration, and rural poverty. Clements and many of his followers were inclined to be critical of modern American agriculture, and indeed of much of modern economic development for being so destructive to the order of nature, and by extrapolation their ideal of a 'sustainable' life on the land was one that followed closely the model of the climax stage.

When the idea of the super-organismic climax began to seem a little far-fetched, ecologists replaced it with another concept of natural ecological order, the ecosystem. The ecosystem was a pattern of order in plant and animal assemblages that was based more on the study of physics than on analogies with the single living organism; in the ecosystem, energy and material flow in regular, orderly, efficient patterns. Human activity, warned ecologists like Eugene Odum much as Clements did before him, must conform to those patterns if we want to live in a harmonious, enduring relationship with nature.

Very recently, however, many ecologists have begun to question all those older ideas, theories, and metaphors, even to assert that nature is inherently *disorderly*. Some have tried to maintain that the ecosystem, like the climax stage, is a fiction that does not really describe the turbulence of the natural environment, or at least that such ideas are too vague or inflexible. Beginning around 1970 ecology went off in search of new ways to describe forests, grasslands, oceans, and all the other biomes of the planet, and the outcome is the emergence today of a more permissive ecology that rejects virtually all notions of balance and order, new or ancient, and portrays instead a nature that is far more lenient toward human activity than were Clements's or Odum's. We live in the midst of a nature that has been undergoing profound and constant change for as far back as we can look, scientists now argue with the aid of new scientific techniques; we confront a nature populated by rugged individualists, eager opportunists, and self-seekers. There is no integrated community in that nature, no enduring system of relationships; no deep interdependence. To be sure, the sun seems to come up regularly every day and in predictable spots; the four seasons come and go with a great deal of regularity. But pay no attention to all that, they say; look at the populations of plants and animals that live in any given area that we might call wild, pristine, or natural, and you will find no regularity, no constancy, no order there at all.⁹

Many of these ideas appear in a recent book entitled *Discordant Harmonies* (1990), which is self-described as 'a new ecology for the 21st century'. Here is how its author, Daniel Botkin, a leading California ecologist, sees the current situation in his science:

Until the past few years, the predominant theories in ecology either presumed or had as a necessary consequence a very strict concept of a highly structured, ordered, and regulated, steady-state ecological system. Scientists know now that this view is wrong at local and regional levels . . . that is, at the levels of population and ecosystems. Change now appears to be intrinsic and natural at many scales of time and space in the biosphere.

'Wherever we seek to find constancy' in nature, Botkin writes, 'we discover change.'¹⁰

The basis for this new ecology is a body of evidence that is essentially historical, including pollen samples, tree-rings, and animal population cycles, all of which show the world of nature to be in a constant flux, as unstable as the human scene where wars, assassinations, invasions, depressions, and social turmoil of every sort constitute the only normal condition we know.

For example, one can observe the history of a small, old-growth forest in New Jersey that was preserved from building development in the 1950s under the assumption that it was a surviving remnant of the mature climax forest, dominated by oaks and hickories, that once grew in the area. Scientists suppressed fire in the forest to keep it pristine and undisturbed. By the 1960s, however, they began to discover that maple trees were invading their preserve from the outside. If they suppressed all fires, if they tried to keep their forest 'natural', they were bound to fail. What then, they had to ask themselves, was the state of climax in this habitat? What could be called natural? What was the true order of nature?

Other evidence comes from pollen taken from pond and lake sediments all over North America, and indeed from all the major continents. They show that every area of the earth has experienced a wild variation in vegetation cover from year to year, from century to century, and from the glacial to the interglacial period. When the great ice sheets flowed over the North American continent, all the plants retreated south or into the lowlands - and it was not the orderly retreat of an organized, super-organismic community but a chaotic rout. Then when the glaciers retreated, leaving the land bare, the same plants made a ragged, chaotic invasion of their old ground. There was no organized return of whole communities.

Here is Botkin again:

Nature undisturbed by human influence seems more like a symphony whose harmonies arise from variation and change over every interval of time. We see a landscape that is always in flux, changing over many scales of time and space, changing with individual births and deaths, local

disruptions and recoveries, larger scale responses to climate from one glacial age to another, and to the slower alterations of soils, and yet larger variations between glacial ages.¹¹

But Botkin later makes a very telling amendment to that statement when he adds that 'nature's symphony' is more like several compositions being played at once in the same hall, 'each with its own pace and rhythm'. And then he comes to what is really the practical upshot of his ecology for policy makers, environmentalists, and developers: 'We are forced to choose among these [compositions], which we have barely begun to hear and understand.' Or one might say that after learning to hear all those discordances of nature, we humans must also assume the role of conducting the music. If there is to be any order in nature, it is our responsibility to achieve it. If there is to be any harmony, we must overcome the apparent discord. 'Nature in the 21st century,' this scientist concludes, 'will be a nature that we make.' Such a conclusion is where Botkin's science has been leading him all along: to a rejection of nature as a norm or standard for human civilization and to an assertion of a human right and need to give order and shape to nature. We are arriving, he proclaims, at a new view of Earth 'in which we are a part of a living and changing system whose changes we can accept, use, and control, to make the Earth a comfortable home, for each of us individually and for all of us collectively in our civilizations'. I believe that this new turn toward revisionism and relativism in ecological science is motivated, in part, by a desire to be less disapproving of economic development than environmentalists were in the 1960s and 1970s. Botkin criticizes that era for its radical, sometimes hostile, rejection of modern technology and progress. We need a science of ecology, he believes, that approaches development in a more 'constructive and positive manner.'¹²

A permissive ecology?

Those conclusions constitute what I would call a new permissiveness in ecology – far more permissive toward human desires than was the climax ecology of Frederick Clements and emphatically more permissive than the popular ecosystem ideas found among environmentalists of the 1960s and 1970s. This new ecology makes human wants and desires the primary test of what should be done with the earth. It denies that there is to be found in nature, past or present, any standard for, or even much of a limitation on, those desires. Botkin hints at this denial in the beginning of his book when he criticizes the environmentalism of the 1960s and 1970s as 'essentially a disapproving, and in this sense, negative movement, exposing the bad aspects of our civilization for our environment . . .' What we must do, he

argues, is move away from that critical environmentalism toward a stance 'that combine[s] technology with our concern about our environment in a constructive and positive manner.'

This new turn in ecology presents several difficulties that I think the sustainable development advocates have not really acknowledged. In the first place, the whole idea of what is a normal 'yield' or 'output' from the natural economy becomes, if we follow Botkin's reasoning, far more ambiguous. Scientists once thought they could determine with relative ease the maximum sustained yield that a forest or fishery could achieve. They had only to determine the steady-state population in the ecosystem and then calculate how many fish could be caught each year without affecting the stock. They could take off the interest without touching the fixed capital. Botkin argues that it was just such assurance that led to over-fishing in the California sardine industry – and to the total collapse of that industry in the 1950s.¹³

But if the natural populations of fish and other organisms are in such continual flux that we cannot set maximum sustained yield targets, could we instead set up a more flexible standard of 'optimum yield', one that would allow a more general margin for error and fluctuations? That is where most ecological sustainability thinking rests today. Harvest commodities from nature, but do so at a lightly reduced level to avoid overstressing a system in stochastic change. Call it the safe optimum notion. But that formula does not really address the more basic challenge implicit in recent ecological thinking. What can sustainable use, let alone sustainable development, mean in a natural world subject to so much disturbance and chaotic turbulence? Our powers of prediction, say ecologists, are far more limited than we imagined. To many, our understanding of what is normal in nature now seems to be arbitrary and partial.

The only real guidance Botkin gives us, and this is likewise true of most ecologists today, is that slow rates of change in ecosystems are 'more natural', and therefore more desirable, than fast rates. 'We must be wary,' Botkin says, 'when we engineer nature at an unnatural rate and in novel ways.'¹⁴ And that is all he really offers. But when we have to have more specific advice to manage this or that acre of land successfully, the ecologist is embarrassingly silent; he or she can hardly say any more what is 'unnatural' or what is 'novel' in light of the incredibly changeable record of the Earth's past.

In the much acclaimed partnership between the advocates of ecological sustainability and of development, who is going to lead whom? This is the all-important question to ask about the new path that so many want us to take. I fear that in that partnership it will be 'development' that makes most of the decisions, and 'sustainable' will come trotting along, smiling and genial, unable to assert any firm leadership, complaining only about the

pace of travel. 'You must slow down, my friend, you are going too fast for me. This is a nice road to progress, but we must go along at a more "natural" speed.'

In the absence of any clear idea of what a healthy nature is, or how threats to that collective biological whole might impinge on us, we will end up relying on utilitarian, economic, and anthropocentric definitions of sustainability. That, it seems to me, is where the discussion is right now. Sustainability is, by and large, an economic concept on which economists are clear and ecologists are muddled. If you find that outcome unacceptable, as I do, then you must change the elementary terms of the discussion.

Flaws in the ideal

I find the following deep flaws in the sustainable development ideal:

First, it is based on the view that the natural world exists primarily to serve the material demands of the human species. Nature is nothing more than a pool of 'resources' to be exploited; it has no intrinsic meaning or value apart from the goods and services it furnishes people, rich or poor. The Brundtland Report makes this point clear on every page: the 'our' in its title refers to people exclusively, and the only moral issue it raises is the need to share what natural resources there are more equitably among our kind, among the present world population and among the generations to come. That is not by any means an unworthy goal, but it is not adequate to the challenge.

Second, sustainable development, though it acknowledges some kind of limit on those material demands, depends on the assumption that we can easily determine the carrying capacity of local regional ecosystems. Our knowledge is supposedly adequate to reveal the limits of nature and to exploit resources safely up to that level. In the face of new arguments suggesting how turbulent, complex, and unpredictable nature really is, that assumption seems highly optimistic. Furthermore, in light of the tendency of some leading ecologists to use such arguments to justify a more accommodating stance toward development, any heavy reliance on their ecological expertise seems doubly dangerous; they are experts who lack any agreement on what the limits are.

Third, the sustainability ideal rests on an uncritical, unexamined acceptance of the traditional world view of progressive, secular materialism. It regards that world view as completely benign so long as it can be made sustainable. The institutions associated with that world view, including those of capitalism, socialism, and industrialism, also escape all criticism, or close scrutiny. We are led to believe that sustainability can be achieved with all those institutions and their values intact.

Perhaps my objections can be fully answered by the advocates of the sustainable development slogan. I suspect, however, that their response will, in the end, rest on the argument that the idea is the only politically acceptable kind of environmentalism we can expect at this point. It is desirable simply because it represents the politics of compromise.

Having been so critical toward this easy, sloganeering alternative, I feel obliged to conclude with a few ideas of my own about what a real solution for the global crisis will require. I grant that it will be more difficult to achieve, but would argue that it is more revolutionary in impact and more morally advanced.

We must make our first priority in dealing with the earth the careful and strict preservation of the billion-year-old heritage achieved by the evolution of plant and animal life. We must preserve all the species, sub-species, varieties, communities, and ecosystems that we possibly can. We must not, through our actions, cause any more species to become extinct. To be sure, we cannot stop every death or extinction, since the death of living things is part of the inevitable workings of nature. But we can avoid adding to that fateful outcome. We can stop reversing the processes of evolution, as we are doing today. We can work to preserve as much genetic variety as possible. We can save endangered habitats and restore those needed to support that evolutionary heritage. We can and must do all this primarily because the living heritage of evolution has an intrinsic value that we have not created but only inherited and enjoyed. That heritage demands our respect, our sympathy, and our love.

Unquestionably, we have a right to use that heritage to improve our material condition, but only after taking, in every community, every nation, and every family, the strictest measures to preserve it from extinction and diminution.

To conserve that evolutionary heritage is to focus our attention backward on the long history of the struggle of life on this planet. In recent centuries we have had our eyes fixed almost exclusively on the future and the potential affluence it can offer our aspiring species. Now it is time to learn to look backward more of the time and, from an appreciation of that past, learn humility in the presence of an achievement that overshadows all our technology, all our wealth, all our ingenuity, and all our human aspirations.

To conserve that heritage is to put other values than economic ones first in our priorities: the value of natural beauty, the value of respectfulness in the presence of what we have not created, and above all the value of life itself, a phenomenon that even now, with all our intelligence, we cannot really explain.

To learn truly to cherish and conserve that heritage is the hardest road the human species can take. I do not even know, though I have plenty of doubts, whether it is realistic at this point, given the state of global politics, to expect

most nations to be ready or willing to take it. But I do know that it is the right path, while following the ambiguities, compromises, and smooth words of sustainable development may lead us into quicksand.

Notes

1. Quoted in World Commission on Environment and Development (1987) *Our Common Future*, Oxford and New York, Oxford University Press, p. 64. See also R. Sandbrook (1982) *The Conservation and Development Programme for the UK: a response to the World Conservation Strategy* (1989) *Our Common Future: a Canadian response to the challenge of sustainable development*, Ottawa, Harmony Foundation of Canada; and Raymond F. Dasmann (1988) 'Toward a Biosphere Consciousness', in Donald Worster (ed.), *The Ends of the Earth: perspectives on modern environmental history*, New York, Cambridge University Press, pp. 281–5.

2. Marvin Harris (1977) *Cannibals and Kings: the origins of cultures*, New York, Random House.

3. I have found two books by Michael Redclift (1984 and 1987) useful here: *Development and the Environment Crisis: Red or Green Alternatives?* London, Methuen; and *Sustainable Development: Exploring the Contradictions*, London, Methuen. See also M. L'el'e Sharachchandram (1991) 'Sustainable Development: A Critical Review', *World Development*, Vol. 19, June, pp. 607–21. Also, several of the essays in the symposium, *History of Sustained-Yield Forestry* (edited by Harold K. Steen (1984), Durham, NC, Forest History Society), especially the following: Robert G. Lee, 'Sustained Yield and Social Order', pp. 90–100; Heinrich Rubner, 'Sustained-Yield Forestry in Europe and Its Crisis During the Era of Nazi Dictatorship', pp. 170–75; and Claus Wicbecke and W. Peters, 'Aspects of Sustained-Yield History: forest sustention as the principle of forestry – idea and reality', pp. 176–83.

4. Clem Tisdell (1988) 'Sustainable Development: differing perspectives of ecologists and economists and relevance to LDCs', *World Development*, Vol. 16, March, pp. 373–84.

5. Arthur A. Goldsmith and Derick W. Brinkerhoff define sustainability as a condition in which an institution's 'outputs are valued highly enough that inputs continue'. See their book (1990) *Institutional Sustainability in Agriculture and Rural Development: a global perspective*, New York, Praeger, pp. 13–14.

6. Wes Jackson, Wendell Berry, and Bruce Colman (eds.) (1984) *Meeting the Expectations of the Land: essays in sustainable agriculture and stewardship*, San Francisco, North Point Press, p. x.

7. An example of how these older ecological theories still influence the advocates of sustainable development is P. Bartelmus (1986) *Environment and Development*, London, Allen and Unwin, p. 44.

8. Donald Worster (1977) *Nature's Economy: a history of ecological ideas*, New York, Cambridge University Press, pp. 205–18.

9. I have discussed some of these trends in my article, 'The Ecology of Order and Chaos', *Environmental History Review*, Vol. 14, Spring/Summer 1990, pp. 1–18.

10. Daniel B. Botkin (1990) *Discordant Harmonies: a new ecology for the twenty-first century*, New York, Oxford University Press, pp. 10, 62.

11. *Ibid.*, p. 62

12. *Ibid.*, p. 6.

13. See also Arthur McEvoy (1986) *The Fisherman's Problem: ecology and law in California fisheries, 1850–1980*, New York, Cambridge University Press, pp. 6–7, 10, 150–1.

14. Botkin (1990), p. 190.