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CHAPTER 18

The Need to Study Earth's Ecosystems

J.M.R. Stone

"Everyone in the World depends completely on Earth's ecosystems and the services they provide, such as food, water, disease management, climate regulation, spiritual fulfillment, and aesthetic enjoyment" (*Millennium Ecosystem Assessment Report*, 2005).

I will start with a few words about education, in the broad sense; and will then discuss research and the three areas that need further attention.

Education at the lower-school level is often seen as the preserve of a carefully guarded, strongly unionized and over-regulated group of professionals. Nevertheless, children need to be made aware early of the origin of such resources as energy, food and water in order:

- to overcome the comfortable perception that dinner just miraculously appears at the same time every evening thanks to an all-powerful parent;
- to have them understand that the water that runs in the tap all so reliably and, for many of us in the West, at an insignificant cost, is a resource that one has to share and may become limited; and
- to make the point that the gas that one has become so accustomed to taking for granted and on which mindless suburban development is premised is in fact non-renewable and is likely to be no longer cheap and plentiful.

The challenges at the higher levels of education are qualitatively not that different if more exasperating because of the increasing wealth of information. First, at this level there is the knowledge to explain more

rigorously our unsustainable exploitation of the planet's natural resources — to explain the limits of the goods and services that it provides. Secondly, there is the wealth of information from systematic observations of natural resource availability. Thirdly, are the extraordinary results of research on the complex functioning of the earth's systems. Furthermore, society is in a privileged position because of science. Individuals are able not only to assess the state of the planet's health but more significantly to project what may be the consequences of the present patterns of exploitation — society can look into the abyss. Finally, there is the evidence of history; there are many examples of societies that came up against the limits of nature because of unsustainable development and suffered the consequences, including collapse.

There is now a rich and compelling base of knowledge; the problem is in "internalizing" this knowledge, of understanding that society is a part of the problem and equally can be part of the solution. Many of one's students accept the science, but are unwilling or unimaginative enough to change their lifestyles and consumption habits — unwilling because of peer pressure perhaps and unimaginative because of the clamouring power of advertising. H.G. Wells once remarked that human history becomes more and more a race between education and catastrophe.

Relying only on the powers of scientific information seems to be insufficient; humans are remarkably successful at denial. We need a moral framework. But this leads into dangerous grounds of culture, values and history. Surely it has to be understood that what defines us as a civilized people is concern for others as well as our environment. It is inescapable that we have to reconsider our consumption habits. Students need to see alternative possibilities.

If education finishes with school or university, learning needs to continue for this is an era of constant change and new knowledge. What do I mean by this? I am not thinking just about such worthwhile initiatives as the Open University or the Workers Educational Association. Rather, I have in mind the effective transfer of knowledge to the general public and in particular to political leaders as a means of enhancing democracy and making wise, informed decisions. To take the particular issue of climate change, the Intergovernmental Panel on Climate Change (IPCC) has been quite successful at assessing knowledge of climate change and packaging it in accessible, balanced and useful forms. Over the past two decades, there have been several other scientific assessments starting with that on ozone depletion and including the Millennium

Ecosystem Assessment. These assessments have been quite successful at raising awareness of the issues and have produced many reports, magazine articles, popular books and films such as *An Inconvenient Truth*. However, it is not always clear, from the worrying lack of action, just how much has been learned from this rich transfer of knowledge.

One is left asking what more than these strong scientific conclusions, based on a wealth of literature and expert scientific judgement, is needed? If it is more research, it is surely not on further defining the problem. It is perhaps rather on potential solutions, providing examples, examining the costs and the benefits of taking action or not. I believe we also need a better understanding of human behavioural patterns — even though that suggestion may reaffirm the public's worry that scientists are out to control the world. Society must wrestle with its apparent need to seek short-term rewards and the tendency to greed, denial, tribalism, and ignorance which often raises barriers to action. Better understanding of these tendencies is the first area of research I would highlight that needs more attention.

In a recent survey by the Pew Centre it was found that the American public is increasingly concerned about the issue of climate change. However, there is now evidence that these views are fragile and inconsistent. My own interpretation is that this may be due to a lack of a really adequate understanding of the way our environment and economy work, reinforced by pundits rehearsing the conventional wisdom that one cannot tackle the environment and the economy at the same time. I believe this is deeply flawed thinking and that this economic crisis offers us the opportunity to restructure our economies, introduce new technologies and offer different lifestyles that together would have a smaller environmental footprint.

Over the last thirty years, the scientific understanding of the earth's natural resource endowment and the functioning of the complex and interrelated systems of the geosphere and biosphere has grown impressively. There is now a whole new assemblage of disciplines known as earth systems science. This has brought one a long way from the first stumbling steps of the 1972 book *Limits to Growth* by Denis Meadows and colleagues (Meadows *et al.*, 1972).

A valuable foundation for action can be the various scientific assessments that have been produced. Perhaps the most relevant is the Millennium Ecosystem Assessment. The assessment concluded that: "Over the past 50 years, humans have changed these ecosystems more

rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fiber, and fuel."

The economic and public health costs associated with damage to ecosystem services can be substantial. Not only does the degradation of ecosystem services represent loss of a natural resource capital asset, but the externalities are not usually accounted for in the economic calculations. All of which would seem to point to the need for a serious effort to understand more fully the interdependencies between the environment and the economy. This would increase the chance that we could have a well-informed debate on these matters instead of a noisy exchange of ill-quantified misconceptions. This is the second area of research that I would highlight for more attention.

There is still much that is not known about the functioning of the earth's systems and further research will be needed. One is forever surprised, for example, by the functioning of the carbon cycle which is essential if one is to translate anthropogenic emissions into atmospheric concentrations. But systematic observations are just as important (and even more difficult to assure long-term funding). Without them one is effectively flying this spaceship earth with a dashboard that was either not installed or is incomplete.

Research to understand natural resources and ecosystem functioning must look at the drivers of change that include: population growth, economic activity, technological advances as well as socio-political and cultural factors. A systems approach is necessary since these drivers act in complex, interactive ways.

But the real barriers to action are sometimes institutional. While the effective management of ecosystems is constrained by the lack of complete knowledge, there is often a failure to use the information that does exist. The commitment of the new U.S. President to reinstate the role of science to its rightful position is enormously encouraging. The institutional barriers extend to not having in place the right enabling environment for wise policy and decision-making. There is a need to build institutional capacity. Many of these issues are "wicked problems" where there is uncertainty everywhere, there are no simple answers and, to use the title of a book by Westley, Zimmerman and Patton, the best one can do is *Getting to Maybe*. This policy experimentation should be scientific in the sense that the problem is well defined, hypotheses are posed, potential solutions are designed, pilot tests are run, data are collected and analyzed and the solutions refined.

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18. The Need to Study Earth's Ecosystems 115
J.M.R. Stone

19. Understanding Energy Resource Problems 121
J.H. Beall

20. Understanding the Realities and Limitations of Solar Power on Earth 127
J.S.C. McKee

Part VIII: GLOBALIZATION AND THE ROLE OF NATIONAL AND INTERNATIONAL ORGANIZATIONS

21. Is Economic Interdependence Stabilizing or Destabilizing? 133
P. Calamai

22. Teetering on the Edge 137
D.J. Hand

23. Statistical Modeling and the Financial Crisis 143
D.L. McLeish

24. The Sky Grows Darker Still 149
K.W. James

Part IX: DISCUSSION AND CONCLUSIONS

25. Summary 159
J.C. Bailar III

26. Problems of Scientific Communication 163
W.B. Allen

APPENDIX

Conference Programme 171

List of Participants 175

Recital Programme 177