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CHAPTER 26
Roles for ecology in ecological economics and sustainable development

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Abstract

The problem of sustainable development originates in the interdependence of economic and natural systems, which is the point of departure for ecological economics. An interdisciplinary view of ecological economics would give ecologists a role in 'getting the science right' for solving given problems, whereas a transdisciplinary view would see them also participating in the construction of problems. There is also a need for ecologists to engage more in shaping the world views of all of the participants in political processes. Two recent examples of ecologists making substantial inputs to studies of the role of the natural environment in relation to economic activity are considered.

26.1 Introduction

Ecological economics and sustainable development are broad subjects that can and do fill many volumes. This chapter briefly reviews some of the major issues to allow a discussion of the roles for ecology in economics and development. Greater detail is provided in the references cited in this chapter. For more general background reading on sustainability and policy, refer to Common (1995). The following take some particulars further: Faber *et al*. (1994) on biodiversity conservation; the *Human Development Report* (UNDP 1996) on global poverty and deprivation; and *World Resources 1996-7* (WRI 1996) for information and commentary on the global environment.

26.2 Limits to growth?

According to the old adage, the poor are always with us. By the 1960s, economists and many politicians, had come to believe that this need no longer be true. Without economic growth, improving the lot of the poor means taking away from the rich. The rich generally resist, and anyway are few in number. With total output constant, poverty alleviation through redistribution involves social conflict and will, the argument goes, be largely ineffective. But if total output grows exponentially over time, then the lot of the poor can be improved without redistribution. In the early post-World War II period economic growth became the paramount objective of policy worldwide mainly, but not solely, because it alone was seen as the means to reduce the human suffering that poverty involved (Arndt 1978).

The Limits to Growth (Meadows *et al*. 1972) reported the results of experiments with a computer model of the global economic system and its interdependencies with the natural environment. It was a challenge to economic growth as the pre-eminent global policy objective based on feasibility

considerations arising from the location of economic activity within an environment which is a thermodynamically closed system.

With very few exceptions, the reaction to *The Limits to Growth* by economists was dismissive and hostile. The judgement by one economist that the book was 'a brazen, impudent piece of nonsense that nobody could possibly take seriously'(Beckerman 1972) was representative of the substance of most economists' reaction, if expressed somewhat more robustly than was typical. According to most of its economist critics, what *The Limits to Growth* said was that the world economy would collapse in the twenty-first century due to the exhaustion of its stocks of mineral resources. Indeed, one still today comes across statements by economists that this is what the book said, followed by the observation that known reserves are today generally higher than they were in 1972, which shows that the book was nonsense and that there are no environmental limits to growth.

Such accounts of the content of *The Limits to Growth* are completely erroneous, and appear to reflect having read only the first couple of chapters. It is true that the first model run reported did show collapse as the consequence of resource depletion (not exhaustion). However, in the next reported run, the model was modified by an increase in the resource availability limit such that depletion did not give rise to problems for the economic system. In this run, the proximate source of disaster was the level of pollution consequent upon the exploitation of the increased amount of resources available. This consequence follows from the law of conservation of matter, generally ignored in economics. A number of variant model runs were reported, each relaxing some constraint. The conclusions reached were based on consideration of all of the variant model runs.

The Limits to Growth did not conclude that disaster is inevitable. It did conclude that it was probable on current trends, and that:

> It is possible to alter these trends and to establish a condition of ecological and economic stability that is sustainable far into the future. The state of global equilibrium could be designed so that the basic material needs of each person on earth are satisfied and each person has an equal opportunity to realise his or her individual human potential (Meadows *et al.* 1972, p. 23).

Its results had the clear implication that global economic growth could have only a minor role in eliminating poverty; achieving sustainability and eliminating poverty would require major international redistribution of wealth. For most economists this is as unpalatable as the conclusion - the inevitability of disaster - that many falsely attribute to *The Limits to Growth*.

In a sequel, *Beyond the Limits* (Meadows *et al.* 1992), the 1972 conclusions are re-affirmed, with the caveat that there is less time available to bring about the changes that are necessary if a 'condition of ecological and economic stability' is to be realised. This sequel has attracted much less public attention and much less hostility from economists than the original. One reason for this would appear to be that the issues canvassed - the long-term implications of the interdependence of economic and environmental systems - have been incorporated into the sustainable development agenda.

26.3 Sustainable development?

The concept of sustainable development came to prominence in 1987 with the publication of the so-called 'Brundtland Report', according to which:

> Sustainable development seeks to meet the needs and aspirations of the present without compromising the ability to meet those of the future (WCED 1987, p. 40).

This report was produced by the World Commission on Environment and Development (WCED); the official title is *Our Common Future* (WCED 1987).

The WCED brought together, at the global level, the problems of poverty and environmental

degradation. It argued that economic activity is dependent on a healthy environment, which is therefore something that serves the interests of the poor as well as the rich. It accepted the standard argument that economic growth is necessary for improving the lot of the poor, that many environmental systems are already stressed, and that many competent analysts consider that more growth will further damage such systems, undermining the base for future economic activity. There is then a dilemma. Alleviating current poverty carries the risk of creating future poverty. Sustainable development is what the Brundtland Report offers as the way out of this dilemma.

It is a brilliant political document. It has been widely praised and little criticised, and most national governments and inter-governmental agencies, as well as business and labour organisations, declare themselves to be committed to the pursuit of sustainable development. Most economists have embraced the concept of sustainable development with something approaching enthusiasm. The different reactions by economists to the Brundtland Report and *The Limits to Growth* are interesting. In both cases, environmental problems associated with growth are identified and discussed. In both cases, it is argued that it is impossible to conceive that current trends can be continued far into the future without creating major economic problems. The explanation for the different reactions by economists to the two reports would appear to be as follows. *The Limits to Growth* offers sustainability in the sense of a constant level of total world output which can be maintained into the indefinite future. Implicit is the continuing existence of pressure for redistribution from rich to poor nations. In contrast, the Brundtland Report offers continuing growth, which remains the primary solution to the poverty problem.

The passage in *Our Common Future*, where the definition of sustainable development quoted above appears, goes on to state:

> Far from requiring the cessation of economic growth, it (i.e. sustainable development) recognises that the problems of poverty and underdevelopment cannot be solved unless we have a new era of growth in which developing countries play a large role and reap large benefits (Meadows *et al*. 1972, p. 40).

Growth is not to be confined to the developing countries:

> The medium-term prospects for industrial countries are for growth of 3-4 per cent, the minimum that international financial institutions consider necessary if these countries are going to play a part in expanding the world economy. Such growth rates could be environmentally sustainable if industrialised nations can continue the recent shifts in the content of their growth towards less material- and energy-intensive activities and the improvement of their efficiency in using materials and energy (Meadows *et al*. 1972, p. 51).

Sustainable development is economic growth, albeit of a kind which treats the environment properly. Some environmentalists regard it as an oxymoron. Economists have discovered in sustainable development an idea and a political agenda which leaves intact the status of the growth objective, which does not imply major redistribution from rich to poor, and which opens up lots of opportunities for advice, from economists among others, on how to make growth more environment friendly. The advice that economists offer is that it is all a matter of correcting market failure, making individuals and firms bear the costs of the environmental damage that they do, and changing obviously counterproductive government policies such as, for example, subsidising agriculture and coal production in Europe.

Recently some economists have argued that economic growth is itself the means to environmental protection. According to the 'environmental kuznets curve' or 'inverted U' hypothesis, as a nation's per capita income rises, so environmental damage per capita first rises with it, then levels off, and finally starts to decline. The World Bank, for example, has embraced this argument with enthusiasm. The evidence is actually mixed. The data are consistent with the hypothesis for some forms of damage with local short-lived effects (sulphur emissions, particulates, faecal coliforms) but not for more dispersed and long-lived pollutants such as carbon dioxide. In any case, as discussed in Stern *et al*. (1996), even where data are consistent with the hypothesis, the pattern of per capita income levels and growth rates across the nations of the world can be such that, at the global level, growth and damage

are positively correlated over the medium-term future.

26.4 Ecological economics

The International Society for Ecological Economics (ISEE) was established in 1989 when the first issue of its journal *Ecological Economics* appeared. The disciplinary backgrounds of those attending ISEE conferences and publishing in the journal have included economics, ecology, physics, chemistry, philosophy, geography, sociology, engineering and mathematics. The varied nature of what ecological economists do can be seen in the pages of *Ecological Economics* (now published monthly) and in volumes based upon papers presented at ISEE conferences (Costanza 1991; van den Bergh & van der Straaten 1994; Jansson *et al*. 1994).

It is hardly surprising that there is disagreement on a satisfactory definition of ecological economics. The field is in its infancy, and evolving. However, most of those involved would agree that it starts from an appreciation of the interdependence of economic and natural systems. Most would also agree that its central policy concern is sustainability/sustainable development, which arises from that interdependence. In a recent survey, Perrings *et al*. (1995) defined ecological economics as 'the study of interdependent economic and ecological systems'. In the first article in the first issue of *Ecological Economics*, the (ecologist) President of the newly established ISEE stated that:

> Ecological economics addresses the relationships between ecosystems and economic systems in the broadest sense. These relationships are the locus of many of our most pressing current problems.... but they are not well covered by any existing discipline....(ecological economics) will include neoclassical environmental economics and ecological impact studies as subsets (Costanza 1989, p. 1).

This might be described as the 'interdisciplinary' view of ecological economics: there are problems for which the solutions require inputs from the existing disciplines of economics and ecology. An alternative view is that ecological economics can and should be 'transdisciplinary': redefining the nature of problems and developing new modes of analysis. Both of these views are consistent with the Perrings *et al*. (1995) definition, and both are reflected in work done in ecological economics. The paragraph quoted immediately above continues:

> ... but it will also encourage new ways of thinking about the linkages between ecological and economic systems (Costanza 1989, p. 1).

An example of work in the transdisciplinary vein is Common and Perrings (1992). Economics conceptualises the sustainability problem as that of maintaining a constant level of per capita aggregate consumption forever - see Toman *et al*. (1995) for a survey of the economics literature. Ecologists see the problem in terms of maintaining the resilience or functional integrity of ecosystems. Common and Perrings (1992) proposed that an ecological economics conceptualisation of sustainability would involve maximising a time integral of income subject to the constraints implied by the maintenance of resilience. The analysis of this problem showed that sustainability so conceived may require compromising consumer sovereignty. Human preferences may be such that economic activity is consistent with system integrity, but they may not be. Consumer sovereignty is the foundational normative principle of economics; the pattern of economic activity to be sought is that which best fits, given available resources and technology, with human preferences. As generally understood, the sustainable development agenda does not challenge this principle; it is primarily about correcting market failure so as to realise consumer sovereignty. As noted above, economists generally have been able to embrace this agenda precisely because it is not seen as challenging their fundamental beliefs. A transdisciplinary ecological economics is challenging to those fundamental beliefs.

One consequence of the interdependence of economic and ecological systems is that uncertainty, as opposed to risk, is a pervasive feature of economic activity (Perrings 1987; Faber *et al*. 1996). While it is not true that economics ignores uncertainty, it is the case that economists are basically inclined to

treat future events as known or risky. Insistence on uncertainty *strictu sensu* is a challenge to economists' basic way of thinking. Although the safe minimum standard approach to environmental policy analysis (Bishop 1978) predates the emergence of ecological economics, it has had little impact on mainstream economics. Instead, it fits much better with ecological economics, and aligns particularly with the precautionary principle (Cameron & Aboucher 1991.

26.5 Roles for ecology

From either the interdisciplinary or the transdisciplinary view, the development of ecological economics clearly and necessarily requires inputs from ecology. It is useful to distinguish two sorts of input, which correspond roughly to the distinction between ecological economics as interdisciplinary and as transdisciplinary. In the first role, it is primarily a matter of ensuring that policy analysis 'gets the science right'. In the second, it is primarily a matter of contributing to the world views within which policy problems and responses are constructed. Of course in fact, the distinction is artificial and ecologists and economists working together on problems in an interdisciplinary way are likely to yield new ways of constructing the problems seen as requiring solutions.

26.5.1 Input to policy analysis

No economist would dispute, at the level of principle, that good environmental policy requires getting the science right. Since economists are not trained in the natural sciences, they would further agree that where a policy problem involves, for example, impacts on ecosystems and the arising implications for human welfare, there is a need to involve ecologists in dealing with the problem, formulating the policy objective and choosing between alternative policy instruments. As a matter of practice, ecological economists would be more inclined to see, in any given case, the need for ecological input, being more inclined to expect ecological impacts to be involved. Given a recognised need for ecological input, the interdisciplinary approach would, in the case of a perceived problem of river pollution for example, involve a division of labour along the following lines.

Reducing the pollution will involve costs and benefits varying with the extent of the effluent reduction, and the efficient solution will be where the excess of benefits over costs is maximised; so we need to know the relationships between cost and reduction level and benefit and reduction level. The former can be pretty much handled by economists, perhaps with some help from engineers. To figure the latter, economists would want to ask people how much they would be willing to pay to see the river in alternative states in terms of its swimability, fishability, potability and wildlife. To do this, it is necessary to know how these states, now and in the future, relate to effluent levels, and for this we need 'science' from, among others, freshwater ecologists.

The problem of how much and which land to set aside as protected areas for biodiversity conservation can be formulated in the same way, and here the role of ecologists in 'getting the science right' is clearer and larger. In this case, the difficulties involved in dealing with the inherent uncertainties are also clearer.

26.5.2 An ingredient in the 'cultural soup'

The policy-problem model just described does not concern itself with the process by which a problem comes to be perceived as such. Further, the cost-benefit approach to solving a policy problem takes the preferences of the affected individuals as given. Of course in fact, the evolution of policy and subsequent environmental outcomes is greatly influenced by the way people, including decision-makers and their expert advisers, see the world and perceive problems. Again, individuals' preferences between, say, local tax rates and different levels of river water quality are, in fact, greatly influenced by their world views and by the information available to them about how the particular problem at issue relates to such. Boyden (1987) introduced the term 'cultural soup' to mean the set of world views

prevalent, and discussed the history of public health policy in relation to changes over time in the mix of the 'cultural soup'.

A transdisciplinary approach to ecological economics recognises the role of world views in the policy process, and hence its significance for sustainable development. This opens up another role for ecology in the development of ecological economics and the pursuit of sustainable development - influencing the constituency of the 'cultural soup'. Of course, ecology is already one ingredient, along with economics, philosophy, religion and a host of other ingredients. It is an ingredient that has come to have more influence in recent years as is evidenced by the emergence on to the policy agenda of biodiversity conservation. However, it is arguable that, if progress toward sustainability is to be made, ecology needs to become a larger ingredient.

26.5.3 Sustainability indicators

One area that has attracted considerable interest in ecological economics is the development of indicators of whether or not the conditions for sustainability are being met. A number of indicators have been suggested - see, for example, Ayres (1996), Azar *et al.* (1996) - but as yet there is no consensus on what would comprise a minimal useful set, and no country's regular official statistical compilations include such data in an accessible form. Ecologists could make useful contributions in this area. In doing so, it would be useful to keep in mind two purposes that such indicators can serve, parallelling the distinction made above. On the one hand, there is a need for indicators to inform specific policy settings and choices where it is mainly a matter of 'getting the science right'. Of course one problem here is that there is considerable ignorance about what the conditions for sustainability actually are. On the other hand, indicators which are capable of impacting strongly on the public consciousness, while not necessarily being directly useful for policy determination, also have a role in affecting the general climate of opinion within which policy choices are made.

26.6 Two examples

There are many examples of ecologists being involved in ecological economics to be found in, for example, *Ecological Economics* and books based on ISEE conferences. Below are two recent, prominent examples where ecologists have made major inputs to exercises also involving economists, aligning them with the broad two-way classification suggested above.

26.6.1 Carrying capacity

In 1994, the Beijer International Institute of Ecological Economics organised a meeting intended:

> ... to establish a substantive dialogue among a small group of economists and ecologists to gauge whether an interdisciplinary consensus exists on the issues of economic growth, carrying capacity, and the environment (Arrow *et al.* 1995, p. 521).

The report appeared in *Science* in 1995 (Arrow *et al.* 1995). It addressed the proposition, discussed above in section 26.2 as the 'environmental kuznets curve' hypothesis, that economic growth is itself good for the natural environment, noted that for some environmental impacts the data appeared to confirm the hypothesis, but that it could be inferred:

> ... neither that economic growth is sufficient to induce environmental improvement in general, nor that the environmental effects of growth may be ignored, nor, indeed, that the Earth's resource base is capable of supporting indefinite economic growth (Arrow *et al.* 1995, p. 520).

The report further stated:

> The environmental resource base on which all economic activity ultimately depends.....is finite....All of this

> implies that there are limits to the carrying capacity of the planet (Arrow *et al*. 1995, p. 520).

and that:

> If human activities are to be sustainable, we need to ensure that the ecological systems on which our economies depend are resilient (Arrow *et al*. 1995, p. 521).

This is coming very close to endorsing the essential message of *The Limits to Growth*. Getting several distinguished economists, including one Nobel Laureate, to put their names to such a report can be regarded as a major accomplishment by the ecologists involved. That this is the case can be judged from the fact that three academic journals (see, for example, the November 1995 issue of *Ecological Economics*) ran special issues on this *Science* publication, though for none of the journals was the substantive content of the report in any way novel. The accomplishment falls into the second of the categories distinguished earlier; this is an exercise in addressing world views rather than policy analysis. However, the report does emphasise in general terms the need for policies to protect ecosystem resilience, and for sustainability indicators. The accomplishment would have been far greater had the report been published elsewhere, in *The Economist* for example. The world views that need to be challenged are those of economists, politicians, and much of the general public; none of these groups are avid readers of *Science*.

26.6.2 Valuing ecosystem services

In 1996, the National Center for Ecological Analysis and Synthesis sponsored a study by thirteen individuals, most of whom could apparently be described as ecologists and only two of whom are economists, which was reported in *Nature* (Costanza *et al*. 1997). In the same issue of *Nature* is a short article by an ecologist commenting favourably on the study (Pimm 1997). The simplest way to describe the study is to quote the article's abstract:

> The services of ecological systems and the natural capital stocks that produce them are critical to the functioning of the earth's life-support system. They contribute to human welfare, both directly and indirectly, and therefore represent part of the total economic value of the planet. We have estimated the current economic value of 17 ecosystem services for 16 biomes, based on published studies and a few original calculations. For the entire biosphere, the value (most of which is outside the market) is estimated to be in the range of US$16-54 trillion (1012) per year, with an average of US$33 trillion per year. Because of the nature of the uncertainties, this must be considered a minimum estimate. Global gross national product total is around US$18 trillion per year (Costanza *et al*. 1997, p. 253).

This as an example of what ecologists should not do for ecological economics. The problem here is not so much the uncertainties that the authors admit, though much has been written about the problems of the valuation methods employed, but that the number arising is meaningless and useless. The point here is not about disciplinary demarcation. It is not that valuing should be left to economists. The exercise would have been as misconceived if carried out by economists. In fact, most of the valuations applied to identified ecosystem services were originally computed by economists. The authors, on the other hand, consider that:

> ... this exercise is essential in order to: (1) make the range of potential values of the services of ecosystems more apparent; (2) establish at least a first approximation of the relative magnitude of global ecosystem services; (3) set up a framework for further analysis; (4) point out those areas most in need of additional research; and (5) stimulate additional research and debate (Costanza *et al*. 1997, p. 253).

Here, (1) and (2) are primarily objectives of the second type distinguished above, while (3), (4) and (5) relate more to policy analysis. It seems clear that the authors actually see this kind of exercise as being mainly about affecting world views. They do not discuss any specific policy issues. They do say, for example, that:

> Costanza *et al*. 1997, p. 259).

The implication is that it is only through monetary value numbers that the importance of ecosystem services can be appreciated. Thus:

> Because ecosystem services are not fully 'captured' in commercial markets or adequately quantified in terms comparable with economic services and manufactured capital, they are often given too little weight in policy decisions (Costanza *et al*. 1997, p. 253).

There is little doubt that ecosystem services are typically given too little weight in policy decisions. But it is surely a mistake to attribute this solely to the fact that they do not have prices attached to them. Politicians and voters give lots of weight to things that do not have prices attached to them: national identity and sovereignty, civil liberty, public health, crime levels and so on. The idea that putting prices on ecosystem services is necessary and sufficient for getting politicians and voters to take them seriously seems to me to involve a very curious view of politics and of human psychology. It is a view that is apparently shared by most economists who embrace the agenda of sustainable development as set out in the Brundtland report and who want to devote non-trivial amounts of scarce intellectual talent to producing 'green national income accounts' and related endeavours - see, for example, Bartelmus (1994), Common and Norton (1994).

In seeking to influence the current 'cultural soup' ecologists would do better to work with tools such as 'ecological footprinting' - see, for example, Wackernagel and Rees (1997) - and measures of photosynthesis product appropriation (Vitousek *et al*. 1986). For policy analysis purposes they also have a lot to contribute to the development of sustainability indicators.

26.7 Conclusion

In a democracy, policies to promote sustainable development have to have the support of or at least be tolerable to a majority, or at least a large minority, of the electorate if they are to be effective. Hence, while 'getting the science right' in analysing particular policy problems is necessary for the pursuit of sustainable development, it is not sufficient. Solutions will remain academic unless they can command political support. Hence, ecologists should give even more attention than they currently do to influencing the 'cultural soup' that nourishes the population at large. This is not a recommendation that they become either 'green activists' or propagandists. Rather, it is the suggestion that they do more to spread a proper understanding of what they know, and what they do not know; the inherent uncertainty that attends environmental policy needs to be more widely appreciated. Nor is it to suggest that, given all the competing influences, this would be easy. It would be highly desirable for all first year tertiary students to study a comprehensive and compulsory subject which would acquaint them with current economic conditions around the world and the biophysical circumstances within which such conditions must be addressed. Such a unit might well be called 'Ecological Economics'; it would have to be interdisciplinary and might become transdisciplinary. <

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