4

Environmental Economics

The previous chapter focused on the way that the dominant economic paradigm has responded when confronted with environmental problems. To some extent environmental economics works within the same paradigm and accepts many of the techniques and tools that neoclassical economics has developed. Environmental economists concern themselves with two main issues which arise from the recognition of planetary limits: environmental pollution and the depletion of scarce resources, including species. Initially environmental economics was a distinct sub-field from natural resource economics, which had a longer pedigree, but the two are now generally studied together.

As its name suggests, environmental economics foregrounds concern for the environment and takes these issues more seriously: 'Environmental economics, in which environmental goods and services, as well as environmental risks, are given a monetary value, is the first systematic attempt to introduce the environmental dimension within mainstream economics.' (Barry, 2007: 239). It may seem surprising that economists took so long to wake up to the fact that the economic system was running up against planetary limits, but, if we think back to the spaceman vs. the cowboy metaphor that was introduced in Chapter 2, we can begin to understand how the thinking of economists prevented them from recognizing the limits—perhaps until it was too late.

The following section provides an introduction to environmental economics as the first branch of that discipline that has systematically prioritized the environment in its study. Section 4.2 explores a key aspect of environmental economics: creating markets for environmental goods and especially how these might be priced. Section 4.3 explores a theory about how economic growth and environmental quality might be related. Section 4.4 considers how far markets are capable of protecting the environment while Section 4.5 provides a case-study of one example of pricing a key global resource: the tropical forests.

4.1. *Economics with the Environment at its Heart*

Hanley and his colleagues (2001) begin their useful introduction to the subject by listing the insights from economic theory which they think are helpful to policy-makers seeking to protect the environment. These are reproduced in Box 4.1. This list indicates clearly that environmental economics is a school of economics, first, and then takes the environment into its thinking, although

the authors also concede that there are insights from ecology which economists ought to be aware of.

Box 4.1. Ten Key Insights from Economics which Policy-Makers Need to be Aware of

1. Economic and environmental systems are determined simultaneously
2. People make decisions in response to incentives and to maximize utility
3. Environmental resources are scarce
4. Markets are the best way of allocating a vast range of resources
5. Environmental problems arise from market failure
6. Government intervention can make things worse
7. Environmental protection costs money
8. When managing renewable resources choosing the maximum sustainable yield is rarely optimal
9. Economic growth is not a panacea but has achieved high quality of life
10. Environmental problems are global and negotiating solutions by agreements will be hard

We can see from this list that environmental economists have faith in the market as a useful allocation mechanism and believe that the reason it has generated so many environmental problems is due to 'market failure', i.e. the market not operating as efficiently as it should. As we will see later, their proposed solutions revolve around various techniques to ensure that markets can take into account environmental costs and benefits. Environmental economists use the methods of conventional economics, with its reliance on mathematics, in both analysing the problem and seeking solutions. Hence, they will use a diagram such as that presented in Figure 4.1 to explain how economic activity and waste are related.

The figure makes clear that environmental economists take the natural limits of the planet very seriously: 'First, like anything else in nature, the assimilative capacity of the environment is *limited*. Thus, the natural environment cannot be viewed as a bottomless sink. With respect to its capacity to degrade waste, the natural environment is, indeed, a *scarce* resource.' (Hussen, 2000: 92). Figure 4.1 assumes that there is a positive linear relationship between waste and economic activity, i.e. that as economic activity increases, the amount of pollution increases at a proportional rate. The 45^{o} line in the figure is a visual representation of this relationship and the equation $W = f(X, t)$ indicates that pollution (W) is a function of the level of economic activity (X) and the variable *t*, which represents technological and ecological factors. If we assume that the latter are fixed, then we can conclude that there is a fixed assimilative capacity of the environment, which is

represented in the graph as the dotted horizontal line which intersects the y-axis at W_0. Hence a level of pollution represented by X_0 can safely be absorbed.

If we relax our original assumption, we could model a change in the level of technological sophistication with which we deal with pollution by moving the dotted line upwards, meaning that the environment could now assimilate more pollution. Alternatively, we could change the relationship between the level of economic activity and the rate at which pollution is discharged, perhaps by moving towards more efficient production processes. This would be represented by a movement downwards of the diagonal line so that it was less steep, so that again we could increase the level of X without further degrading the environment.

Figure 4.1. The flow of materials, energy and waste through and ecosystem [Hussen Figure 5.1]

The primary aim of environmental economists is to protect the environment. Their commitment is that markets are powerful mechanisms that can be used to safeguard the environment against the potential negative effects of economic activity. The environmental crisis makes it clear that markets are currently not protecting the environment, hence environmental economists seek to explain this 'market failure':

> Market failure comes about when people cannot define property rights clearly. Markets fail when we cannot transfer rights freely, we cannot exclude others from using the good, or when we cannot protect our rights to use the good. Under these conditions, free exchange does not lead to a socially desirable outcome because we either provide too much of bad goods like pollution or too few of good things like open space (Hanley *et al.*, 2001: 16).

They have three central explanations, which are interrelated:

1. The public goods problem: Goods which we all benefit from but some of us pay for, or which damage us all but only some of us produce, what economists call 'public goods' are always problematic in market systems. Hence, a market system may result in too much pollution and too few footpaths.
2. The 'externality' problem, i.e. the fact that pollution is 'external' to the operation of the factory or business and hence can be ignored in the company balance-sheet (this is discussed further in Chapter 11).
3. The common goods problem: when it is unclear who owns a part of the environment then nobody has the right incentive to protect it. Environmental economists refer to this as a 'missing market' and seek to create a commodity

which can be owned and therefore protected (this is discussed further in Chapter 14).

Because environmental economists consider that the best way to protect the environment is to create a market, they need to find ways to both commodify and price the environment. The following section addresses how they create prices for non-market goods.

4.2. *Valuing the Environment*

As we saw in the last chapter, neoclassical economists consider that markets are the most efficient means for allocating resources and that prices are important signals for allowing economic agents to interact with each other over the exchange of these resources. The reason environmental pressures have arisen that the market is not able to cope with is, according to this theoretical perspective, a result of their not being easily susceptible to being commodified and priced.

It is frequently the case that some of the world's poorer nations have less spoiled ecosystems which are supporting the global environment, such as the rainforests which act as massive sinks for carbon dioxide and huge reserves of species. Since 1992 UNCED (UN Conference on Environment and Development) has been exploring ways to create global markets for environmental goods in a process which recognizes the valuable 'good' that the country providing the environmental service is offering the world. If global production processes despoil these environments then the countries that lose them should be financially compensated. Table 4.1 lists some of the proposed global markets that might be created—these are sometimes referred to as 'shadow markets' because they do not really exist.

Table 4.1. Potential Global Markets for 'Environmental Goods and Services'

Type of mechanism	Compensating benefit to host country	Global environmental benefits
Global markets		
Intellectual property rights/bio-prospecting deals	Contracts and up-front payments to share any commercial returns from pharmaceutical and other products	Biodiversity, protected areas
Joint implementation/carbon offsets	Foreign capital investment in energy and land use sectors	Reducing greenhouse gases, carbon store, biodiversity
Debt-for-nature swaps	Purchase of secondary debt in exchange for	Biodiversity, carbon store

	protected areas	
Market regulation/trade agreements	Premium in importing markets for sustainable exploitation of resources	Biodiversity, wildlife, forests
Transferable development rights	Landowners/developers are compensated with alternative rights to develop areas with less environmental value	Biodiversity, protected areas, carbon store
International compensation		
Global environmental facility	Payment of the incremental cost of conserving any global benefits	Biodiversity, protected areas, ecosystem services, carbon store, international waters, reducing GHG emissions
Global overlays	Modifying conventional cost-benefit appraisals of projects to account for any global benefits	Carbon store, biodiversity
Environmental funds	Long-term financing of environmental and community-based conservation projects	Biodiversity, protected areas, regional and trans-boundary benefits

Source: Pearce and Barbier, 2001.

If we could create these shadow markets, how would we go about setting prices for the environmental goods to be traded in them? If we could price aspects of the environment that we wished to protect, then markets would be able to resolve the environmental crisis:

> A critical step in the economic calculus is that between a preference for something and a willingness to pay to secure it. That is how markets work, and in affording economic values to environmental assets, functions and processes the economist is taking what are often, but far from always, non-market phenomena and stimulating willingness to pay for those phenomena (Pearce, 1998: 14).

Environmental economists believe that if they could create markets and prices to cover environmental goods and services they would have solved the environmental problem. The creation of 'missing markets' is a key tool in the environmental economist's kit and they have ingenious and laborious techniques for attempting to do this.

Pearce (1998: 41) identifies three economic functions of the environment: as a supplier of resources, as an assimilator of wastes, and as a

direct source of utility in terms of enjoying the view or feeling spiritually uplifted. He also distinguishes between four different types of 'value' that are provided by the environment:

Direct values relate to resources that can be physically extracted from the ecosystem and then sold or made into products that can be sold: examples might include wood from rainforests, plants that can be turned into medicines, and so on.
Indirect values relate to other 'services that the ecosystem provides but do not have a solid physical existence': examples are the ability of certain plants to absorb chemical wastes and break them down, or the capacity of the earth's environment to absorb carbon dioxide.
Option values is the term that is used to describe money that people are prepared to pay to protect the environment so that they can derive either direct or indirect value from it in the future.
Existence values are an attempt to put into monetary terms the intrinsic value that people accord to the survival of an ecosystem in its own right, perhaps because they appreciate the view or value the survival of species which rely on it for their continued existence.

The first three types of value are all use values, whereas the fourth is a non-use value.

For environmental economists the explanation for the over-production of pollution or over-use of resources is that the 'environmental goods' that are damaged by these processes are not traded in markets—which they refer to as 'missing markets'. Hence, 'traditional cost-benefit analyses tended to ignore the loss of the values derived from aspects of the environment when economic development takes place. In recent years economists have put much more effort into attempting to identify the economic values associated with preservation.' (Dresner, 2002: 108). They do so by creating 'shadow prices', i.e. imputing prices to pseudo-goods that do not actually exist. Such prices are devised through a research process, for example surveying people to determine how much they would be prepared to pay for the preservation of an environmental good, if it could be traded and if a market for it existed.

There are fundamental problems with trying to price environmental protection, perhaps the most important being that the environments of countries where people have less money will automatically acquire a lower monetary value, not because they are less valuable in any moral sense but merely because the people living there, who would lose if they were destroyed, cannot afford to offer so much to pay for them. Dresner (2001: 111) cites the example of a disagreement between economists working for the IPCC and a London-based lobby group the Global Commons Institute. The argument focused on the differential valuation of land in rich and poor

countries. The loss of land in the countries of the South was valued at one tenth of the rate of the land in rich Western countries. 'Based on an assessment of "willingness to pay", the IPCC economists had valued the cost of a lost life in Western countries at US$1.5m. . . . They had valued a life at US$100,000 for the rest of the world. This is just one of a number of moral and practical criticisms that are made of the techniques of shadow pricing.'

There are a number of actual techniques that can be used to create pseudo-prices for aspects of the environment. According to Pearce all have two stages: first the economic value must be demonstrated and measured; second, it must be captured or 'appropriated'.

Conventional Market Approaches

This is the most straightforward method, since it begins with the existing market cost that needs to be paid to restore the environment to its pre-existing state. If the environmental problem we are considering is pollution from a factory, for example, the price is whatever it would cost to clean up that pollution. If this price is not enough to protect the intrinsic value of the watershed which absorbs the pollution, then a technique of 'shadow pricing' might be used as well—adding to the cost of the clean-up an additional value which reflects what people would be prepared to pay to have their watercourse restored. Sometimes these market approaches aim to restore the value of something that has been destroyed by pollution, for example paying a farmer the value of a crop that could not be sold because it had been contaminated.

Household Production Functions

This name appears to bear little relation to the technique it describes, which involves costing the substitute that can be offered to the consumer who has lost out because something they value in the environment has been destroyed. Examples might be the cost of installing insulation to prevent noise from aircraft destroying the peaceful enjoyment of the home or the cost of travelling to a park that is far from a person's home because the nearby park has been used as development land by a supermarket.

Hedonic Price Methods

Hedonic pricing involves using markets that do exist that approximate to the goods or services that are destroyed and using the prices that are paid in that market to impute a price to the non-tradable commodity. The price that exists in the real market is considered as an implicit price for the missing market. A popular example is the 'hedonic housing market', which relates the price

premium for homes in a certain area to the value people place on the peace, proximity of green space for leisure, low levels of noise pollution and so on in the local environment.

Experimental Methods

The previous methods are all conducted by environmental economists working from existing data and in the quietude of their offices. In experimental methods they venture into the world and discover how much people value aspects of the environment by asking them directly what they would be prepared to protect it. In a method known as 'contingent valuation' people are asked what they would be willing to pay to protect their local park or to avoid having a nuclear power-station built in their community, for example. The method known as 'continent ranking' or 'stated preference' involves how much they value an environmental good relative to other goods which are actually bought and sold in a market, enabling the researcher to fix the relative price of the environmental good that they are interested in.

It is clear from these various techniques that they are hugely complicated (and expensive) to calculate and that the prices that are arrived at can never be considered to have a definite relationship with the value people place on the environmental good or resource that is under threat or has been lost. An environmental economist would argue that, in a society where markets dominate, pricing the environment, no matter how inadequately, affords the environment the best protection. Critics might suggest that a more pragmatic conclusion would be that there are areas of life too precious to be included in the sphere of the market.

4.3. *When Will We Be Rich Enough to Save the Planet?*

The previous section indicated that, if we create pseudo-markets for environmental goods, then those in poorer countries—or poorer areas in wealthier countries—will find their environments less well protected. Another way of looking at this issue is to consider development as a movement towards the demand for more sophisticated goods. Poorer people are struggling to meet their basic needs for food and shelter and so cannot afford to concern themselves with protecting their environment. Environmental economists suggest that there is an inverted U-shaped curve relating income to indicators of environmental quality. They call this the 'environmental Kuznets curve' (see the illustration in Figure 4.2), referring to a similarly-shaped curve that Kuznets used to described the relationship between income levels and equality within a society. The curve implies that, while development may initially result in poorer environmental standards as

pollution levels rise, as countries become richer still they begin to prioritise environmental quality and hence it rises again. For example, 'We find that while increases in GDP may be associated with worsening environmental conditions in very poor countries, air and water quality appears to benefit from economic growth once some critical level of income has been reached' (Grossman and Krueger, 1994: 18-19) or, more succinctly, the evidence suggests that it is possible to grow your way out of environmental problems.

Figure 4.2. Environmental Kuznets Curve

As Ekins notes, these are strong conclusions:

> They create the impression that economic growth and the environment are not only not in conflict—the former is necessary to improve the latter. They invite an emphasis on achieving economic growth rather than on environmental policy, because the former is perceived to be able to achieve both economic and environmental objectives, while the latter may impede the former (Ekins, 2000: 183).

The state of the environments of the world's richer nations can itself be used as evidence against the theory of the EKC. If we are not rich enough by now to protect our environments, when will the turning point arrive? And can we find enough resources and energy on a limited planet to reach it?

The leading ecological economist Herman Daly has made scathing remarks about the Environmental Kuznets Curve:

> Hurray! The cure to an environmental problem is just to persist in uneconomic growth. Once you get beyond the hump of the U it goes down and you enter the realm of win-win solutions, everything gets better at the same time and so forth. . . .So, what is the point that I am making? The point is that these problems all have the same solution, more economic growth and the assumption in all cases is that growth truly is economic, that this growth really is making us richer at the margin rather than poorer. If we enter an era of uneconomic growth then uneconomic growth makes us poorer. It is not going to sustain the demographic transition and cure overpopulation. Neither will it help to redress unjust distribution, nor will it help in cleaning up the environment (Daly, 1999).

We might summarise his point as follows: while a response to the pollution that development brings with it might be to control that pollution, that itself brings further demand for economic growth, and so we can enter an infinite regress in which we are using more energy but never achieving the environmental quality we are seeking.

Ekins concludes that the evidence for the EKC is mixed and varies depending on the type of pollutant we are considering. In terms of evidence

for the EKC hypothesis for environmental quality as a whole it is not convincing. The evidence is strongest in the case of air pollution including carbon monoxide, nitrous oxide and sulphur dioxide. However, there is no way of determining whether this relationship is causal and it does not appear to arise automatically from economic processes but rather from political decision-making: 'any improvements in environmental quality as incomes increase is likely to be due to the enactment of environmental policy rather than endogenous changes in economic structure or technology' (Ekins, 2000: 210).

The hypothesis also fails to draw a distinction between different groups within societies. It may be that there are elites within poor countries who benefit from increased economic activity but can remove themselves from the negative environmental consequences of that activity, for example they may manufacture clothes in a factory that pollutes the local river, which impacts on the life of villagers downstream, but themselves live in a distant urban centre. So the villagers may demand pollution control but have no power to ensure it. It is fairly clear that the environmental regulation that has been introduced in the richer Western countries has been the result of determined and persistent political activity so that there is no automatic connection and—for countries without democratic systems—perhaps no connection at all between economic development and improved environmental protection.

4.4 *Can Markets Save the Planet?*

So the central aim of environmental economists is to extend the market mechanism—and especially the price mechanism—to encompass the environment. They have come under sustained attack from environmentalists (as well as ecological and green economists) for this attempt to commodify as 'ecosystem services' certain fundamental aspects of the planet. While others would criticize his view of the planet as a provider of goods and services in this way, Pearce is keen to stress that it is actually an indication of his commitment to environmental protection:

> They are economic functions because they all have a positive economic value: if we bought and sold these functions in the market-place they would all have positive prices. *The dangers arise from the mistreatment of natural environments because we do not recognize the positive prices for these economic functions.* This is not the fault of economics or economists. . . Indeed, environmental economists have been at considerable pains to point out these economic functions and to demonstrate their positive price. (Pearce, 1998: 41).

Pearce (1993: 13) is also keen to make a distinction between 'measuring the values of people' and their preferences for protecting aspects of their environment and actually putting a price on the environment itself. His claim is that environmental economists are attempting to do the former and that they have been sorely misunderstood by their critics who claim they are trying to do the latter. The environment has both an intrinsic value and an economic value, he claims, and using money as a measuring rod to assess the one does not diminish the other; in fact, it might provide a means of better protecting it.

This chapter has introduced the response of orthodox economics to the environmental crisis—changing the objective without changing the methods. For some economists this is not going far enough: 'Environmental economics may be criticized for economizing the environment rather than ecologising economics' (Barry, 2007: 240). As we will see in the following chapter, the pricing of the environment is a key point of disagreement between environmental economists and ecological economists, who claim that some aspects of life are, literally, priceless and that attempts to create pseudo-prices for them may miss the point.

4.5. *Case-Study: Pricing the Rainforest*

In the context of a rainforest the four different kinds of values outlined in Section 4.2 are all relevant: direct value, indirect value, option value and existence value. The total economic value (TEV) is the sum of these four types of value: TEV = DV + IV + OV + EV. Table 4.2 indicates what sorts of values a rainforest provides in each of these categories.

Table 4.2. Total Economic Value of a rainforest

Direct value (1)	Indirect value (2)	Option value (3)	Existence value (4)
Sustainable timber			
Non-timber products	Watershed protection	Futures uses under (1) and (2)	Forests as a source of spiritual value
Recreation	Nutrient cycling		Cultural and heritage value
Medicine	Climate change mitigation		Inheritance to future generations
Plant genetics	Micro-climate		Existence of species who rely on the ecosystem
Human habitat			

Source: Pearce,1993; Ruitenbeek (1990, 1992).

Pearce reports a specific valuation project that was conducted on the Korup National Park in south-western Cameroon in the late 1980s. The rainforest is a rich and varied habitat: 'It contains Africa's oldest rainforest, over 60 million years old, with high species endemism. There are over 1000 species of plants, and 1300 animal species including 119 mammals and 15 primates. Out of the total listed species, 60 occur nowhere else and 170 are currently listed as endangered.' (Pearce, 1993: 17). The research project focused on estimating the direct and indirect value of the forest to Cameroon itself. It was considered that the existence value would be of importance only to those outside the countries and so no attempt was made to place a monetary value on them. Option values were also not estimated. The research determined that the benefit of conserving the rainforest would have been just over 3,000m. CFA [Cameroonian francs] whereas the loss of value through the end of logging and the loss of sale on timber would have been more than 5,000m. CFA., meaning that the Cameroon would have lost through conserving the rainforest.

At this stage the World Wildlife Fund, who were sponsoring the research, directed attention towards the non-use value of the rainforest. If the rest of world valued this sufficiently it would be prepared to pay the Cameroonian government to protect it. This could be by means of what are known as 'debt-for-nature swaps' (Table 10.1 gives some idea of the value foreign governments place on these sorts of swaps). The loss of economic value through preserving the rainforest rather than exploiting it is considerable to local people, but others will benefit because their livelihoods gained from using resources provided by a living forest will continue, as will their ability to feed themselves by catching fish. Other values included in the calculation relate to revenues from eco-tourism to the rainforest, and cost savings because the flooding and soil erosion that would follow intensive logging would not take place. The project did not attempt to place a monetary value on the existence value of the rainforest, nor did it value the contribution of the forest to absorbing CO_2 and thus mitigating the worst effects of climate change.

Summary Questions

- The Environmental Kuznets Curve would suggest that poorer countries always protect their environments less well than richer countries—do you think this is actually the case?
- Think of an environmental loss that occurred in your experience—which of the pricing methods described would best put a price on the loss you experienced, if any?
- How can we price the value of forests in mitigating the worst effects of climate change?

- How useful would it be to include such 'shadow prices' in international climate change negotiations?

Further Reading

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