

GATEKEEPER SERIES No LEEC 89-01

*Briefing papers on key issues
in environmental economics*

Sustainable Development: an economic perspective

DAVID W. PEARCE



IIED

INTERNATIONAL
INSTITUTE FOR
ENVIRONMENT AND
DEVELOPMENT

LONDON ENVIRONMENTAL ECONOMICS CENTRE

GATEKEEPER SERIES

This Gatekeeper Series is produced by the London Environmental Economics Centre (LEEC). This Centre was established in 1988 and is a joint venture by the International Institute for Environment and Development (IIED) and University College London (UCL). Its aims are the furtherance of policy relevant research in the field of environmental and natural resource economics, particularly in the context of developing countries.

This Gatekeeper Series highlights key topics in the field of environmental and resource economics. Each paper reviews a selected issue of contemporary importance and draws preliminary conclusions of relevance to development activities. References are provided to important sources and background material.

The Swedish International Development Authority (SIDA) funds the series, which is aimed especially at the field staff, researchers and decision makers of such agencies.

THE AUTHOR

David Pearce is Professor of Economics at University College London and Director of London environmental Economics Centre.

Introduction: the Economic Meaning of Sustainable Development

Sustainable development is about being fair to the future. It is about leaving the next generation a similar, or better, resource endowment than that which we inherited. Resources enable us to achieve society's goals, the maximum wellbeing of the population combined with special concern for the most disadvantaged, the poor, the sick, the infirm. But any generation can increase its wellbeing at the expense of the future by plundering resources now, by rapidly depleting exhaustible resources such as coal and oil, by removing more than the sustainable yield of renewable resources such as timber and fish, and by disposing of wastes to receiving environments in amounts greater than those environments can assimilate. Being fair to the future means behaving sustainably. It means taking only the sustainable yield from renewable resources and honouring the environment's limited capability for receiving waste. It means using exhaustible resources wisely so that, as they are depleted, the profits from their use are reinvested in technology and other forms of capital wealth.

The basic rule of sustainability - leaving the same or an improved resource endowment as a bequest to the future - is open to two broad interpretations. Everyone is familiar with the idea of capital wealth - the stock of machinery, factories, roads made by man. There is human capital too - the stock of knowledge that advances as man discovers, experiments and thinks. By now we should also be familiar with the idea of environmental wealth - the stock of natural assets such as tropical forests, freshwater, fisheries and wildlife. Less familiar is the idea of thinking of other environments as wealth too. The ozone layer is an environmental asset, as are the fundamental biogeochemical cycles that regulate the earth and life upon it.

The Broad Interpretation of Sustainability

On the first interpretation of sustainability as fairness to the future it is the total stock of all forms of wealth that must not be depleted. It is consistent with this view that environmental wealth is depleted as long as that depletion is compensated for by a building up of the other forms of wealth, human and capital wealth. Equally, if man-made wealth is run down, environmental capital must be built up to compensate. On this broad view of sustainability the two basic forms of capital - man-made and natural - are substitutes for each other. Deciding how much to have of each form of capital then depends on the values placed on them by society. If it is more important to clear tropical forest for agriculture or timber, then the broad interpretation of sustainability sanctions that process.

This view of sustainability can be found in the literature on sustainable development. Several observations are in order.

First, deciding how much to have of each form of capital rests on determining their correct values. To the economist this means finding the right prices. Pricing man-made capital presents little problem since it is bought and sold in the market place. Pricing the environment is much more difficult. It strikes many people as immoral since the environment is surely 'beyond price'. There are also few markets in environmental services: we do not buy and sell the services of the ozone layer, nor the watershed protection functions of tropical forests, nor the water purification functions of wetlands. To say that environments are 'beyond price' is unhelpful. If it means environments are infinitely valuable then the logical outcome is that we should never do anything to harm any form of environmental capital. A moment's reflection will show that such a rule would stultify human existence. If it means that environments are somehow outside the economic value system then we have little basis for choosing between environmental and man-made capital. The argument that environments are 'beyond price' are not illogical: of course there are moral arguments for preservation based on rights to existence. But there is an alternative route to conservation and it is more workable and persuasive. Even though environmental services are rarely bought and sold in markets, it is possible to get some idea of what those values would be if only there was a market. This is the economist's idea of a 'shadow price', the price that would rule if environmental goods and services were traded in the 'right' amounts¹. So, our first observation is that sustainable development means getting our accounting systems to reflect, as far as possible, the shadow prices of the environment.

The second observation follows from the first. We cannot leave it to unfettered markets to secure the 'right' amount of environmental capital. Market economies tend to behave as if environmental services were free goods, gifts of nature. But economies and environments interact in intricate and pervasive ways simply because of the laws of thermodynamics. It is an inescapable fact that economies cannot function without materials and energy, and it is equally inescapable that those materials

¹. Strictly, shadow prices exist for all commodities whether they are marketed or not. Shadow prices are the prices that would rule if resources in the economy were optimally allocated. It is well known in economics that freely functioning markets will not secure such an optimal allocation because of what is known as 'market failure'. One conspicuous form of market failure arises because the prices of goods and services do not include the services of the environment that are used up in making those goods.

and energy will reappear in natural environments as wastes². But anything that is effectively sold at a zero price will be overused. Hence any economic system that treats environmental systems as free goods will overuse them. Environmental degradation is a symptom of 'market failure'.

The third observation about broad sustainability is that we must invest the proceeds of any resource depreciation to ensure fairness to the future. But all too often we do not do this: we consume the proceeds. This is a familiar feature of political debate in resource-endowed countries. In the United Kingdom, for example, there has been controversy over the uses to which North Sea oil revenues have been put.

Sustainability as Conservation of Natural Resources

The broad interpretation of sustainable development is consistent with running down environmental wealth as long as man-made capital is substituted for it, and as long as the 'trade-off' is fully informed in terms of the right prices for the two forms of capital. But the sustainable development debate has tended to place even more importance on environment than is given in the broad view. What are the arguments for conserving natural assets so as to leave the next generation with a similar environment to ours ?

Many environmental assets do not have man-made substitutes. We cannot feasibly plug the hole in the ozone layer, nor substitute readily for the carbon cycle. The fact of non-substitutability should lead us to be even more cautious about running down environmental capital.

A further variation on non-substitutability is that we cannot replace an extinct species. Much environmental capital has the feature of being irreversible: once lost it cannot be regained. This may be contrasted with man-made capital which can be destroyed and rebuilt almost at will. Some people argue that the wellbeing obtained from some other asset will be just the same: although we cannot substitute for the rhinoceros or elephant, we can create some good which will give us equal pleasure. This 'substitution of wellbeing' argument ignores the important fact that wellbeing, or 'utility' in the economist's language, is not homogeneous. There are experiences which for many people are unique and for which there are no substitutes: the music of a great composer, the writing of a Shakespeare, the wonder of a rainforest.

². Subject to recycling, of course. But we cannot recycle energy at all, while the second law of thermodynamics should remind us of the impossibility of 100% materials recycling.

Finally, we do not fully comprehend how natural environments function and what services they provide. Yet in face of such uncertainty it seems dangerously risky to behave as if we know what we are surrendering by degrading our environment further.

For these reasons at least, sustainable development must mean compensating the future for any environmental losses by replacing those losses with similar assets. Simply pointing to a constant or increasing stock of total wealth is not enough.

The Economic Implications of Sustainable Development

We have dwelled at length on the meaning of sustainable development because such reflection points to several major steps that need to be taken in practice.

(a) Changing the National Accounting System

There is already a significant amount of effort going into the modification of the way in which we measure economic progress. The basic indicator is gross national product (GNP), which measures the aggregate value of the output in the economy in a given year. GNP ought to be related to society's wellbeing. If GNP goes up we ought to be able to assume that wellbeing has improved. But GNP is misleading in this respect. Consider what happens if people spend money trying to adapt to or prevent pollution. Their expenditures appear as a contribution to GNP. The environmental damage they seek to offset is not recorded at all. This is essentially the same point we made earlier: simply because environments do not generally have markets it does not mean that they have no economic value. But GNP essentially measures the value of marketed output. It ignores the environment. A more correct measure of GNP would net out the kinds of 'defensive' expenditures incurred to combat pollution.

In the same way, any environmental damage that occurs should be valued and deducted from GNP. National accounts statisticians are also used to making reasoned estimates of the amount of depreciation of man-made capital. They deduct this depreciation from GNP to get net national product (NNP). This is a better measure of wellbeing because it allows for the fact that some of the wealth from which GNP flows is subject to decay, depreciation. But NNP ignores natural wealth. It too is subject to depreciation, for example by running down reserves of oil or reducing the standing stock of forest. There is no logic to support including one form of depreciation and ignoring the other.

These types of modifications to the accounting systems are beginning to be made, but they are complex and costly in practice. A feasible alternative is to publish a separate set of resource accounts which show, in non-monetary units, just what is happening to the resources in a given country. Such accounts exist in France and Norway. More modest modifications can be made to sets of environmental statistics published in most developed economies but which are rare in the developing world. The main change is the need to show how changes in environmental variables are linked to changes in the economy. This at least avoids the error of managing the economy as if economy and environment are unrelated.

(b) Correcting Prices

Whether the broad or narrow view of sustainability is adopted the discussion showed that it is vital to ascribe the right economic values to natural resources. Two modifications are needed. First, the prices of natural resources should reflect their full value. The price of a resource is obviously linked to the cost of its extraction or harvest. The market mechanism will ensure that these costs are reflected in prices. But resource extraction and harvesting can also impose costs on others. If timber is removed unselectively from a tropical forest there is damage to the watershed through river pollution and soil erosion. Those costs are not reflected in the price of timber. The market has 'failed' because the timber price is not picking up the value of the natural environmental services it has effectively used. We can say that prices should not just reflect the extraction and harvesting costs, but also the environmental costs. There is one more adjustment to be made to resource prices. If a resource is harvested sustainably its stock will remain broadly constant over time. If it is used unsustainably its stock will be reduced and what is lost will not be available to the next generation. This lost future benefit from unsustainable management is called a user cost. Obviously, there must be a user cost involved in all extraction of an exhaustible resource. There is also a user cost attached to the non-sustainable use of a renewable resource.

We therefore have a basic rule for the 'proper' pricing of natural resources. Those prices should reflect extraction costs plus environmental costs plus user costs³.

³. Economists relate prices to costs at the margin. That is the best allocation of resources (one that maximises the wellbeing of society) is achieved when prices everywhere reflect the cost of producing an extra quantity. The resource pricing rule outlined here is thus more strictly formulated as price equals marginal extraction cost plus marginal environmental cost plus marginal user cost, or $P = MC + MEC + MUC$.

The second adjustment is to the prices of commodities. Because the production of goods and services necessarily uses up environmental services which are treated as if they are free, those prices are not correct prices. The adjustment required is consistent with the 'polluter pays principle' - i.e. making the polluter pay for the costs of environmental clean-up or for the environmental damage done by the production of the good in question. This can be done by imposing a charge on the good for its pollution content. The charge will be partly passed on to the consumer in the form of higher prices. This may seem to be making the consumer rather than the polluter pay. But it is exactly what should happen. The consumer, after all, is the ultimate polluter: he signals to the producer what he wants and should therefore pay the full costs of its production. In practice pollution charges are rare: the main way in which the polluter pays principle is implemented is by making polluters pay the costs of regulations designed to achieve a given environmental standard. But it is time to begin much more imaginative policies involving pollution charges.

(c) Project Appraisal

The third illustrative modification required for the implementation of sustainable development practice is to alter the way in which we appraise investments. When deciding on a development project it is all too common to pay only lip service to the environment. This is especially true of the rules used by bilateral and multilateral agencies lending to the developing world. Practice is being changed slowly. The vital modifications needed are in terms of measuring the environmental effects of projects and getting environmental values integrated into the economic appraisal. The techniques for doing this are fairly widely available, although there is still a large amount of work to be done. A further change is required. Development projects will inevitably degrade some environmental assets even when environmental effects are properly priced. But allowing that degradation is not consistent with holding the stock of environmental assets constant over time. Thus it is necessary to alter the portfolio of investments to ensure that there are offsetting investments in the environment. These offsetting investments will not necessarily pass an orthodox project appraisal test. Their function is to compensate for the environmental losses incurred in other projects⁴.

⁴. This 'compensating project' idea is more fully explored in David Pearce, Edward Barbier and Anil Markandya, Sustainable Development and Cost Benefit Analysis, London Environmental Economics Centre, LEEC Paper 88-03.

Conclusion

Putting sustainable development into practice means altering the way we measure economic progress. It also means altering the way we allocate resources within the economy. The price mechanism is very powerful allocator of resources because it relies on people acting in their own self-interest. It follows that we can use that self-interest motive to good effect by altering the signals that we send out to producers and consumers in the economy. But 'getting prices right' is only part of the story. Monitoring the environment to see how it is changing and investing in the environment to ensure that the stock of environmental assets is not reduced overall is fundamental to achieving sustainable development⁵.

⁵. This is a necessarily brief paper. The ideas in it are developed at length in David Pearce, Edward Barbier and Anil Markandya, Sustainable Development: Economics and Environment in the Third World, Edward Elgar Publishing, London, in press; and David Pearce, Anil Markandya and Edward Barbier, Sustainable Development, Resource Accounting and Project Appraisal: State of the Art Review, Report to the UK Department of the Environment, London, 1989.

THE LONDON ENVIRONMENTAL ECONOMICS CENTRE

PUBLICATIONS

JUNE 1989

LEEC DISCUSSION PAPERS

88-01

David W Pearce, Edward B Barbier and Anil Markandya,
Environmental Economics and Decision Making in
Sub-Saharan Africa. September 1988. (£2.50)

88-02

Edward B Barbier, Sustainable Agriculture and the Resource Poor:
Policy Issues and Options. October 1988.
(£2.50)

88-03

David W Pearce, Edward B Barbier and Anil Markandya,
Sustainable Development and Cost Benefit
Analysis. November 1988. (£2.50)

89-01

Edward B Barbier and Anil Markandya,
The Conditions for Achieving Environmentally
Sustainable Development. January 1989. (£2.50)

89-02

Nicholas Michael and David W Pearce,
Cost Benefit Analysis and Land Reclamation:
A Case Study. February 1989. (£2.50)

89-03

Douglas Southgate,
Efficient Management of Biologically Diverse
Tropical Forests. March 1989. (£2.50)

89-04

Timothy Swanson,
A Proposal for the Reform of the African
Elephant Ivory Trade, June 1989. (£3.50)

89-05

Edward B Barbier and Joanne Burgess,
The Demand For African Elephant Ivory,
June 1989. (£2.50)

GATEKEEPER SERIES

LEEC GATEKEEPER SERIES

David W Pearce, Sustainable Development: an Economic Perspective (£2.00)

BOOKS

Edward B Barbier, Economics, Natural-Resource Scarcity and Development: Conventional and Alternative Views, Earthscan Publications Limited, London, 1989. (£29.95)

David W Pearce, Edward B Barbier and Anil Markandya, Sustainable Development: Economics and Environment in the Third World, Edward Elgar Publishing Limited, London 1989 [in press].

Copies of the above papers are available from:

Marilyn John
IIED
3 Endsleigh Street
London WC1H 0DD
UK.
Tel: 01 388 2117
Teles: 261681 EASCAN G
Fax: 01 388 2826

IIED/UCL LONDON ENVIRONMENTAL ECONOMICS CENTRE

The London Environmental Economics Centre is a joint initiative of IIED and the Department of Economics of University College London. It has been funded by core contributions from the governments of Sweden, Norway and the Netherlands.

The Centre has as its main objectives:

- Research into environmental problems of less developed countries from an economic standpoint;
- Dissemination of research and state of the art environmental economics through publication, public and professional address and specialist conferences;
- Advice and consultancy on specific issues of environmental policy.

The logo for the International Institute for Environment and Development (IIED) consists of the letters 'IIED' in a bold, serif font. The letters are white and set against a black rectangular background.

INTERNATIONAL
INSTITUTE FOR
ENVIRONMENT AND
DEVELOPMENT

3 Endsleigh Street, London WC1H 0DD, UK