# CHAPTER 9

# ECONOMICS AND NATURE CONSERVATION

## CHAPTER OUTLINE



## 9.1 INTRODUCTION

Economics is traditionally viewed as a method for understanding how best to make money from what are known as the "three factors of production": land, labour and capital. The objective of most enterprises, whether by individuals, companies or governments, is to maximise profits.

This view of economics suggests that it should have no role to play in promoting conservation. It all sounds very 'unsustainable', in that only a single product (money) is seen as having any value, and the more of it and the quicker it can be made the better. Increasingly, the world seems to be becoming more and more monetarised, and development is only seen as being important if it is *economic* development, or making money. Conservation is often seen as standing in the way of making money, and in economic terms is often considered to be a cost, something that reduces or obstructs profitability.

However, economics need not be like this. Economics should only ever be considered a tool, and wise use of tools depends on wise users. In the right hands, economics can be a powerful tool for supporting conservation. If we want to promote conservation amongst economists and politicians, many conservationists now argue that we will have to start speaking their language, and manipulate its use so that it provides us with good economic arguments for conservation.

## 9.2 TRADITIONAL ECONOMICS

### 9.2.1 Traditional economics and conservation

There are many examples of environmentally harmful developments that have been sanctioned by traditional economic analyses. In each case, the analyses assume that the economic value of the land will be enhanced by the development. Examples include:

- converting primary natural forest to timber production forest, often resulting in the "mining" of the forest for timber with no thought for long-term sustainability;
- converting natural production forest to short-rotation plantations of exotic species;
- converting forest to agricultural land; and
- submerging forest under reservoirs for hydroelectric power generation.

One reason for this is that, in a traditional economic model, the measure of success of any intervention or enterprise is considered in monetary terms: how much money can be produced, and at what expense to the producer. The aim is to **maximise monetary profits for the individual, company or government**. Costs to the producer borne in converting or exploiting the natural forest will be compared with the profits to be made from conversion or exploitation. By these standards, conversion and exploitation is normally seen to be profitable.

### 9.2.2 Discount rates and externalities

Profitability depends not just on the overall long-term financial value, but also on how quickly that financial value is realised. A quick return on investment is seen as desirable, so converting to crops with shorter rotations also becomes desirable, as does "mining" the forest's timber in as short a time as possible. This is because most people do not want to see their money "tied up" for years and years: they would rather have it sooner, even if overall they do not get as much money this way as they would if they waited for it all to arrive at once after many decades. This is human nature in most societies: in an uncertain world, we want to make quick profits and prefer to ignore the long-term consequences of this decision either for ourselves, our descendants or society at large. In other words, we value the present over the future. In the language of economists, we have high personal **discount rates**. Money-lenders (such as banks) often exacerbate this natural tendency because they too have high interest rates (which reflect the personal discount rates of the bank's investors), so the sooner the loan can be paid back the better. This means that when potential supporters of projects are looking at the likely commercial profitability of a project, or investigating how a project's performance would compare with a commercial venture, they often use quite a high discount rate in their calculations. A final drawback is that quick profits from the unsustainable use of resources can be ploughed back into further investments, so multiplying profits further. As long as there are still resources to exploit, this often remains the most profitable option.

This illustrates a serious problem with traditional economics: it is selfish. The only costs that are considered are those borne by the individual, company or government investing in the enterprise. All other costs are **externalised**. Box 9.1 summarises this apparent paradox, according to some leading environmental economists. For conservation to succeed, then, we need something different from traditional economics.

**Box 9.1**
**The paradox of economics and biodiversity loss (Pearce and Moran, 1994).**

1. Economic forces drive much of the extinction of the world's biological resources and biodiversity.
2. Yet biodiversity has economic value. If the world's economies are rationally organised, this suggests that biodiversity must have less economic value than the economic activities giving rise to its loss.
3. Yet we also know that many biological resources do have significant economic value. And we know that many of the destructive activities themselves have very low economic value.
4. Therefore, something is wrong with the way actual economic decisions are made; for some reason they fail to "capture" the economic values that can be identified.
5. These "economic failures" lie at the heart of any explanation for the loss of biological diversity. If we can address them, there is a chance of reducing biodiversity loss.

## 9.3 WELFARE AND ENVIRONMENTAL ECONOMICS

### 9.3.1 Introduction

Welfare and environmental economics are extensions of the traditional economic model. But instead of seeking to maximise profits for individuals, companies or governments, they seek to **maximise economic welfare for the whole of society**. The welfare of a society is the sum of the well-being of every individual member of that society. Thus for an intervention or enterprise to appear profitable under welfare and environmental economics, the benefits to society must be shown to outweigh all the costs to society. In other words, welfare economics **internalises the externalities** that traditional economics ignores. Since conservation in the modern sense of the word is so closely linked to sustainable development, promoting the wise use of resources for society as a whole, this is a very useful tool for conservationists.

Many different techniques are available to support these new economic ideas. Most aim to come up with a figure for the **total economic value** of a resource or project. Some are taken directly from traditional economics, while others have been devised more recently and are called "new" economics.

One of the main methods used is **cost-benefit analysis** (CBA). CBA is a method that is used widely in many branches of economics. The main difference is that, in welfare economics, CBA covers a much wider scope, to encompass as many of the costs and benefits as possible rather than sticking to those that affect only the individual, company or government.

Typically, whatever methods are used, welfare and environmental economics are useful to conservationists in six main ways (Pearce et al., 1988):

- in demonstrating the national importance of environmental goods and services;
- in calculating the benefits of projects and programmes designed to improve the environment;
- in estimating the true (normally externalised) costs of non-environmentally sustainable projects or programmes;
- in calculating a basis for compensation for environmental damage;
- in determining the extent to which regulatory policy should be implemented; and
- in determining the extent to which past policies have been socially beneficial.

## 9.3.2 Cost-benefit analysis (CBA)

### *9.3.21 The CBA process*

Conducting a cost-benefit analysis of a conservation project, such as establishing a protected area or zoning a forest reserve, involves three steps (Ruitenbeek, 1990):

1. **identifying** what would happen in the absence of a conservation project (e.g. deforestation, loss of soils, water shortages, depletion of resources generally).
2. **quantifying** the timing and amount of the economic costs and benefits of these physical changes by assigning "shadow prices".
3. **adding** the benefits and **subtracting** the costs to decide whether a project is actually worthwhile.

This is normally done by devising a matrix shell of defined benefits and costs (a bit like an EIA matrix), and then filling in the boxes by quantifying them in monetary terms.

### *9.3.22 Valuation methods for CBA*

It is not always easy to work out the exact value of any of the costs or benefits involved in forest conservation. Normally, some kind of **shadow pricing** has to be adopted, that is, estimating or calculating the implicit values of things that are not valued explicitly. Box 9.2 lists some of the ways that may be appropriate.

### *9.3.23 Classifying the values in a CBA*

It is possible to classify the potential values in various ways which help us to appreciate them better and carry out the three-stage process outlined above. The following categories are from McNeely (1988):

**Direct values ("goods")**

- Consumptive use value
- Productive use value

**Indirect values ("services")**

- Non-consumptive use value
- Option value
- Existence value

*Direct values*

These are concerned with the enjoyment, satisfaction or basic sustenance received directly by consumers of biological resources, in other words, the "goods". Of course, in a conservation project, the number of values may be limited if they conflict with conservation, in which case they should still be considered in a cost-benefit analysis, but as costs (i.e. benefits foregone) rather than benefits accruing to the project.

**Consumptive use value** is the value placed on nature's products that are consumed directly, without passing through a market. From a forest, products such as timber, forage, firewood, food, wildlife, fish, herbs and medicines would be included if they are used locally and not traded. The value of such products is considerable, but because it does not pass through a market the value never makes it into government figures such as Gross Domestic Product. In a cost-benefit analysis, however, the consumptive use value can be estimated by substituting the market value of the products consumed if they were sold on the market instead of being consumed.

**Box 9.2**
**Some valuation methods for cost benefit analysis.**

- **Local market prices.** Local market prices often exist for non-timber forest products. If the forest disappeared, the local people would have to buy these goods from the market. Thus the value of the products harvested by the local people can be worked out as the amount they collect multiplied by the local market price.

- **Market price of substitute.** If the forest disappeared it might not be possible for the local people to buy, for example, fuelwood, on the local market. The only realistic alternative would be for them to buy charcoal instead, imported from outside. In this case, the value to the local people of free collection of firewood from the forest is equivalent to the value of a comparable amount of charcoal that would have to be bought from outside. For estimating the value of bush meat, it would be necessary to estimate the cost of replacing bush meat with the meat from domestic animals bought on the open market.

- **The product is marketed in other areas.** In some forests you may have to pay for collection of poles, or for camping, while in others it is free. The value of these products in the forest where it is free can be calculated from its value in a similar forest where it is not free, since this indicates the collector's/camper's willingness to pay for the products in general.

- **Effect on production**. If a forest were cleared, this could have impacts on production of crops or industry outside the forest, if rainfall or climate or river-flow changed. The loss or gain in production in these affected areas can be quantified per unit area. In another scenario, the only other fuel available if a forest were cleared might be dung. In this case, the value of the forest as a source of fuelwood would have to be worked out based on the cost of using dung as fuel rather than as fertiliser, which could be calculated by measuring the difference in crop yields between crops fertilised with dung and those not fertilised. Alternatively, it could be calculated by working out how much farmers would have to spend on chemical fertiliser to give them the required level of crop production to compensate for the lack of dung being added to their crops.

- **Preventative expenditure**. If a forest were cleared, it might mean that additional expenditure would be involved in preventing the damaging effects of clearing, such as siltation or soil erosion. The cost of forest clearance should therefore include the cost of developing siltation ponds or terraces, etc., or the cost to the government of supplying piped water from alternative sources, i.e. the **market value of the physical effects** of the project, in this case forest clearance.

- **Connected expenditures.** Sometimes expenditures are involved in the consumption of apparently free goods or services. For example, even if camping in a forest is free, people still pay to reach the forest for their free experience (a **travel cost**). These expenses indicate the camper's willingness to pay for the camping. Similarly, tourists who want to go on an African safari in a National Park have to pay not only the park entry fee and the fee charged by the safari company, but also the cost of the flight from their country of origin.

- **Interviews and questionnaires (contingency methods)**. It is possible to get an idea about the value of the forest by asking people how much they think it is worth. For instance, how much would they be willing to pay to save a forest from being cleared, or how much should they be compensated for the loss of a forest. The values given in response can be very variable, depending on how the question is phrased and who is asked, and are normally very high.

Examples:

- 75% of the animal protein consumed in Zaire comes from wild sources, mostly from forests (Sale, 1981). Much of this is consumed without ever being traded.
- Firewood provides over 95% of the total primary energy needs in Uganda, and much of this is consumed without ever being traded (FAO, 1992).
- Large numbers of plant species found in Ugandan forests have uses for either food or medicine (Iwu, 1993; Peters et al., 1992).
- In Sarawak, Malaysia, it is estimated that the cost of replacing the 18,000 tonnes of wild meat harvested from the natural forest with a similar amount of protein from domestic livestock or fish would be $40 million per year (Caldecott, 1988).

**Productive use value** is the value assigned to products which are commercially harvested. From a forest, timber is the main example, but others include firewood, forage, canes, poles, food, wildlife, fish, herbs and medicines in certain places. The contribution made by wild species to domesticated resources is also a productive use value, such as the value of wild genetic varieties in improving crops, or the value of forest-dwelling pollinators in pollinating crops. In a cost-benefit analysis, productive use values are estimated, where possible, at the production end (i.e. when a product is first traded) rather than at the retail end, when the price has risen because of middle-men.

Examples:

- The calculated net present value of the logging royalties for timber extractable from communally owned forest in Vanuatu, South Pacific, was recently used to come up with the amount of money the local government would have to pay the community for it to hold the land as a protected area on a seventy-five year lease (Tacconi and Bennett, 1994).
- Wild coffee (*Coffea canephora*) in Kibale Forest could produce berries worth $100-200,000 annually at 1985 prices (Struhsaker, 1987).
- In 1982, Indonesia earned $200 million in foreign exchange from non-wood forest products, mostly rattan canes (Gillis, 1986).
- A year's use of natural habitat in Zimbabwe for wildlife production gives an aggregate return that rivals the returns from the most intensive forms of cultivation in the same region (Child, 1984). Most of this value is for sport shooting of game animals, but it also includes meat for consumption.

### *Indirect values*

Indirect values deal mostly with the functions of ecosystems, in other words, the "services", and so do not usually appear in national accounting systems. Despite this, they may far outweigh direct values when they are computed. They tend to reflect the value of biological diversity or forests to society at large rather than to individuals or companies. This can be useful, although it should also be remembered that even if the values accrue to society as a whole, there may be individuals (perhaps local people) for whom these are outweighed by the costs.

**Non-consumptive use value** is the value placed on nature's functions or services rather than goods, and as such is not consumed, traded or reflected in national income accounts. A wide range of services come under this category, such as photosynthetic fixation of solar energy, pollination, maintenance of water cycles, recharging ground-water, protecting watersheds, buffering extreme water conditions (such as flood and drought), regulating climate, production of soil and prevention of erosion, storage and cycling of essential nutrients including the constituents of air, absorption and breakdown of pollutants, and provision of recreational, aesthetic, scientific, educational, spiritual and historical experiences. Some of these values are relatively easy to monetarise, but others are not. For example, it is relatively easy to work out the watershed value of a protected forest, by considering how many people living downstream of it depend on that water (even if they do not physically consume it), and what it would mean to them in monetary terms if that water supply became undependable. It is less easy to work out the contribution played by a single forest to regulating world climate, especially if you have to put a monetary value on it.

Examples:

- Forests keep soil from eroding into rivers. Siltation of reservoirs costs the world economy about $6 billion per year in lost hydroelectricity and irrigation water (FAO, 1994). Existing catchment forests must prevent greater losses, while reforestation of deforested catchments could reduce losses.
- In India, forests provide water regulation and flood control valued at $72 billion per year (FAO, 1994).

- The viability of the $1 billion salmon fishery in the Pacific Northwest of the United States is said to depend on the survival of the region's old-growth forests (FAO, 1994).
- Replacing the carbon storage function of all tropical forests would cost $3.7 trillion (FAO, 1994).
- Each lion in Amboseli, Kenya, has been estimated to be worth $27,000 per year live as a tourist attraction, while a herd of elephants is worth $610,000. The park yields net earnings of $40 per hectare per year, which is about fifty times what any form of agriculture could produce (Western, 1984).
- Tourists in Kenya have stated during a survey that viewing elephants accounts for 13% of the total value of their safaris, representing $23-27 million annually. In another survey, enough tourists said they would pay $100 each to ensure that the elephant population in Kenya stayed at least at its present level to give a total value for the elephants of $25 million to $30 million annually. Furthermore, half the tourists stated that if elephants declined by another 50%, then they would no longer want to visit Kenya, so tourism revenue would drop by as much as $85 million annually (Brown and Henry, 1989).
- On the other hand, it has recently been argued (Norton-Griffiths and Southey, 1994) that conservation (including tourism and forestry) is still a net cost to Kenya, to the tune of about $203 million per year, because of the benefits foregone (opportunity costs) in not developing the land for other uses. Although their analysis is certain to be disputed, the authors are not against conservation: they merely argue that this is the sum that should be provided by the international community to make conservation in Kenya more popular and successful.
- Flatley and Bennett (1994) estimate that just two rainforest areas of Vanuatu have a net present value of at least A$6.8 million per year, based on the number of Australian tourists who expressed willingness to pay a total of up to A$682,000 per year on top of their other holiday expenses to see the rainforests protected, and calculated on the basis of a 10% discount rate in perpetuity. The conclusion is that there are strong economic benefits to be enjoyed from setting up protected areas in Vanuatu, and it would only be necessary to draw on the resources of tourists to fund their establishment.
- In eight out of its nine administrative regions, the US Forest Service calculates that the recreation, fish, wildlife and other non-extractive benefits of National Forests are more valuable than timber, grazing, mining and other benefits (FAO, 1994).

**Option value** is the value placed on being able to use a resource at some future date. It is a means of assigning a value to risk aversion in the face of uncertainty. After all, who can say what our future needs and desires will be? The future is uncertain, and extinction is forever. Therefore, it makes sense to maintain as much biodiversity as we can now. Option values are likely to be even higher in the future than they are now, as resources continue to get depleted all around protected areas, making the protected areas themselves more valuable. In future, we may just want to use more of the same resources that we value now (such as timber, genetic resources, tourism, wildlife), or it may be something that we least expect. Option values can be used as justifications for not pursuing ecologically harmful developments, because it can be argued that we do not know the value of what we are losing. This relies on something called a "**quasi-option**" value, which is the value of learning about future benefits that would be precluded by development or irreversible change in the *status quo*.

Examples:

- In 1979, a new species of wild maize was discovered on a hillside in Mexico that was being cleared for agriculture. It now looks as though this maize could enable the development of a perennial variety of cultivated maize, which means that this wild plant, so nearly extinguished, may prove to have an annual value of $6.82 billion).
- The collection of a wild species of tomato in the Andes in 1963 resulted, after ten generations of crossing with cultivated varieties, in a noticeable commercial improvement valued at about $8 million per year (Swanson, 1991).
- Merck and Co., a pharmaceuticals multinational, recently agreed to pay $1 million to Costa Rica's National Biodiversity Institute for the right to investigate the chemical properties of the species found in the country's rainforests, in the hope that some of them may be found to have useful properties some time in the future. This was based on the assumption that a single research discovery would earn a net present value of $200 million (Aylward, 1993).

- The wild relatives of avocado, banana, cashew, cacao, cinnamon, coconut, coffee, grapefruit, lemon, paprika, oil palm, rubber and vanilla - the exports of which were worth more than $20 billion in 1991 - are all found in tropical forests (FAO, 1994).
- Based on the current value of the pharmaceuticals industry and their dependence on plants from tropical forests, it has been estimated that the annual value to OECD countries of an as yet untested plant species is between $300,000 (Aylward, 1993) and $1.6 million (Farnsworth and Soejarto, 1985). Based on the value of lives saved by plant-derived drugs, the annual value per untested plant species rises to $23.7 million at 1990 prices, but only $1.5 billion if the analysis is extended to the whole world (since people in poorer countries value human lives at a far lower level than those in richer countries). These rates translate to net present values of from $52 to $46,000 per plant species for a host country seeking to licence or get royalties from pharmaceuticals companies (Aylward, 1993).

**Existence value** is the value attached to the existence of a species or protected area by people who may never see it for themselves but nevertheless are pleased that it is there, regardless of whether it will ever have a use for humans. Some people attach such a value because they would like their descendants to be able to know that it still exists. It is impossible to estimate this value in monetary terms, but it is clear that it is a large value if we consider how much money people in richer countries are prepared to give as voluntary contributions to various conservation agencies involved in promoting conservation of forests etc.

Example:

- WWF (World-wide Fund for Nature), an international NGO that promotes conservation, receives private donations of nearly $100 m annually (McNeely, 1988).

### *9.3.24 Strengths and weaknesses of CBA*

CBA is not the only tool in use by welfare economists, but it is an important one. It has many strengths, but also some weaknesses. These are listed in Box 9.3.

**Box 9.3**
**Strengths and weaknesses of cost benefit analysis (Bennett, 1993)**

**Strengths**

- It provides a logical structure for the systematic collection and presentation of information from the perspective of the trade-offs involved in decision-making, especially encouraging the consideration of indirect effects.
- It forces an active search for information, in order to fill in the matrix.
- It increases the explicitness of decision-making, especially when carried out as a public exercise.
- It provides a check on the actions of decision-makers.
- It enables the detection of clearly deficient options.
- It allows for some comparability between widely divergent projects and increases the likelihood of consistency across decisions.

**Weaknesses**

- Accurately measuring costs and benefits in monetary terms is often difficult and costly in itself.
- It faces problems of dealing with uncertainty when projecting streams of costs and benefits into the future.
- It must face the problem of the time value of money, i.e. what discount rates to use.
- It is principally a tool of efficiency maximisation, and largely ignores equity implications.
- The complexity of the impacts of a project may mean that the general public's degree of understanding is so poor that their contribution to CBA valuation can be meaningless.
- It is unethical for some people, as it seeks to monetarise everything and is very utilitarian.

## 9.4 CASE STUDIES OF ECONOMICS WORKING FOR CONSERVATION

### 9.4.1 Comparison of benefits of conservation versus agriculture in Bwindi Forest

A recent study (Kazoora, 1995) looked at the economics of two different scenarios for Bwindi Forest. One scenario is conservation, including ecotourism (especially tracking mountain gorillas) and some small-scale controlled harvesting of forest products. The other scenario is that the forest could be converted to agricultural use, like the surrounding land. Both scenarios have positive net present values, but the conservation scenario is seen to be two orders of magnitude larger than the agricultural one (Figure 9.1).

Before concluding that conservation is a thoroughly good thing, we should look at the criteria that were considered in the valuation. For agricultural conversion, it was a relatively straightforward assessment based on the total forest area, the total area that could be converted, and the value of surrounding agricultural land under different crops. For conservation, the costs and benefits considered are shown in Table 9.1, together with their values in economic terms, where these have been estimated. It should be noted that one of the main economic benefits from conservation (the forest's value as a carbon sink) is only really appreciated at a global scale; many local people may also fail to benefit from some of the other benefits, such as ecotourism value. On the other hand, most of the costs are still borne locally, so a cost-benefit analysis carried out amongst local communities might be very different. This emphasises the need to bare **equity** in mind.

It could be argued that the Trust Fund established for Bwindi under the Global Environment Facility represents such a transfer of benefits from the global community to the local communities, as might Care's Development Through Conservation programme in the parishes surrounding the forest.

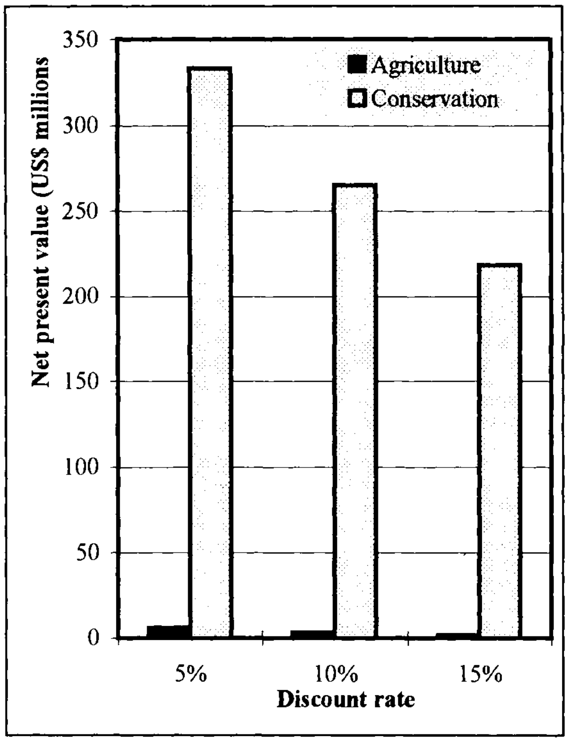


*Figure 9.1. The net present value (over ten years) of conservation of Bwindi Forest, Uganda, versus its conversion to agriculture. Three different discount rates are compared. After Kazoora (1995).*

**Table 9.1.**
**Costs and benefits accruing to conservation of Bwindi Forest, Uganda. Figures in million dollars and refer to a single year. Note that some costs and benefits have not been quantified. After Kazoora (1995)**

| COSTS | | BENEFITS | |
|---|---|---|---|
| • Capital costs, excluding roads | 0.209 | • Ecotourism | 0.237 |
| • Capital costs of roads | 0.100 | • Selective cutting of timber | ------- |
| • Operating costs | 0.080 | • Genetic value | ------- |
| • Lost stumpage value | 6.586 | • Education | ------- |
| • Lost agricultural production | 0.127 | • Carbon sink | 40.300 |
| • Lost forest use | ------- | • Flood/erosion control | 9.000 |
| | | • Fisheries support | ------- |
| | | • Soil fertility maintenance | ------- |
| **TOTAL COSTS** | **7.102** | **TOTAL BENEFITS** | **42.435** |

## 9.4.2 Social CBA of Korup Forest conservation and development project, Cameroon

Korup National Park covers 126,000 ha of lowland equatorial forest in Cameroon, and is one of the most species-rich forests in Africa. Due to fairly infertile soils, it has never been logged and is little affected by shifting agriculture. However, unsustainable hunting, agricultural encroachment and illegal timber harvesting were posing growing threats to the park's survival, and so in 1987 WWF proposed the Korup Project, to develop both the national park and a buffer zone around it. By developing and disseminating sustainable uses of the forest in the project area, it was hoped to reduce pressures on the forest and reverse the process of degradation. It was recognised that it was essential to involve and motivate the local people so that their own living conditions could be improved from their own means.

A preliminary social cost-benefit analysis of the project was carried out (Ruitenbeek, 1990), to assess its likely impact on both conservation and development, and to compare this with an alternative scenario in which it was assumed that the forest would not be protected, and would be logged out over the next 50 or so years. The analysis used conventional techniques of welfare economics, valuing outputs at world prices for traded goods and using shadow prices where appropriate.

It was found that the present value of the benefits of not proceeding with the project and its protection of the forest were 350 million FCFA (the local currency), mostly derived from timber harvesting, whereas the present value of the benefits of proceeding with the project and forest protection were 6850 million FCFA. Since this gives a difference of 6500 million FCFA, it was concluded that the project and protection of the forest was economically advantageous. This has led to the transfer of large sums of aid money to support the project. Figure 9.2 shows the main benefits in comparison with the benefits that could accrue from timber harvesting.

## 9.4.3 Comparison of Korup and Oban

A similar study to the Korup one was carried out in and around Oban National Park in Nigeria, just across the border from Korup (Ruitenbeek, 1990). As in the Korup study, a wide range of values was detected that might have been missed in a simpler, more traditional analysis. Figure 9.3 compares the net benefits of these two projects by looking at the sum of their conservation and timber values. As can be seen, in both cases, conservation is seen to be more economically beneficial than timber harvesting. It is possible that a combination of both strategies would be even more economically beneficial, but it has been felt that timber harvesting (under real-life rather than optimum conditions) was incompatible with some of the conservation values which may only accrue way into the future.

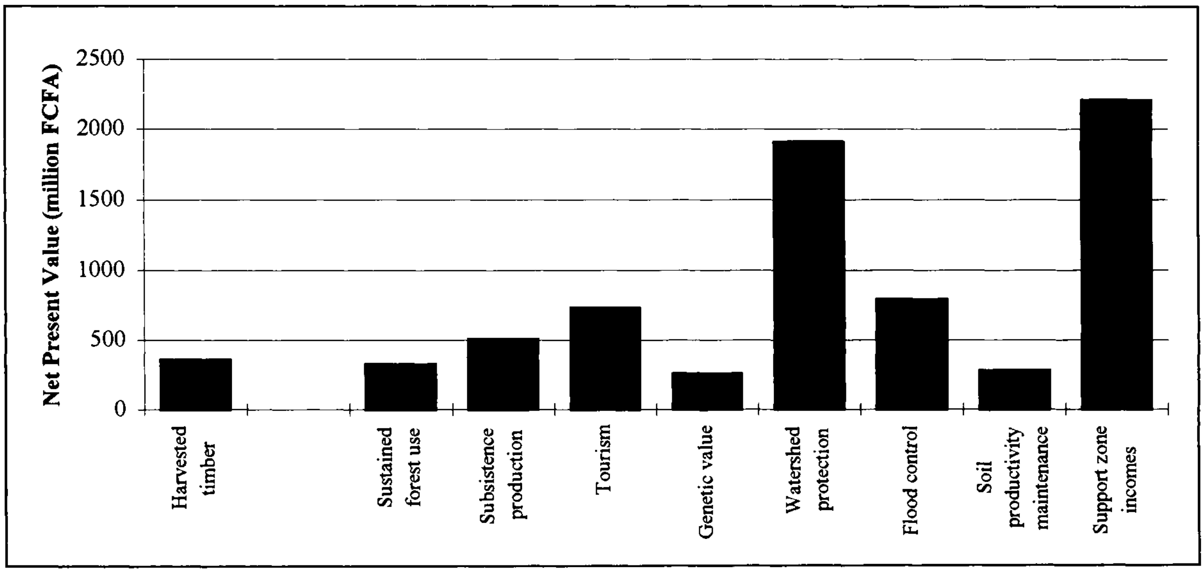


*Figure 9.2. The economic value of harvesting timber (first column) compared with values accruing from the development of a conservation plan for Korup National Park, Cameroon, and its surroundings (remaining columns). After Ruitenbeek (1990).*

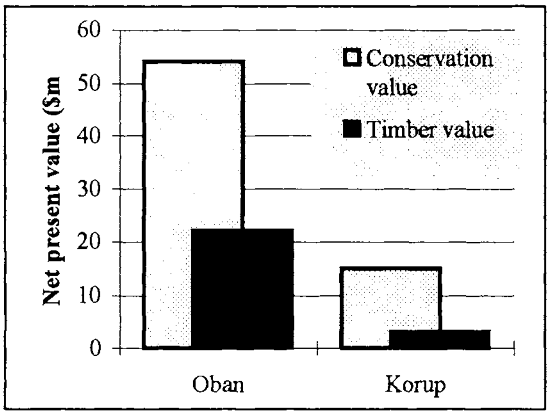


*Figure 9.3. A comparison of the conservation and timber values of two conservation and development projects: Oban in Nigeria and Korup in Cameroon. After Ruitenbeek (1990).*

Because of these studies, economic development plans in the region are being pursued in ways which complement the conservation goals of the parks. Rather than seeing the various goals as conflicting, the attitude has been that conservation can promote economic development. To this end, in Korup, a management area has been defined consisting of 126,000 ha of core park area plus a buffer zone of 300,000 ha around this core. In Oban, the management area consists of a 250,000 ha park and a 200,000 ha support zone (Ruitenbeek, 1990).

### 9.4.4 Measuring the value of shelter belt afforestation and farm forestry in Nigeria

When Anderson (1987) carried out an economic analysis of a forestry project in Northern Nigeria, he traced through some of the ecological linkages arising from afforestation of this sparsely-wooded part of the country. A more traditional analysis of tree-growing might identify the benefits as being the value of the tree products (fuelwood, poles and fruit), by multiplying the yield of each of these products by the market price. Anderson also added the following into the calculation:

- the increases in livestock weight brought about by improved dry season fodder;
- the avoided damage from desertification, measured by the difference in crop yields from soils with and without afforestation;
- improvements in yield due to the shelter belt's and farm forestry's effects on soil nutrient recycling and nutrient retention.

He found that, if only wood benefits are considered, then the internal rate of return of the shelter belt afforestation project would be under 5%, well below the 10% discount rate traditionally used in World Bank assessments. Such a project would probably not normally get funding. Once the wider benefits outlined above are included, however, the internal rate of return of shelter belt afforestation increased to between 13% and 17%. Similarly, that of farm forestry increased from about 7% to between 14% and 22%.

### 9.4.5 Measuring the value of gum arabic planting in Sudan

The gum arabic acacia (*Acacia senegal*) is widely tapped for its yield of polysaccharide gum which is exported throughout the world for use in confectionery, drinks and pharmaceuticals. In 1985, it was Sudan's third most valuable export. It also has many useful environmental qualities, which are easily overlooked by lending institutions and development organisations and even less easy to value. These include:

- its role in stabilising soil because it has a deep tap root and expansive lateral root system, and because it retains soil moisture;
- being leguminous, it fixes atmospheric nitrogen and encourages grass cover, assisting pasture growth;
- leaf and pod decomposition help supply nitrates to the soil, possibly increasing cereal yields by 15% when intercropped; and
- it is a useful source of fodder and fuelwood.

Pearce (1988) found that if fodder and fuelwood yields are allowed for, then the internal rate of return to gum arabic planting could reach 36%. Thus gum arabic can be recommended as a useful tool in anti-desertification projects.

### 9.4.6 Profitability of logging at different discount rates

Pearce (1987) compared the profitability of different logging systems in Indonesia using different discount rates. The discount rate has an important effect on profitability. He found that selective cutting of natural forest was the most profitable option at low discount rates, but that at higher rates, more intensive management systems were more profitable. There was, however, an upper limit in that the most intensive systems (plantations of fast-growing species for sawn timber) were never as profitable as management of the natural forest. Table 9.2 shows his findings.

**Table 9.2. Profitability of different logging systems in Indonesia at different discount rates (Pearce, 1987)**

| Management regime | 5% discount rate | 6% discount rate | 10% discount rate |
|---|---|---|---|
| Selective cutting regime | 2705 | 2409 | 2177 |
| Complete harvesting and regeneration | 2690 | 2593 | 2553 |
| Dipterocarp plantation | | 2746 | 2203 |
| Plantations of fast-growing species for pulp | | 2926 | 2562 |
| Plantations of fast-growing species for timber, harvested after 20 years | | 2419 | 2278 |
| Plantations of fast-growing species for timber, harvested after 10 years | | 2165 | 2130 |

### 9.4.7 Some other studies

- Howard (1995) carried out a study of protected areas in Uganda, particularly forest reserves, and produced an economic analysis of protected areas management. The analyses had not been published at the time of writing this book, but should be in the near future.
- Peters, Gentry and Mendelsohn (1989), quoted in Word Bank (1994) and Sayer (1991), found during a study in a one-hectare plot in Amazonian Peru that over 41% of the trees yielded products with a market value. The net present value just of fruit production was \$6330/ha, assuming that 25% of the fruit crop was left in the forest for regeneration, and a 5% discount rate. The same hectare also contained 93.8 cubic metres of merchantable timber. If liquidated in one felling, this lumber would generate a net revenue of \$1000, but an operation of this intensity would damage much of the residual stand and greatly reduce future revenue from fruit and latex trees. If selective cutting were practised, the combined net present value of fruit, latex and selective cutting would be about \$6820, with logging contributing only about 7% of the total. In this example, logging appears to be a marginal financial option, especially considering the possible impact of logging on fruit and latex trees. Note, however, that the study plot was only 30 km from a major market town, and that prices of forest products would probably be lower in parts of the forest further away from towns.
- Watson (1988) found that the conversion of tropical production forests in Malaysia for intensive cultivation resulted in a substantial net loss in value, from \$2455/ha/yr to \$217/ha/yr.
- Jonsson and Lindgren (1990) found that an improved logging system can reduce the total logging costs by 20%, and can reduce the wastage of valuable logs by 7%. In the improved system, mapping and planning increased the costs, as did better supervision, but this resulted in a 50% increase in extraction production, hence the overall decrease in costs relative to revenue. Meanwhile, directional felling and correct felling and bucking techniques further reduced wastage by 7%. This is good for profits, and good for conservation too.
- A study in Honduras found that the forests on the mountains above the capital city have a net present value of \$13,300/ha, just for their role in water catchment. This was calculated on the basis of the cost of developing alternative sources of water for the city in the absence of this catchment forest.

## 9.5 SUMMARY

- Many environmentally harmful developments, including forest destruction and unsustainable exploitation, have been supported by traditional and often narrowly focused economic analyses.
- Welfare economics seeks to make the discipline of economics more socially and environmentally sustainable, by internalising the externalities.
- Cost-benefit analysis is one technique with many uses in conservation. It has many strengths, but also some weaknesses, particularly in how it seeks to monetarise everything and how it does not consider intra-generational equity.
- There are now numerous cases from around the world that demonstrate how economic analyses based on welfare economics can further conservation.
- In the final analysis, economics is only a tool to decision-making. Good economics will carry more weight than bad economics, but there may be other considerations, such as politics, which lie outside the scope of economics altogether.

## 9.6 FURTHER READING

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