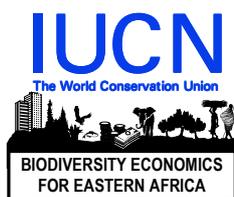


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# ECONOMIC TOOLS FOR ENVIRONMENTAL PLANNING AND MANAGEMENT IN EASTERN AFRICA

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February 1999



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**Citation:**

L. Emerton, L., *Economic Tools Environmental Planning and Management in Eastern Africa*. IUCN — The World Conservation Union, Eastern Africa Regional Office

**Acknowledgement:**

This publication was funded under the general agreement regarding co-operation on biodiversity conservation and sustainable development between the IUCN – The World Conservation Union and the Swiss Agency for Development and Co-operation (SDC), as part of the project “Supporting Global Action to Conserve Biodiversity and Sustainably Use Biological Resources”. It was produced as part of IUCN’s Biodiversity Economics for Eastern Africa Project.

Unless otherwise indicated, the case studies and examples used in this publication all report on work carried out as part of IUCN’s Biodiversity Economics for Eastern Africa Project, including technical support provided to IUCN members and partners in both Eastern and Southern Africa.

**Cover photo:**

Mount Kenya Forest, Kenya

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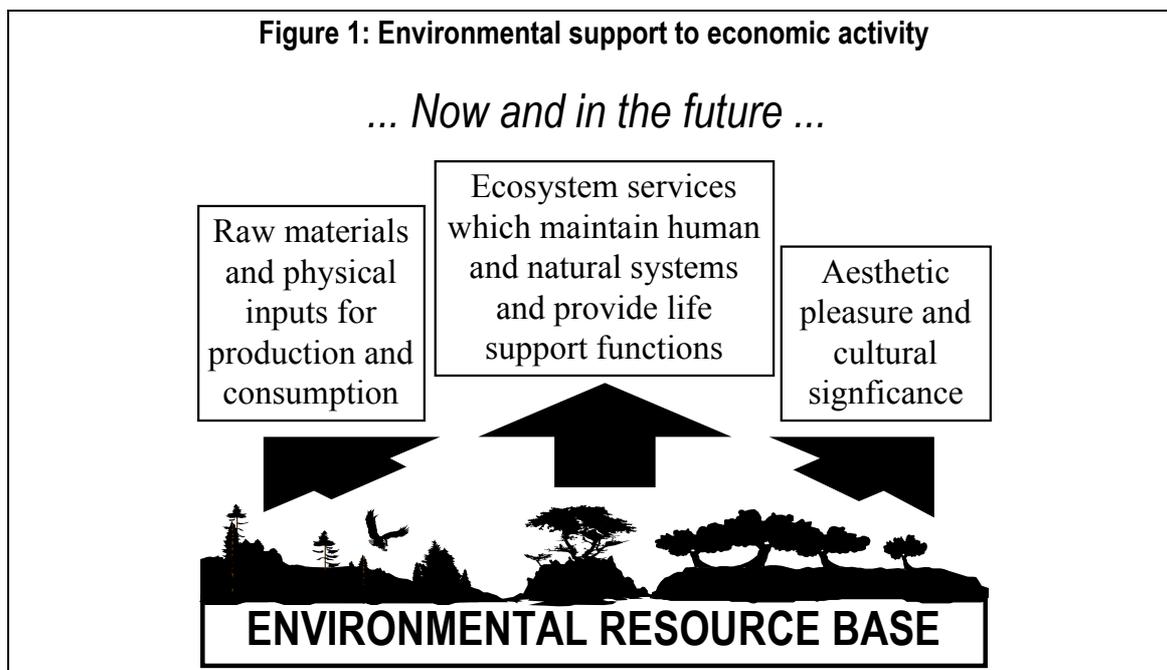
# 1. ECONOMICS AND ENVIRONMENTAL CONSERVATION

## 1.1 INTEGRATING ENVIRONMENTAL CONCERNS INTO ECONOMICS

Economics explains how people survive. It concerns the ways in which individuals and groups act to attain what they want in terms of income, subsistence and other goods and services which they feel will provide them with an adequate quality of life. Economics basically addresses the problem of scarcity – how to fulfil people’s unlimited needs and aspirations from a scarce resource base in a way which is both equitable and efficient.

Incorporating environmental concerns into economics involves introducing concepts of sustainability into scarcity. It deals with the issue of how to meet people’s current needs in a way which is both equitable and efficient and does not diminish the supply or quality of environmental goods and services available for future generations.

## 1.2 THE ECONOMIC BENEFIT OF ENVIRONMENTAL CONSERVATION



A first step in environmental economics is to recognise that environmental resources form the foundation of economic activity and growth. As illustrated in Figure 1 environmental goods and services give basic support to human economic activities, now and in the future, by:

- ⊗ Providing raw materials such as land, water, minerals and timber for economic production and consumption, income and employment;
- ⊗ Generating ecological services such as pollution regulation, climate control and water catchment protection which protect natural and human resources through

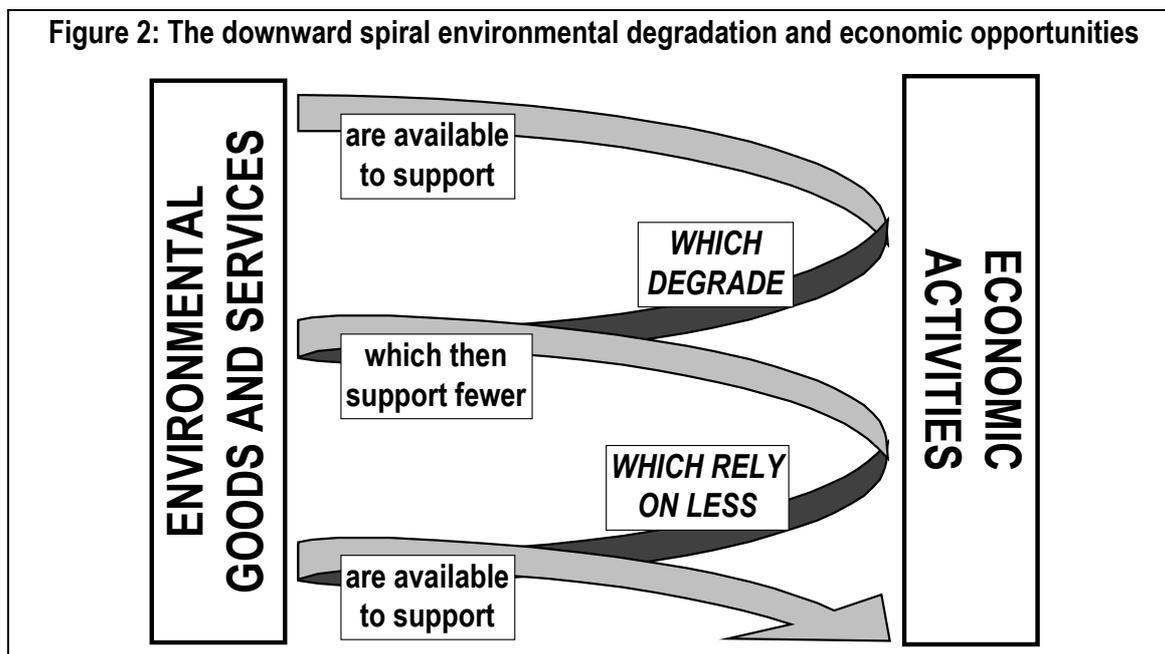
providing a sink for wastes and residues and maintaining essential life support functions;

- ✪ Giving aesthetic pleasure and holding cultural significance for many different people.

If the environmental resource base is conserved it will continue to provide these economic benefits and support human production and consumption in the future. If it is destroyed or environmental quality declines, such goods and services will decrease and human economies will suffer as a result, at global, national and local levels.

### 1.3 ECONOMIC CAUSES OF ENVIRONMENTAL DEGRADATION

Economics is also linked to the environment because economic forces contribute to environmental degradation. While environmental resources support economic production and consumption opportunities, the same economic activities impact back on the environment through using up non-renewable environmental goods and services, by converting environmental resources to other uses and by adding waste and effluent to the environment. A decline in environmental quality and resources impacts on economic activities by diminishing the amount of goods and services available for future production and consumption, and by progressively precluding economic activities. Economic opportunities spiral downwards as the environment becomes more and more degraded, as outlined in Figure 2.



This downward spiral has implications for both economic efficiency – the sound use and management of scarce resources to generate output, and equity – the access of different groups and individuals to secure livelihoods and economic opportunities. The people who bear the costs of environmental degradation are not necessarily those who are causing degradation, spatially or temporally. For example, many of the indirect or knock-on effects

of environmental degradation such as bad health, loss of productive opportunities and ecological disaster are felt by poorer people who lack the resources to cope with these costs, or will be felt by future generations as a result of activities carried out today. Environmental degradation also incurs substantial costs to governments, who bear the overall responsibility for maintaining the basic quality of life in a country.

#### 1.4 USING ECONOMICS FOR ENVIRONMENTAL CONSERVATION

It is clear that production and consumption activities can lead to a downward spiral of environmental degradation, economic costs and loss of productive opportunities. Conversely, environmental conservation can lead to an upward spiral of economic growth and benefits. A major challenge is to ensure that sound environmental management systems are set in place which will enhance current opportunities for production and consumption at the same time as sustaining economic growth in the future.

A range of policy factors, as well as broader socio-economic conditions such as poverty and land pressure, put people in a situation where it makes more economic sense to them to degrade the environment in the course of their day-to-day economic activities than to conserve it. There is often little immediate or tangible economic gain to conserving the environment, and many gains and profits from mining, depleting, polluting or converting it. People are often unwilling – or economically unable – to conserve the environment, because there is no personal benefit to them in doing so.

Economic analysis provides a useful set of tools understanding the forces which lead to environmental degradation. Economic measures can encourage people to conserve the environment by setting in place the conditions which result in their being economically better off by doing so. They aim to make sure that producers and consumers take into account the real value of the environment and the real cost of environmental damage when they make decisions.

#### 1.5 STEPS IN THE USE OF ECONOMICS FOR ENVIRONMENTAL PLANNING AND MANAGEMENT

This manual outlines basic tools for the use of economics for environmental planning and management. These tools follow a number of steps, as outlined in Figure 3, including:

- ✿ **Identifying environmental economic benefits and costs:** ensures that the economic impacts of environmental activities, and the environmental impact of economic activities, are understood and made explicit in both conservation and development planning and management.
- ✿ **Valuing environmental economic benefits and costs:** provides important information which can be integrated into both development and conservation planning and management. Making monetary estimates of environmental values means that they can be considered, and given equal weight, alongside other sectors of the economy, benefits and costs.
- ✿ **Analysing the profitability of economic activities in terms of their environmental effects:** provides a framework within which to use information

about environmental costs and benefits and their values for decision-making. It provides basic measures of whether a policy, programme or activity can be judged desirable in environmental and economic terms.

- ✧ ***Highlighting the economic causes of environmental degradation and the need for economic measures for environmental conservation:*** points to areas and groups where there is a need for the use of economic measures to provide incentives and finance for environmental conservation. It forms the basis of identifying and planning conservation activities.
- ✧ ***Setting in place economic incentives for environmental conservation:*** forms a cross-cutting component of environmental planning and management. Unless people are provided with positive incentives to conserve the environment in the course of their economic activities, and the perverse incentives which encourage environmental degradation are overcome, environmental programmes and projects are unlikely to succeed.
- ✧ ***Financing mechanisms for environmental conservation:*** form an important part of environmental planning and management because they provide the basic funding which enables environmental projects, programmes and activities to be carried out.
- ✧ ***Ensuring that economic measures for conservation are appropriate and sustainable:*** means that they are practically implementable in different social, cultural, institutional and ecological situations.

Figure 3: Steps in the use of economics for environmental planning and management

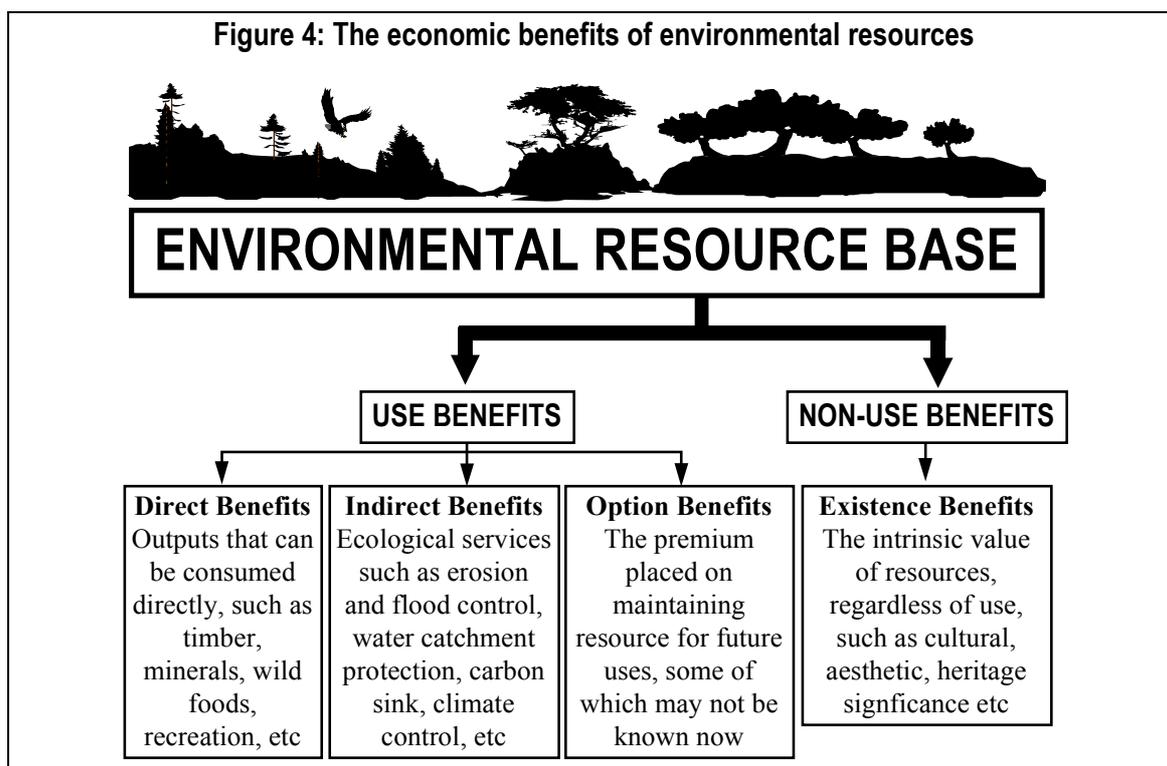
STEPS IN THE USE OF ECONOMICS	ROLE IN PLANNING AND MANAGEMENT	ASKS THE QUESTIONS
<p><b>Identifying environmental economic benefits and costs:</b></p>	<p>Identifying environmental benefits and costs ensures that the economic impacts of environmental activities, and the environmental impact of economic activities, are understood and made explicit in both conservation and development planning and management.</p>	<ul style="list-style-type: none"> <li>•How do environmental resources support economic activities?</li> <li>•How does environmental degradation lead to economic costs?</li> <li>•What are the costs of environmental conservation?</li> </ul>
<p><b>Valuing environmental economic benefits and costs:</b></p>	<p>Data about the economic value of environmental costs and benefits provides important information which can be integrated into both development and conservation planning and management. Making monetary estimates of environmental values means that they can be considered, and given equal weight, alongside other sectors of the economy, benefits and costs.</p>	<ul style="list-style-type: none"> <li>•What is the monetary value of environmental costs and benefits?</li> </ul>
<p><b>Analysing the profitability of economic activities in terms of environmental effects:</b></p>	<p>Environmental economic project analysis provides a framework within which to use information about environmental costs and benefits and their values for decision-making. It provides basic measures of whether a policy, programme or activity can be judged desirable in environmental and economic terms.</p>	<ul style="list-style-type: none"> <li>•What are the environmental and economic benefits and costs of projects and ventures?</li> <li>•Are projects and ventures desirable in environmental terms?</li> <li>•Are conservation activities desirable in economic terms?</li> </ul>
<p><b>Highlighting economic causes of environmental degradation and need for economic measures for conservation:</b></p>	<p>Information about the direct and underlying economic causes of environmental degradation points to areas and groups where there is a need for the use of economic measures to provide incentives and finance for environmental conservation. It forms the basis of identifying and planning conservation activities.</p>	<ul style="list-style-type: none"> <li>•What are the direct and underlying economic causes of environmental degradation?</li> <li>•What are the economic disincentives to conservation?</li> <li>•Which groups need incentives and finance for conservation?</li> <li>•Which groups can finance conservation?</li> </ul>
<p><b>Setting in place economic incentives for environmental conservation:</b></p>	<p>Consideration of economic incentives forms a cross-cutting component of environmental planning and management. Unless people are provided with positive incentives to conserve the environment in the course of their economic activities, and the perverse incentives which encourage environmental degradation are overcome, environmental programmes and projects are unlikely to succeed.</p>	<ul style="list-style-type: none"> <li>•How can incentives can be used to make it more economically desirable for people to conserve than to degrade the environment?</li> </ul>
<p><b>Financing mechanisms for environmental conservation:</b></p>	<p>Financing mechanisms form an important part of environmental planning and management because they provide the basic funding which enables environmental projects, programmes and activities to be carried out.</p>	<ul style="list-style-type: none"> <li>•How can funds be raised for environmental conservation?</li> </ul>
<p><b>Ensuring economic measures for conservation are appropriate and sustainable:</b></p>	<p>Environmental planning and management takes place in many different social, cultural, institutional and ecological situations. Economic measures must be appropriate to these specific on-the-ground conditions if they are to be practically implementable.</p>	<ul style="list-style-type: none"> <li>•Are economic measures for environmental conservation appropriate to local social, political, institutional and ecological conditions?</li> <li>•Are economic measures practically implementable?</li> </ul>

## 2. IDENTIFYING ENVIRONMENTAL ECONOMIC BENEFITS AND COSTS

*Identifying economic environmental benefits and costs ensures that the economic impacts of environmental activities, and the environmental impact of economic activities, are understood and made explicit in both conservation and development planning and management.*

### 2.1 THE ECONOMIC BENEFITS OF ENVIRONMENTAL RESOURCES

A first step in using economics for environmental planning and management is to identify the benefits associated with environmental conservation. It is difficult to justify environmental conservation – to government, businesses or local communities – unless it can be demonstrated to be of social and economic benefit. Traditionally, environmental benefits have been ignored when development decisions are made. At the worst, environmental benefits have been excluded from consideration altogether and at the best the economic value of environmental resource has been seen solely in terms of the raw materials and physical products they generate. By doing this, a large part of the value of environmental resources has been omitted, and a large part of the economic costs of environmental degradation ignored.



The total economic value of environmental resources is much more than the direct outputs (such as timber, minerals, fish, fuel or food) it generates for production and consumption. Environmental resources also provide ecological goods and services (such as catchment

protection, flood control, carbon sequestration or climate control), maintain the option of carrying out economic activities in the future and hold intrinsic cultural and aesthetic value to human beings. All these goods and services improve human welfare and play a vital role in economic activity. As illustrated in Figure 4, the total economic benefit of environmental resources includes:

- ✳ **Direct benefits:** the raw materials and physical products which are used directly for production, consumption and sale including those providing energy, shelter, foods, agricultural production, water supply, transport and recreation;
- ✳ **Indirect benefits:** the ecological functions which maintain and protect natural and human systems through services such as maintenance of water quality, flow and storage, flood control and storm protection, nutrient retention and micro-climate stabilisation, and the production and consumption activities they support;
- ✳ **Option benefits:** the premium placed on maintaining a pool of wetlands species and genetic resources for future possible uses such as leisure, commercial, industrial, agricultural and pharmaceutical applications and water-based developments, some of which may not be known now;
- ✳ **Existence benefits:** the intrinsic value of wetlands species and areas regardless of their current or future use possibilities, such as cultural, aesthetic, heritage and bequest significance.

## 2.2 THE ECONOMIC COSTS OF ENVIRONMENTAL DEGRADATION

A second step in using economics for environmental planning and management is to recognise that environmental degradation leads to economic costs, both now and in the future. Identifying these costs helps to underline the fact that environmental degradation is not just an ecological or biological issue, but also a social and economic concern, because it makes people and countries worse off. The costs of environmental degradation are severe and wide-ranging, and include:

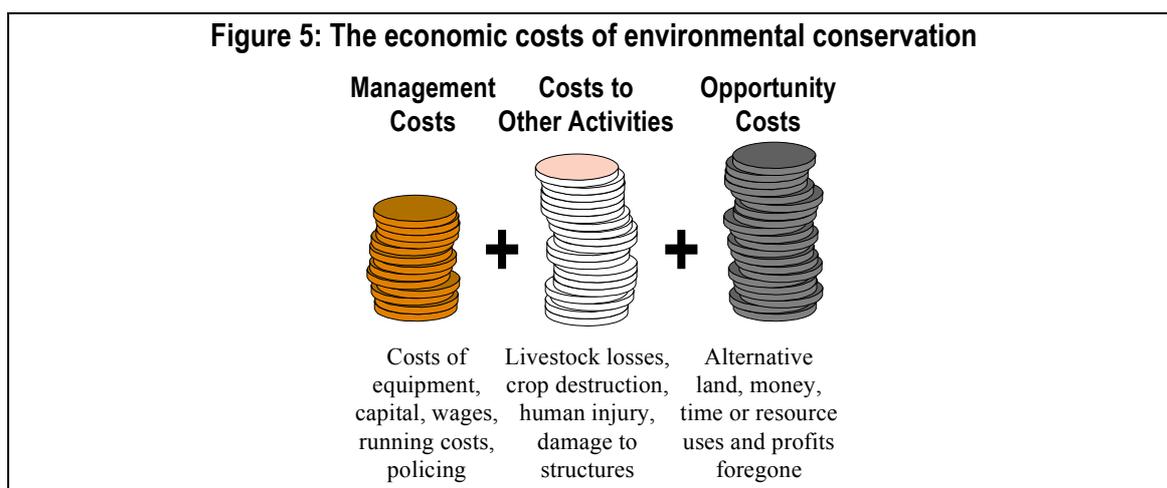
- ✳ **Direct economic costs in terms of production and consumption opportunities foregone:** As environmental resources decline in quantity and quality, especially if they are non-renewable or the rate at which they are used exceeds natural regeneration, the amount of raw materials available to generate economic output grows less, and the amount of output itself declines. An example of this is over-fishing, and the consequent – and growing – decline in fish catches and fisheries income.
- ✳ **Direct economic costs in terms of preventive or avertive expenditure:** As environmental resources decline in quantity and quality, so does the level of ecological services they support. A direct cost is implied in terms of the expenditure necessary to prevent environmental degradation occurring. An example of this is the cost involved in installing soil and water conservation structures to prevent on-farm soil erosion.
- ✳ **Direct economic costs in terms of replacement cost:** As environmental resources decline in quantity and quality, so does the level of goods and ecological

services they support. A direct cost is implied in terms of the expenditure necessary to replace these products as they are lost. An example of this is deforestation, which makes it necessary to produce alternative, non-wood sources of fuel and construction materials and at the same time to replace some of the environmental functions of forests, for example instituting downstream flood control infrastructure to replace the watershed catchment protection once provided by forests.

- ⊛ **Indirect economic costs to other production and consumption activities through knock on effects and externalities:** As environmental resources decline in quantity or quality they have wide effects on other production and consumption activities, even when these activities do not depend directly on a particular environmental resource. An example of this is agro-chemical pollution which affects people's health through contaminating foodstuffs, water and soils; which may destroy fisheries by leaching into surface water; and which may harm livestock through soil and water pollution.
- ⊛ **Costs in terms of future economic options foregone:** There is not yet the scientific and technical knowledge to know the full range of production and consumption possibilities which may eventually be obtained from many environmental resources. We also cannot fully predict human and economic needs for goods and services in the future. As environmental resources decline in quantity and quality, a range of possible raw materials for pharmaceutical, industrial and agricultural applications may be lost for ever.

## 2.3 THE ECONOMIC COSTS OF ENVIRONMENTAL CONSERVATION

Despite the clear economic benefits of environmental resources and the economic losses associated with environmental degradation, there is a cost to conserving the environment. It is extremely important to identify the costs of environmental degradation, because they give rise to economic losses by requiring cash, necessitating expenditures, decreasing income and reducing livelihood options.



As is the case for benefits, environmental costs have tended to be defined too narrowly by economists in the past, focusing only on investment and recurrent costs incurred to the government institutions concerned with environmental conservation. As well as direct physical expenditures, conservation however gives rise to costs because it precludes, diminishes or interferes with other economic consumption and production activities. Valuation must take account of the full range of economic costs associated with environmental conservation, as illustrated in Figure 5, including:

- ✪ **Management costs:** direct physical expenditures on the equipment, infrastructure and human resources required to manage the environment. An example of this is the budget of the national environmental agency in a country;
- ✪ **Opportunity costs:** the alternative uses of time, land, money and other resources required for environmental conservation which could have generated income and profits had they been used differently or allocated elsewhere such as agricultural land uses or unsustainable resource utilisation activities foregone or polluting industrial technologies and production processes precluded. An example of this is the loss of potential income from agriculture in forests, national parks or other protected areas;
- ✪ **Costs to other activities:** the damage and interference to human and economic systems caused by environmental resources, including human and livestock disease and injury, crop pests and sources of competition over resources. An example of this is the crop damage and livestock disease caused by wild animals.

### 3. VALUING ENVIRONMENTAL BENEFITS AND COSTS

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*Data about the economic value of environmental costs and benefits provides important information which can be integrated into both development and conservation planning and management. Making monetary estimates of environmental values means that they can be considered, and given equal weight, alongside other sectors of the economy, benefits and costs.*

#### 3.1 THE AIM OF VALUATION

The basic aim of valuation is to determine people's preferences – how much they are willing to pay for, or how much better or worse off they would consider themselves to be as a result of changes in the supply of, different environmental goods and services. Valuation provides a means of quantifying the economic costs and benefits that accrue to different people from environmental resources, the economic costs arising from their degradation or loss, and the relative profitability of the different economic activities which affect the environmental resource base. It thereby helps to understand and predict the economic decisions and activities which impact on the status and integrity of environmental resources.

Valuation is also important because it provides a way of making sure that decision-makers take account of environmental benefits and costs. Quantifying environmental benefits and costs puts them on an equal footing with other sectors of the economy. It allows environmental values to be considered and incorporated, rather than ignored, when planning and management decisions are made – in the context of establishing and running conservation activities as well as for development activities in other sectors of the economy which impact on the environment.

#### 3.2 TECHNIQUES FOR QUANTIFYING DIRECT ENVIRONMENTAL VALUES

As illustrated in Table 1 a range of methods can be used to quantify the direct values associated with environmental resources. Each has varying applicability, and choice of technique will be determined largely by the nature of each value being considered, available information and overall aims of valuation.

**Table 1: Techniques for quantifying direct environmental values and their applicability**

<b>Technique</b>	<b>Applicability</b>
Market prices	Environmental products which can be bought and sold directly
Prices of alternatives or substitutes	Environmental products which have close substitutes which can be bought and sold
Costs of collection and preparation	Environmental products whose collection and preparation requires marketed inputs
Travel costs	Environmental tourism and recreation
Contingent valuation	Environmental products whose value is clearly perceived
Participatory valuation	Environmental products with a high domestic or subsistence value

##### 3.2.1 Market prices and their limitations

The most simple and straightforward way of finding out the value of environmental resources is to look at their market prices – what they cost to buy or are worth to sell.

These prices reflect what people are willing to pay for them, the value that they place on them.

Collecting data about market prices, sales and purchases is a good way of quantifying the value of environmental goods which can easily be bought or sold – for example fish, timber, fuelwood and minerals. This method can also be used to quantify the value of environmental resources which are used only within the household – as long as they have a market, their price represents expenditures saved or potential to earn income.

### **Box 1: Using market prices to value Lake Victoria fisheries**

It is estimated that in the Kenyan portion of Lake Victoria alone there are approximately 30,000 full-time fishermen catching up to 150,000 tonnes of fish a year, and that more than half a million people are employed directly or indirectly in fishing-related activities. The value of these economic activities was calculated using market prices. Total fish catches may be worth in excess of US\$ 450 million, including exports of some US\$ 180 million and local employment worth up to US\$ 125 million.

Although market prices are undoubtedly a useful way of quantifying economic values, they are often difficult to apply to environmental resources. A major problem is that many environmental goods have no market at all – for example those which are used within the household for subsistence purposes only and never sold. In other cases market prices are distorted because of taxes, subsidies, monopolies or various other interventions and do not reflect the true value of marine products. Where no markets exist for environmental goods, or where market prices are too distorted to be used, it is necessary to find alternative valuation methods. These are described in the paragraphs below.

### **Box 2: Using the market price of substitute products to value papyrus use in Bushenyi District, Uganda**

Households living in Kisooroza West RC1 use papyrus for a range of domestic purposes, including house construction, carpets, baskets and firewood. Because it is difficult to find a market price for these items, their value was calculated by looking at the price of marketed alternatives or substitute products – to a total village value of over US\$ 2 million a year. For example for roof thatch the market prices of tiles were used, for ceilings boards were used, for carpets rubber sheeting was used, for baskets plastic bowls were used and for fuel firewood was used.

### **3.2.2 Prices of alternatives or substitutes**

Even where environmental resources have no direct market themselves, they often have close substitutes which can be bought and sold. For example if fish and bushmeat were not locally available people might have to meet their protein requirements from purchased foods, bricks and tiles might be a substitute for thatch and wooden building poles, kerosene may be an alternative energy source to charcoal or firewood.

The prices of these substitute goods represent what it would cost to buy the next best alternative if environmental resources were not available. They can be used as a proxy for the value of environmental resources because they reflect the amount of money that they are worth in terms of expenditures saved.

### 3.2.3 Costs of collection and preparation

Even when environmental resources have no market prices, and no market substitutes, people spend time and other inputs collecting and preparing them. That people are willing to allocate scarce labour and other resources to obtaining environmental resources shows that they place a value on them. Labour, equipment and other inputs used in the collection and preparation of environmental resources for sale or home consumption all usually have a price – either in market terms or in terms of the potential income which could be generated if they were allocated to other productive activities.

The labour and other costs spent collecting and preparing environmental resources for consumption can be used to estimate their worth. It represents the value of environmental resources in terms of foregone wages and income – the amount of cash which could have been generated if the time and other resources used for environmental resource utilisation had been allocated to other products or consumption items.

#### **Box 3: Using collection and preparation costs to value forest use in Kakamega Forest, Kenya**

Subsistence forest utilisation in Kakamega forest was valued by looking at the time people spent on collecting and preparing forest products for household use, and using the prevailing casual agricultural wage rate – KSh 15 per hour – to cost this time.

<b>Product</b>	<b>Labour</b>	<b>No. used</b>	<b>VALUE</b>
Firewood	3 hrs/headload	225 hl/hh/yr	10,125
Polewood	2 hrs/pole	50 poles/hh/yr	1,500
Thatch	30 hrs/roof	1.5 roofs/hh/yr	675
<b>Total</b>			<b>15,300</b>

### 3.2.4 Travel costs

Natural ecosystems often hold a high value for tourists and local visitors as a recreational or leisure destination – for example for hiking, game-viewing or bird-watching. Even when people do not pay a fee to enter or use natural areas for recreational purposes they expend time and money to visit them. These expenditures reflect the value that visitors place on them.

The travel cost method of valuation calculates the costs incurred in visiting and using natural ecosystems – for example including petrol, bus fares, labour time, accommodation and other charges. It then constructs a demand function relating visitation rates to travel expenditure, which expresses the extent to which people use natural areas at different cost levels, and allows consumer surplus – the value received over and above what is actually paid – to be calculated.

**Box 4: Using travel cost methods to assess the recreational value of Lake Nakuru, Kenya**

Lake Nakuru National Park is an important international tourist destination. Although fees are charged to enter the park, these underestimate the total value that tourists place on the wetland and its component species, especially flamingos. A travel cost survey of visitors elicited information about length of stay, travel costs, place of origin and visitation rates, distinguishing between resident and non-resident tourists. The results of these surveys demonstrated that the annual recreational value of wildlife viewing in Lake Nakuru National Park was between US\$ 7.5-15 million, of which over a third was accounted for by flamingos.

*(Source: Navrud, S. and Mungatana E., 1994, 'Environmental valuation in developing countries: the recreation value of wildlife viewing', Ecological Economics 11: 135-151)*

**3.2.5 Contingent valuation**

Even when environmental resources are not marketed, people place a value on them. This value may simultaneously reflect many different attributes of environmental resources and ecosystems including their consumption value, social and traditional significance – for example the perceived benefits of products such as construction materials, medicines and wild foods commonly combine utilitarian and cultural aspects. Contingent valuation methods have become one of the most widely-used techniques used to quantify environmental benefits which have no market and whose value simultaneously incorporates multiple components. As described below, they are also one of the only approaches which can be used to estimate the option and existence values associated with natural ecosystems.

Contingent valuation is not based on observed market behaviour or prices, but instead infers the value that people place on environmental resources or quality by asking them questions directly. They set up a hypothetical scenario where products could be bought or sold and elicit bids about how much people would be willing to pay to use or consume them, or how much compensation they would be willing to accept for the loss of their use.

Contingent valuation methods are a particularly good way of valuing marine products which have no market, are not consumed directly, or have strong cultural or traditional importance in addition to their actual use. They are also useful in cases where, even though market prices may exist, it is impossible to estimate the quantity of marine goods consumed.

**Box 5: Using contingent valuation to assess the tourist value of Kenya's elephant population**

Contingent valuation was used to estimate the value of Kenya's elephants to tourists. A survey was administered to visitors to major National Parks and lodges asking "Would you be willing to pay \$100 (or more, or less) to contribute towards elephant conservation?" and "How much would the cost of your safari have to be reduced by if elephant populations decreased by a half?". The annual viewing value of elephants was calculated at between US\$ 25-30 million.

*(Source: Brown, G. and Henry, W., 1989, 'The economic value of elephants', London Environmental Economics Centre Discussion Paper, London)*

### 3.2.6 Participatory valuation

Contingent valuation usually elicits monetary bids from people in order to estimate environmental values. People however frequently become suspicious when faced with a scenario involving payments, taxes or compensation. They will often under-quote the amount of money they would be willing to pay for environmental goods if they fear that such charges may actually be made in the future, and over-quote the compensation they require if they think there may be a possibility of actually receiving payment. Additionally, many environmental resources are used within the context of rural subsistence economies where cash is not the main medium of local value. Cash-based contingent valuation is often an inappropriate method for valuing environmental resource utilisation in developing countries.

Participatory valuation, although sharing some characteristics with contingent valuation, does not use cash amounts to express environmental values. Instead it asks people to value environmental resources in terms of other locally important products or categories of value. It allows respondents to choose a numéraire for valuation which is a commonly used, marketed and valued product in the local economy – for example a sack of maize, a radio or a cow – and express the worth of different environmental resources in terms of this numéraire using PRA techniques such as ranking or proportional piling.

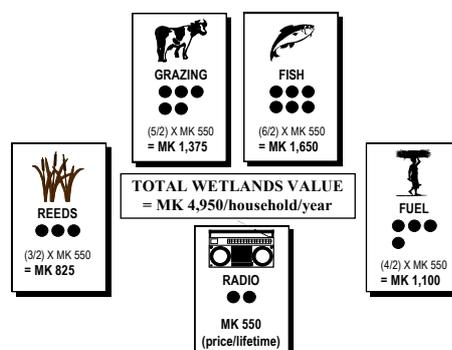
#### Box 6: Using participatory techniques to value wetland utilisation in Lower Shire, Malawi

Wetland resource form an important part of domestic subsistence and local livelihoods in the Lower Shire wetlands. The bulk of wetlands products are used within the household only, and are never bought or sold. Wetlands utilisation is also highly variable at different times of the year. Many wetlands uses are illegal. People are reluctant to speak openly about their activities because they fear arrest. Some wetlands activities also have ritual or cultural significance, and knowledge is

considered the preserve of specialist groups. For all these reasons it was necessary to use an indirect technique for valuation which would allow people to define wetland values within the context of their own perceptions, needs and priorities rather than according to cash amounts.

Whereas households proved reticent in the face of direct questioning, drawing and manipulating pictures of different wetlands activities was found to be a good means of stimulating discussion. These pictures were used to value wetlands utilisation. Because cash measures had little relevance in a subsistence economy such as Lower Shire, it was necessary to find a numeraire for valuation which formed part of the local socio-

economy, had wide significance as an item of value, and could be translated easily into a monetary amount. Households chose a radio as the most appropriate measure of local value. Picture cards depicting wetlands activities were laid out together with a picture of a radio. Each household then distributed 20 beans as counters between these different activities and the numeraire card. It was thus possible to measure the perceived value of wetlands products in terms of radio equivalents, and translate each wetland product into a cash amount based on the market value of a radio, giving a total annual value for wetlands utilisation of 4,950 Kwacha per household.



### 3.3 TECHNIQUES FOR QUANTIFYING INDIRECT ENVIRONMENTAL VALUES

As illustrated in Table 2 a range of methods can also be used to quantify the indirect values associated with marine ecosystems. Each has varying applicability, and choice of technique will be determined largely by the nature of each value being considered, available information and overall aims of valuation.

**Table 2: Techniques for quantifying indirect environmental values and their applicability**

Technique	Applicability
Market prices/substitute prices/ contingent valuation	Environmental services which can be bought and sold directly, have substitutes which are marketed, or have a clearly-recognised economic value
Replacement costs	Environmental services which can be replaced by artificial means
Effect on production	Environmental services which are closely linked to other production activities
Damage avoided/ preventive expenditure	Environmental services which protect human systems and economic activities

#### 3.3.1 Market prices and stated preference methods

Some of the techniques described above which use market prices or stated preferences to value the direct value of environmental resources can also be applied to their indirect values – to the ecological services and functions associated with natural ecosystems. They however rely on the existence of actual or substitute markets for environmental services or on clear and demonstrable links between environmental services and economic benefits – neither of which often apply.

Because of the indirect impact of environmental quality on production and consumption, as it typically has no market, and due to the fact that it generates wide-ranging off-site economic benefits, it is usually necessary to find additional methods to value environmental services. These are described in the paragraphs below.

#### 3.3.2 Replacement cost

If environmental services were no longer available it would sometimes be possible to replace them by alternative means – for example to build artificial reservoirs to compensate for the loss of lakes and wetlands, to instigate physical protection against flooding and storm damage, to construct soil and water conservation measures or to replant forest areas with plantations. These replacement costs represent the value of environmental services which can be at least partially replicated by artificial or technological means. They reflect expenditures saved by the presence of naturally-occurring ecosystems and their associated functions and services.

**Box 7: Using replacement costs to value the erosion control and watershed protection services of Mount Kenya forest**

The erosion control and watershed protection provided by Mount Kenya forest were valued by looking at the cost of replacing these services by artificial means if the forest were no longer there. This involved calculating the costs of developing and maintaining on-farm soil and water conservation measures over the whole forest area. This translated into an overall value of some KSh 76 million a year.

**3.3.3 Effect on production**

Environmental services support other economic processes and activities – for example soil fertility provides crop yields and livestock output, flooding regimes support floodplain agriculture and fisheries, mangrove and marsh areas play an important role in fish breeding. Where these other economic activities have a market value it is possible to look at the changes in production and consumption arising from changes in the status and integrity of the environmental resource base. These effects on production reflect the indirect contribution of environmental services to economic output.

**Box 8: Using effect on production to value soil protection in Eritrea**

Soil erosion resulting from loss of natural vegetation threatens agricultural productivity in Eritrea. Annual rates of soil loss were estimated to average 12 tonnes per hectare on cropland leading to a decline in yields of between 0.3-0.6%, and 15 tonnes per hectare per year in rangeland leading to a decline in livestock productivity of 0.05-0.1%. Together these losses, representing the value of erosion control services provided by natural vegetation, total some 1.23 million Nakfa a year.

**3.3.4 Damage avoided and preventive expenditure**

Environmental services, as well as generating economic benefits, help to avoid economic costs – for example by ensuring that infrastructure is protected against floods, montane settlements are not destroyed by landslides or pastoralist livelihoods are not destroyed by loss of floodplain grazing. Calculating the value of the damage which would occur as a result of the loss or irrevocable degradation of the environmental resource base provides a way of valuing environmental services in terms of losses avoided and costs saved.

**Box 9: Using damage avoided approach to value flood control functions of the Tana Delta wetlands, Kenya**

Wetlands and mangroves on the Tana Delta provide important flood and storm control functions, protecting coastal infrastructure and settlements. This function was partially valued by looking at the damage avoided to roads and bridges by the control of annual floods – a total present value of some KSh 275 million in terms of re-establishment and maintenance expenditures avoided.

Alternatively, environmental services can be valued by looking at how much it would cost to set in place measures to prevent or mitigate the damages arising from their loss. All these expenditures represent the value of environmental services in terms of costs saved.

**Box 10: Using the preventive expenditure approach to value shoreline protection functions of coastal marshes and mangroves in Seychelles**

Coastal marshes and mangroves play an important role in shoreline stabilisation, erosion control, flood and storm protection on Mahé Island in the Seychelles. The value associated with these functions was calculated by applying a preventive expenditure approach. In the absence of wetlands services it would be necessary to construct groynes and flood barriers to offset or prevent coastal erosion and damage to infrastructure, to a total cost of some SR 3.9 million a year.

**3.4 TECHNIQUES FOR ENVIRONMENTAL OPTION AND EXISTENCE VALUES**

It is extremely difficult to quantify option and existence values, largely because neither have a market or support directly production and consumption activities. Usually the only way to quantify option and existence values is to use some kind of method which calculates through indirect means people’s stated or observed preference for environmental resources or quality – for example by using contingent or participatory valuation, or by assessing the amount of money contributed from outside towards environmental conservation. Both types of valuation methods have the disadvantage that they are usually difficult, costly and time-consuming to carry out. For this reason, despite their importance and significant economic worth, the option and existence values associated with the environment often remain unquantified.

**3.5 TECHNIQUES FOR QUANTIFYING THE COSTS OF ENVIRONMENTAL CONSERVATION**

As illustrated in Table 3, market prices and effect on production techniques have the most applicability to valuing the costs associated with environmental conservation.

**Table 3: Techniques for quantifying the environmental costs and their applicability**

Technique	Applicability
Market prices	Management costs
Effect on production	Opportunity costs, costs to other activities

**3.5.1 Management costs**

The direct costs of environmental conservation can be calculated by identifying the labour, equipment, infrastructure, vehicles and other investment and recurrent expenditures required. In most cases these can all be valued at market prices.

**Box 11: Using market prices to value the costs of environmental conservation in the Seychelles**

The direct costs of conservation in the Seychelles were calculated by looking at expenditures made by government, NGOs and private sector on activities concerned with environmental protection. These costs included staff, inputs, equipment and infrastructure as well as expenditures on new, environmentally friendly, technologies. Environmental conservation gave rise to costs of SR 113 million a year for government and NGO projects and programmes, and SR 150 million investments for industry and commerce.

### 3.5.2 Opportunity costs

The three main opportunity costs associated with environmental conservation are the cash and subsistence losses arising from curtailing unsustainable resource utilisation activities, and the income and output which could have been generated by converting natural environments into other land uses, and the income and employment foregone by not implementing, or modifying, developments or production processes which would have a negative impact on environmental quality. All of these opportunity costs can usually be valued using effect on production techniques.

**Box 12: Using effect on production to value the local opportunity costs of conserving Lake Mburo National Park, Uganda**

Three main opportunity costs are incurred by conserving Lake Mburo National Park – constraints on livestock and agricultural land uses and restrictions on natural resource utilisation. These opportunity costs were calculated by applying an effect on production approach to valuation. Agricultural opportunity costs were valued by assessing the total area of the park which is suitable for crop and livestock production, and calculating the potential returns from these activities – some US\$ 137.3 million a year for livestock or US\$ 6.6 billion a year for mixed agriculture. The opportunity cost of conservation in terms of resource use foregone was assessed using survey data identifying the proportion of adjacent households who wished to exploit particular resource in the park but were prevented from doing so, and calculating the potential annual value of these utilisation activities foregone – some US\$ 226 million a year.

### 3.5.3 Costs to other economic activities

The costs to other activities resulting from environmental conservation are most often valued using either effect on production or human capital approaches. While the former is particularly applicable to the costs associated with crop and livestock damage by wild pests, the latter is specifically focused on human health and productivity.

**Box 13: Using effect on production to value wildlife costs to agriculture around the Maasai Mara, Kenya**

The costs of wildlife damage to agriculture around the Maasai Mara have been estimated using effect on production and avertive expenditure techniques to comprise an average of 35-45% of total crop production costs or some US\$104/km<sup>2</sup> of rangeland for livestock. Methods used to arrive at these values include crop output and income foregone, costs of labour and other equipment allocated to guarding crops against wild animals or fencing livestock enclosures, and the value of livestock lost to wildlife-related disease and mortality.

The human capital approach to valuation establishes a dose-response or cause-effect relationship, linking for example the prevalence of water-borne illness or the incidence of injuries and death caused by wildlife with increased human disease and decreased productivity. It adds up the loss of earnings and costs of medical treatment and health care arising from harmful natural species and ecosystems.

**Box 14: Using human capital methods to calculate the economic cost of pesticide poisoning around Lake Naivasha, Kenya**

The human costs associated with pesticide poisoning resulting from horticultural and floricultural activities irrigated from Lake Naivasha were valued using human capital valuation techniques. The frequency of pesticide applications and resulting incidence of illness for different crops was calculated, and valued in terms of the costs of medical consultation, drugs and work days lost – to an average cost of some KSh 5,000 per poisoning case or up to KSh 1,800/ha of agricultural production.

### 3.6 LIMITATIONS TO VALUATION

Valuation is a useful tool for environmental planning management because it highlights a range of costs and benefits which have in the past often been ignored by planners, policy-makers and decision-makers. Valuation techniques however only provide tools which help to make better and more informed decisions about environmental management – they are not ends in themselves, and have a number of shortcomings and weaknesses. There are a number of methodological issues and limitations which should always be borne in mind when carrying out environmental valuation:

- ✱ Environmental valuation is usually, of necessity, **partial**. Most quantified estimates of the economic benefit of environmental goods and services focus only on selected components of their value. They should be taken as a minimum estimate of the total economic value of environmental conservation.
- ✱ The **reality of values** is sometimes limited. They are rarely “real” values and often do not exist in terms of concrete prices and income. Rather than definitive or binding figures, most values should be seen as indicative estimates which present a guide to what environmental resources may be worth, for use in planning, decisions and policy. It is always important to make explicit the hypotheses, suppositions and assumptions which have been used in the course of environmental valuation.
- ✱ Environmental values are **unequally distributed** between people and over time. Most valuation techniques do not take account of this differentiation or variability. Different people have different perceptions of the value of environmental resources and ecosystems, and these may vary at different times. Economic valuation is usually based on a particular person’s or group’s conception of what a particular environmental good or service is worth at a specific point in time. It is not necessarily universally valid, or extrapolable between different groups, areas, species or over time.
- ✱ Environmental degradation can have **irreversible effects** including the complete collapse of human livelihoods, the permanent loss of consumption and production possibilities or the total extinction of wild species. The full risk or ultimate implications of these losses, or how the loss of one species or habitat may affect other resources or activities in the future, is not known. The final or knock-on effects of environmental degradation can never be fully quantified or reflected in economic valuation.

- ✪ Some environmental benefits will always be ***unquantifiable and unmeasurable*** because the necessary scientific, technical or economic data is not available. Other aspects of environmental valuation which relate to human life or religious and cultural significance involve ethical considerations, especially when they are used to argue that specific activities or particular people's needs are more desirable or important than others. It is impossible to value environmental benefits fully, and in some cases it should not even be attempted.

## 4. ENVIRONMENTAL ECONOMIC PROJECT ANALYSIS

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***Environmental economic project analysis provides a framework within which to use information about environmental costs and benefits and their values for decision-making. It provides basic measures of whether a policy, programme or activity can be judged desirable in environmental and economic terms.***

### 4.1 THE AIM OF ENVIRONMENTAL ECONOMIC PROJECT ANALYSIS

Environmental economic project analysis provides a framework for using valuation to assess the impacts of policies, programmes, projects and ventures which impact on the environment. It shows whether activities, overall, give rise to an economic gain or loss in terms of their environmental effects – whether they are desirable in environmental and economic terms or not.

Individuals, households, firms and government all engage in activities and ventures because they aim to generate revenues, profits or some other form of benefits. Economic considerations have always been important determinants of how projects are identified, planned and chosen, and influence decisions about whether and how to implement, modify or cancel them. The incorporation of environmental costs and benefits into economic project analysis is however more recent. Project analysis has tended in the past to focus only on the direct and on-site impacts of activities, and projects concerned the environment have not been subjected to rigorous economic analysis. Today environmental and economic considerations form a part of most project analyses, whether or not they are concerned directly with environmental resources and goals.

Most projects, activities and ventures are subjected to some form of economic analysis, whether it involves a rough comparison of likely costs and benefits or a detailed assessment of inputs, outputs and impacts under different scenarios. Economic analysis involves weighing up costs and benefits in order to choose the most preferable project, activity or venture. Addressing environmental costs and benefits within economic project analysis has a range of aims, including:

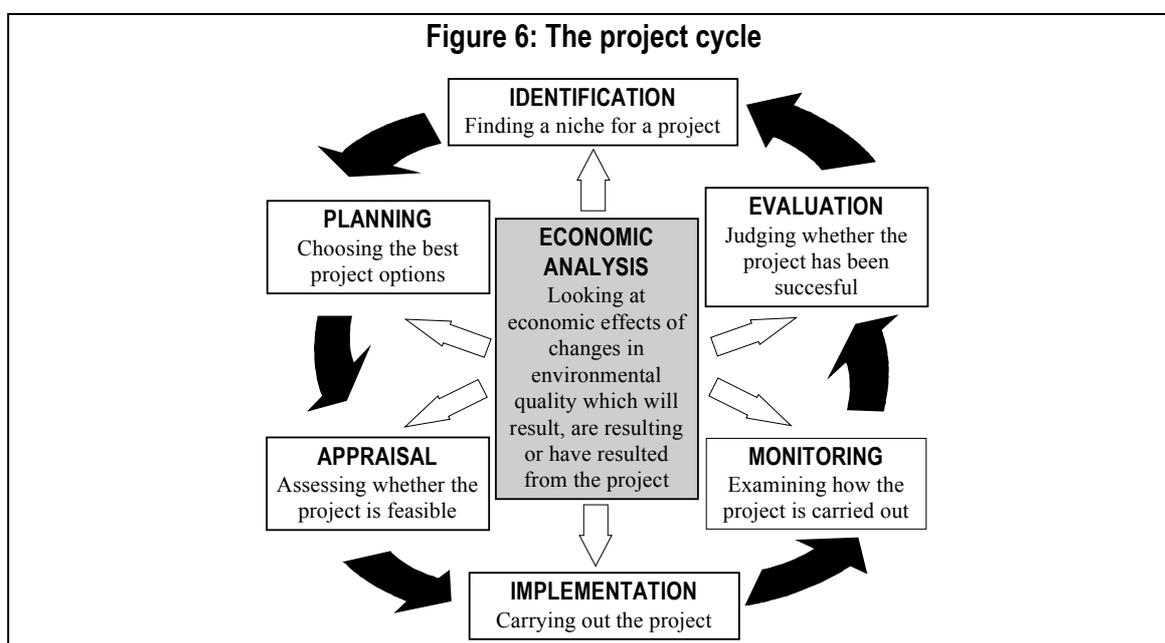
- ✱ ***Understanding the economic implications of changes in environmental quality*** arising from projects;
- ✱ ***Highlighting the full value of environmental benefits*** which must be weighed against project costs and highlighting the full value of environmental costs which must be weighed against project benefits;
- ✱ ***Assessing the economic implications of projects concerned with environmental conservation***, and understanding the environmental implications of projects concerned with other goals or sectors;
- ✱ ***Indicating the full economic value of environmental resources which are considered free or have no market***, and helping to price the environmental resources used, depleted or destroyed in projects;

- ✳ **Highlighting the environmental and economic impact of projects on different groups**, and identifying who gains and who loses as a result of project activities and their effects;
- ✳ **Modifying the way projects are carried out so as to avoid environmental degradation** and encourage environmental conservation.

## 4.2 ENVIRONMENTAL ECONOMIC ANALYSIS IN THE PROJECT CYCLE

Every project, activity or venture, whether or not it is directly concerned with the environment, goes through a number of stages in its lifetime. These stages are known as the project cycle, as outlined in Figure 6, and include:

- ✳ **Identification:** finding a niche for a project;
- ✳ **Planning:** deciding how a project can be carried out and choosing the best project options;
- ✳ **Appraisal:** assessing whether a project is feasible;
- ✳ **Implementation:** carrying out the project;
- ✳ **Monitoring:** examining how the project is being carried out, seeing whether it has met its targets and using this information to improve future project activities;
- ✳ **Evaluation:** examining whether the project has been successful in terms of its original goals and objectives.

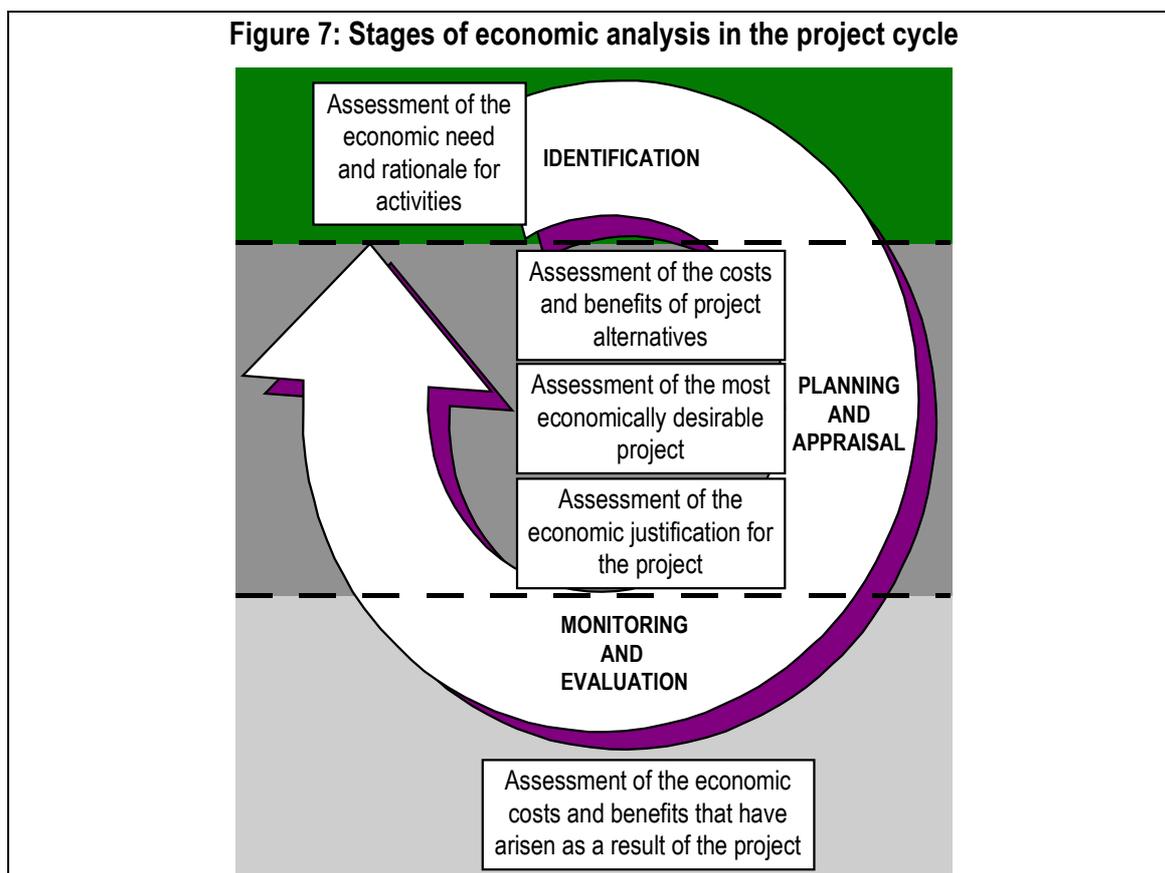


Each stage of the project cycle is subject to economic analysis, alongside analysis in other areas – including financial, technical, social, institutional and environmental analysis. The ultimate aim of including environmental concerns in economic project analysis is to incorporate environmental values alongside other costs and benefits, to consider the full

implications on the environment of projects and to assess the economic effects of any changes in environmental quality occurring as a result of projects.

As outlined in Figure 7, economic analysis is applied to every stage of projects. The project cycle involves a continuous series of analyses, checks and assessments to ensure that projects are proceeding in a way which is economically justifiable and acceptable: These include:

- ✪ At the **identification** stage, economic analysis describes the need and rationale for the project and states whether there is an economic niche for it;
- ✪ At the **planning and appraisal** stage, economic analysis describes and compares different alternatives for projects and activities and highlights the most economically justifiable and feasible option for action;
- ✪ At the **monitoring and evaluation** stage, economic analysis describes the changes which have arisen as a result of projects and activities, compares them to original goals and objectives and states whether they are economically acceptable.

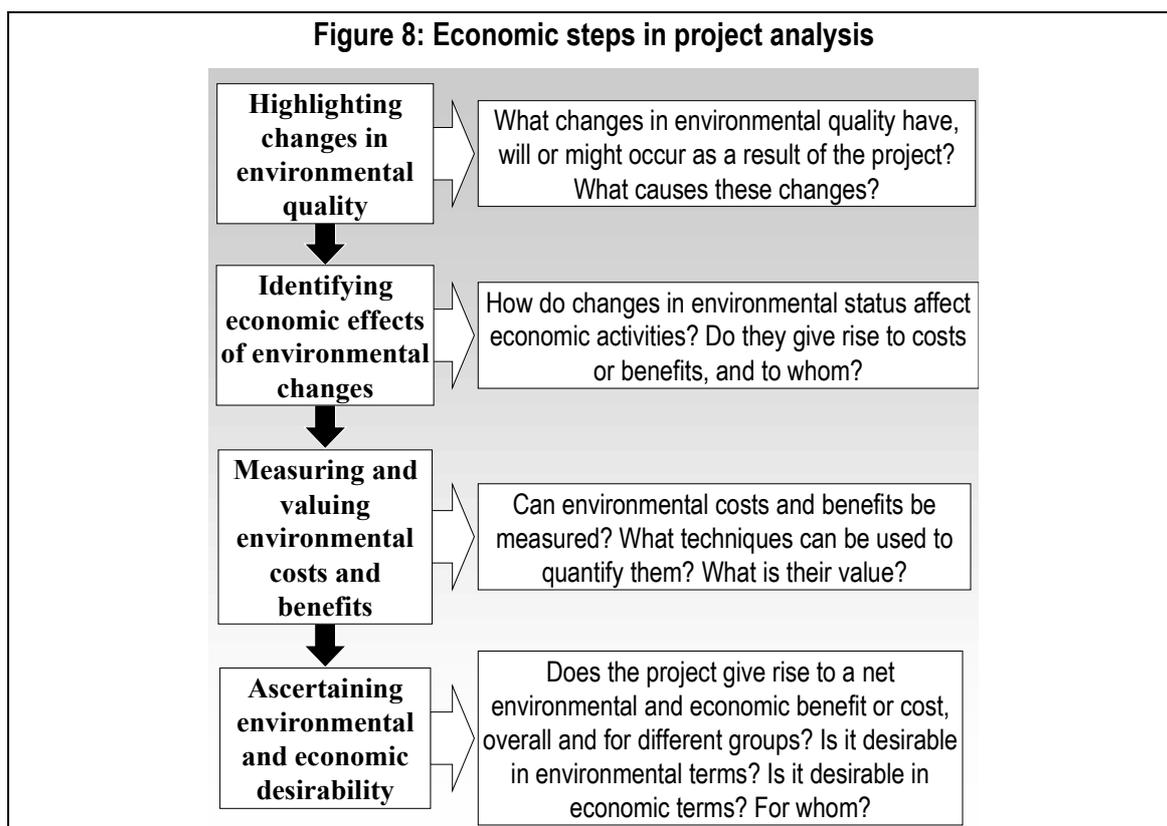


### 4.3 STEPS IN ENVIRONMENTAL ECONOMIC PROJECT ANALYSIS

Although environmental economic analysis has different aims and outputs at each stage of the project cycle – for example to help identify, plan, choose, implement, monitor or

evaluate activities, it always involves assessing and comparing costs and benefits, and has the ultimate aim of deciding whether the project is worthwhile in environmental and economic terms. Analysis follows a number of common stages, as outlined in Figure 8, including:

- ✪ **Highlighting changes in environmental quality that have occurred as a result of the project:** how and why project activities have contributed to changes in environmental quality, or in the supply of environmental goods and services, intentionally or in unintended ways;
- ✪ **Identifying the economic effects of changes in environmental quality:** how changes in environmental goods, services and quality have affected economic activities, production and consumption overall, and for different groups;
- ✪ **Measuring and valuing environmental costs and benefits arising from the project:** how far environmental costs and benefits can be measured and quantified, and finding techniques to value them;
- ✪ **Deciding whether a project is viable in environmental and economic terms:** whether economic and environmental benefits outweigh costs and whether the project can be considered to be desirable in environmental and economic terms, overall and for different groups.



## **4.4 COMPARISON OF PROJECT COSTS AND BENEFITS**

In order to ascertain the environmental and economic effects of a project it is necessary to compare the costs and benefits it gives rise to and make a judgement as to whether project activities lead to an economic gain or loss.

### **4.4.1 Cost benefit analysis**

The commonest way of assessing the economic effects of projects is through cost-benefit analysis (CBA). CBA compares benefits to costs, and indicates the net benefit (or cost) of a project – the difference between its total benefits and total costs – in order to draw conclusions about its desirability and viability.

Projects have different implications for different people. In addition to looking at the overall costs and benefits of a project, venture or activity, we can carry out cost-benefit analysis from a range of perspectives. For example a government may want to know if a project is socially beneficial, an investor may want to know the returns he is getting from his investment, local communities may want to know what costs and benefits a project will generate for them.

### **4.4.2 Financial and economic analysis**

Cost benefit analysis distinguishes between financial and economic values. Whereas economic values concern overall costs and benefits to society, financial values are based on market prices. These two values are often different because a range of subsidies, taxes and other price distortions mean that market prices do not always reflect the true value of goods and services. How far economic and financial values diverge depends on the level of distortion in the economy.

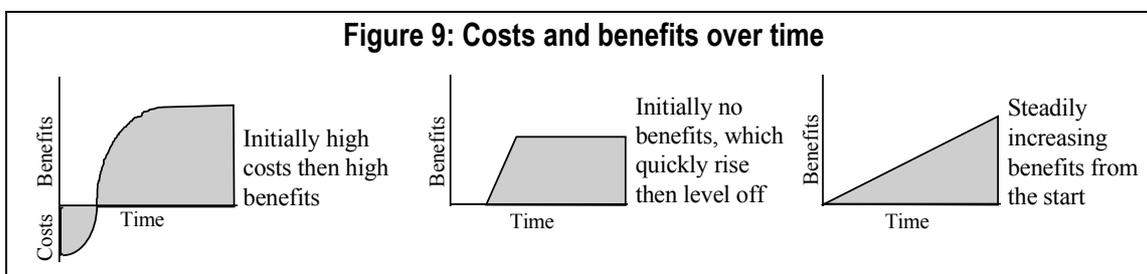
From an individual's or firm's viewpoint, actual market profits are of primary importance in project analysis – they want to compare money spent with money received using a financial cost-benefit analysis. However, from the point of view of the government, or society at large, we may want to look at the overall economic effects of a project on the whole economy, in which case an economic or social cost-benefit analysis is used.

A financial analysis simply uses market prices to calculate costs and benefits. In an economic analysis these prices are adjusted so that they reflect the real resource costs – or opportunity costs – to the economy of undertaking a particular activity. To convert market prices into social or economic prices we need to account for price distortions in the economy – for example, if goods are taxed we need to subtract this amount from their market price, if they are subsidised we need to add this amount to their market price, if they use imported inputs we may need to adjust their price if the exchange rate is overvalued, and if the activity gives rise to significant externalities we may want to take account of these.

### **4.4.3 Time and discounting**

In order to deal with long-term impacts and effects of a project rather than a snapshot image of its costs and benefits at a single point, we have to take account of time in CBA.

Projects and activities are usually spread over a number of years, and benefits and costs accrue at different times. As outlined in Figure 9 even where the total net benefit of two projects is the same one might have very high initial capital costs or very slowly accruing benefits, which affect how desirable it is.



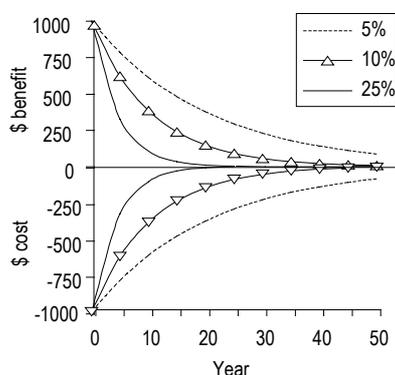
Time is a crucial factor in making comparisons between projects because benefits and costs are worth different amounts to people depending on when they accrue. Money now is generally worth more than money in the future, both because of time preference – people prefer to enjoy benefits sooner and costs later, and due to the opportunity cost of capital – money tied up in a project has an alternative value, because it could have been invested elsewhere to generate interest or profits.

In order to overcome these problems of time, project costs and benefits accruing over a number of years are commonly discounted in order to give them a common value at today's prices. Discounting is the inverse of applying a compound interest rate, and steadily reduces the value of costs and benefits as they fall further in the future. A discount factor is applied to a future cost or benefit at the end of year  $n$  of a project in order to reduce it to its equivalent present value as follows:

<b>Discount factor =</b>	
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Choice of discount rate will of course influence the profitability of a project – as illustrated in Figure 10, the higher the discount rate applied, the less that future benefits and costs will be worth in today's terms. Although the choice of discount rates for environmental projects is subject to some debate (it has been argued that they should be subject to lower discount rates, because so many of the costs of environmental degradation and benefits of environmental conservation accrue far into the future), it is generally accepted that discount rates for all projects should be set at the prevailing opportunity cost of capital – the returns on investment that could be expected if money was invested elsewhere in the economy rather than being tied up in a project.

**Figure 10: The present value of \$1000 over time at different discount rates**



#### 4.4.4 Measures of project worth

Using discounted benefit and cost figures, CBA yields three main indicators of economic worth which can be compared between projects or activities to see which holds the highest net benefit:

- ✪ **Net present value:** the net present value of an activity or project is the difference between its discounted benefits and costs. If the net present value is positive – its discounted benefits are greater than its discounted costs – it is economically desirable;
- ✪ **Benefit-cost ratio:** the benefit-cost ratio of an activity or project is its discounted total benefits divided by its discounted total costs. If the benefit-cost ratio is greater than one – its discounted benefits are greater than its discounted costs – it is economically desirable;
- ✪ **Internal rate of return:** the internal rate of return is the discount rate at which the stream of costs and benefits of a project or activity are equal – the rate which makes the net present value of the project or activity equal to zero. If this rate is higher than the prevailing opportunity cost of capital – often measured as the current interest rate on savings, it is economically desirable.

#### 4.4.5 Other decision criteria

Economic factors form only aspect of project analysis. In practice, economic criteria are rarely the only, or deciding, factor in assessing projects and activities. Other technical, social, institutional and political factors are also important, and in environment-impacting projects a range of biological, ecological and business considerations must be taken into account.

Even in economic project analysis, CBA is usually combined with other decision criteria and analytical tools. Some of these are particularly appropriate for assessing environmental projects, and include:

- ✪ **Cost-effectiveness analysis:** cost effectiveness analysis is a criterion for judging the most economically efficient way of carrying out an project or activity, once it has been decided that this is worth doing. The preferred option is the one which can achieve certain objectives (such as the preservation of a particular wildlife areas or species, or the development of a specific wildlife enterprise) at least cost;
- ✪ **Safe minimum standards:** the safe minimum standards criterion favours projects or activities which minimise possible losses for a certain group or resource. It is particularly appropriate to wildlife conservation projects which deal with species or habitats about which little is known, are rare or endangered, that may be subject to irreversible losses or whose loss may lead to unknown costs and knock-on effects;
- ✪ **Distributional analysis:** wildlife projects and activities often have explicit development, distributional or equity aims and in most cases have an overriding goal of conserving or better managing wildlife. In this case, costs and benefits accruing to different groups and wildlife and non-wildlife costs and benefits have different weights and importance to the decision-maker. Some form of analysis of the distribution of costs and benefits is commonly required;
- ✪ **Multi-criteria analysis:** multi-criteria analysis is the application of more than one criterion to project or activity desirability. It uses criteria which are relevant to the particular project or activity under consideration and may include such indicators such as payback period, size of investment, number of beneficiaries, cost per beneficiary, distribution of benefits, ease of implementation and so on.

## 5. IDENTIFYING THE ECONOMIC CAUSES OF ENVIRONMENTAL DEGRADATION

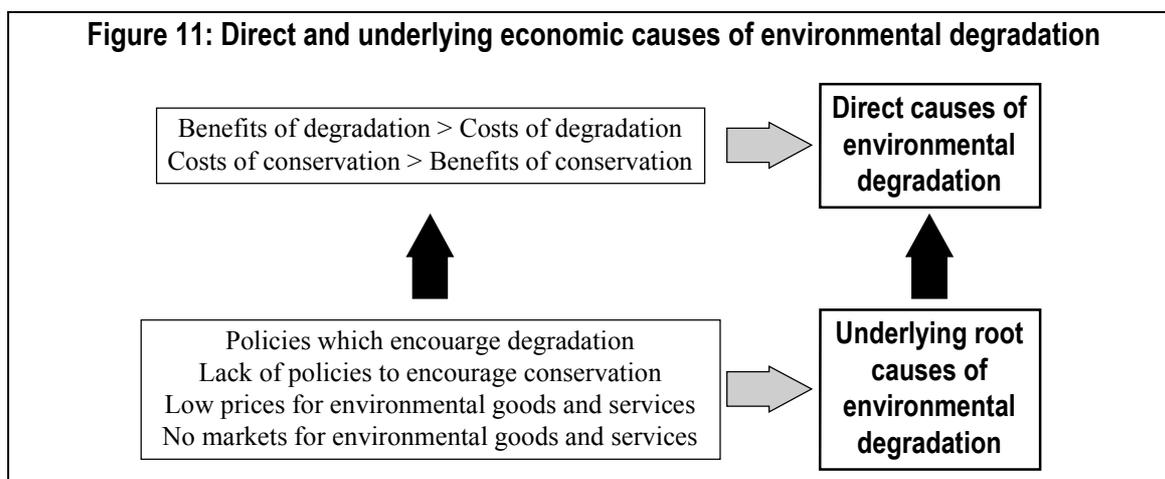
*Information about the direct and underlying economic causes of environmental degradation points to areas and groups where there is a need for the use of economic measures to provide incentives and finance for environmental conservation. It forms the basis of identifying and planning conservation activities.*

### 5.1 THE AIM OF IDENTIFYING ECONOMIC CAUSES OF ENVIRONMENTAL DEGRADATION

Environmental economic valuation and project analysis demonstrate the relative costs and benefits associated with environmental conservation and degradation for different groups. They indicate whether particular courses of activity are environmentally and economically desirable and viable. Further analysis is however required to explain why environmental economic costs and benefits accrue as they do, how they may lead to a situation where environmental degradation occurs and what additional measures it is necessary to take in order to encourage people to conserve the environment in the course of their economic activities.

### 5.2 HIGHLIGHTING THE ECONOMIC CAUSES OF ENVIRONMENTAL DEGRADATION

Environmental degradation is caused directly by economic activities – for example the clearance of natural forest or wetlands for agriculture, over-exploitation of natural resources or disposal of untreated wastes and effluents into the air, land and water. People degrade the environment in the course of economic activities because they can do so at no cost, because they gain from doing so, and because they receive no immediate benefit – or incur a cost – from conservation. Distributional analysis, described below, can highlight these imbalances in costs and benefits and indicate situations where they are leading people to degrade the environment.



However, as illustrated in Figure 11, these direct causes of environmental degradation are permitted or encouraged to occur as a result of much deeper economic, market and policy factors. It is necessary to understand these broader economic factors so as to be able to identify practical tools and measures which can address the reasons for environmental degradation, overcome its underlying root causes and set in place the conditions under which people are willing and economically able to conserve the environment. Policy analysis, described below, can highlight broader economic factors which are encouraging environmental degradation.

### 5.2.1 Environmental economic distributional analysis

Environmental costs and benefits are unequally distributed between different groups. In turn, the actions of many different groups have the potential to impact on environmental quality. Analysing the distribution of environmental benefits and costs between groups helps to ascertain who, under the *status quo*, gains and loses from environmental conservation and degradation. Distributional analysis identifies the groups who have few incentives to conserve the environment because they receive insufficient net benefits or bear an unfair proportion of its costs, and highlights cases where groups are benefiting from, or degrading, environment resources at no cost to themselves.

#### **Box 15: Gainers and losers in Mount Kenya Forest conservation**

Analysis of Mount Kenya Forest shows that under the *status quo*, there are net gainers and net losers from forest conservation. Both recreational visitors and the regional economy – including the groups and businesses who are licensed to extract timber and minor forest produce from Mount Kenya Forest as well as the off-site and downstream beneficiaries of the ecological services provided by the forest – receive a net benefit from forest conservation. This is because they bear few of the costs of forest conservation except for paying nominal charges and fees for the extraction of forest products. The Forest Department – who bear the direct costs of forest conservation, which are in excess of the revenues accruing from the sale of forest products, and forest-adjacent residents – for whom the opportunity costs and animal damage costs associated with the forest outweigh the benefits of non-resident cultivation and domestic forest utilisation, are net losers from forest conservation. There is a clear need to generate incentives for the Forest Department and local communities to participate in forest conservation. It is clear that at least some of this finance can be generated from visitors and tourists, and the regional economy who currently benefit freely from Mount Kenya Forest's biodiversity.

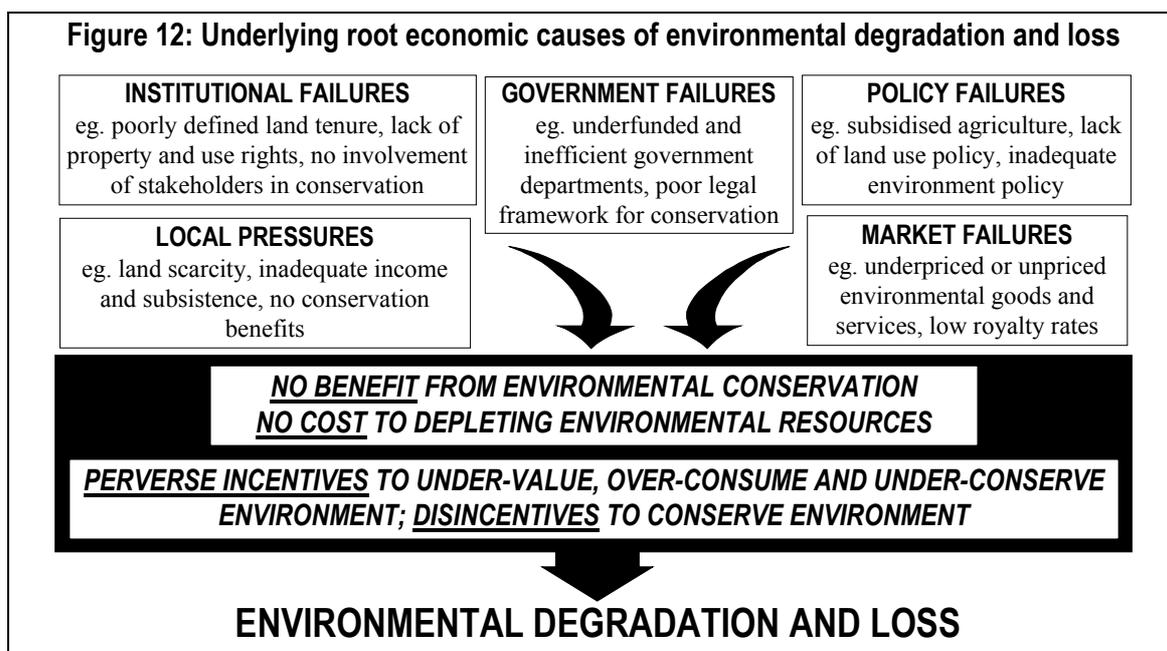
### 5.2.2 Environmental economic policy and market analysis

A broad range of underlying economic forces and circumstances set the conditions under which people face disincentives to conserve the environment. As illustrated in Figure 12 these include:

- ⊗ **Market failures** occurs when environmental resources are free, or underpriced by the market. The prices people pay for goods which give rise the environmental degradation do not incorporate these costs, and the profits people receive for goods and services generated through conserving the environment do reflect these benefits. Environmental values are not reflected in private costs and revenues – rather, they occur as **externalities** which accrue to the rest of society. Because of market failure, people will tend to over-consume environmental resources and environment-depleting goods, and under-conserve the environment, because they

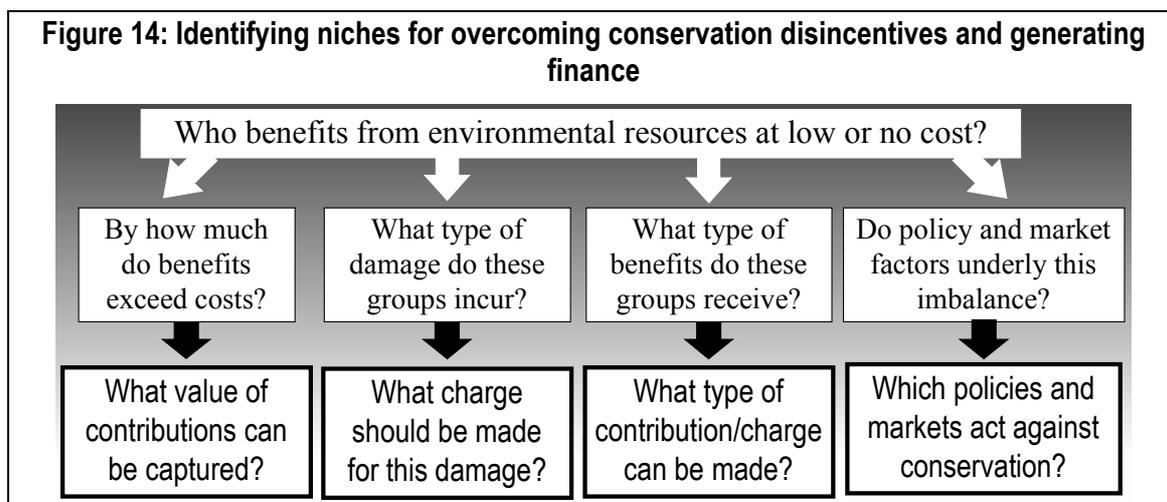
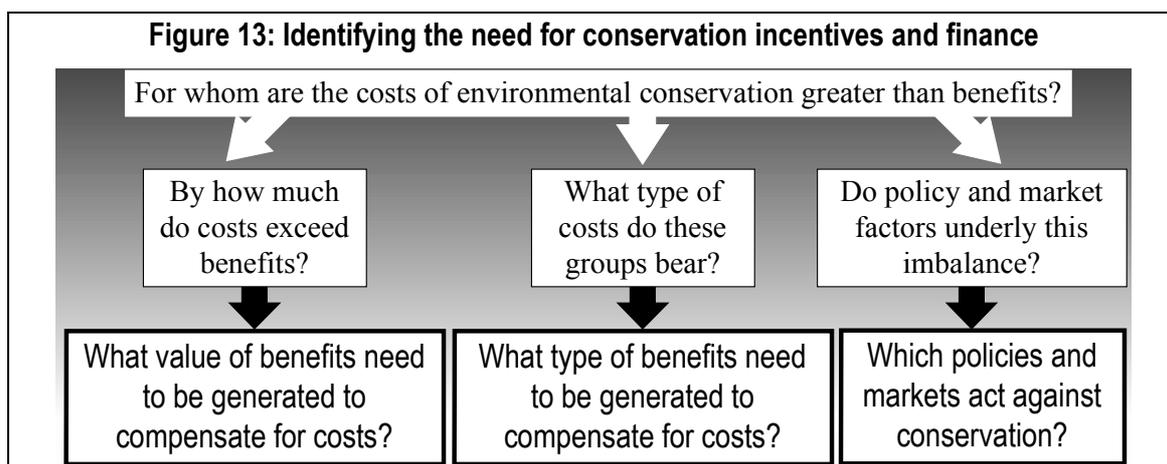
make decisions on the basis of the private profits they receive, not on the basis of **social costs and benefits** – the costs and benefits that accrue to other groups in society, or to the national economy as a whole. Examples of market failures include the low price of charcoal or minerals as compared to the environmental damage their extraction causes, low timber royalty rates, the lack of charges or fines for environmental pollution or the lack of markets for environmental services such as water catchment pollution;

- ✳ **Policy failure** occurs when policies lead to the prices of environmental goods and services being distorted in themselves or relative to other prices. It results from the taxes, subsidies and other financial and economic instruments which are used to manipulate prices and profits and stimulate certain sectors of the economy. Policy failure means that market prices send the wrong signals to producers and consumers, encouraging them to favour particular consumption choices and resource uses, regardless of their true value or the impacts they have on the environment. Examples of policy failure include subsidies to agricultural land uses at the expense of environmental conservation, water policy which promote developments which interfere with upstream riverflow or wetlands, fisheries policies which encourage over-fishing and the use of destructive gear and methods, and inadequate or absent environmental policies;
- ✳ **Institutional failure** occurs when the organisations, laws, property rights and social sanctions which govern economic activity, resource use and ownership do not encourage conservation or allow people to appropriate the full benefits from environmental conservation, while also meaning that they do not feel the full costs associated with its degradation. Examples of institutional failure include the absence of government institutions concerned with environmental conservation, the exclusion of local communities from forest and wildlife management bodies and weak tenure, property and use rights over land and other resources.



Environmental economic policy analysis identifies the wider forces in society which cause or encourage people to degrade the environment in the course of their economic activities.

### 5.3 IDENTIFYING NEEDS FOR ECONOMIC MEASURES FOR ENVIRONMENTAL CONSERVATION



The aim of highlighting the direct and underlying economic causes of environmental degradation is to identify where there are needs to set in place economic measures for conservation. In particular distributional and policy analysis can identify:

- ❖ **Groups who bear the costs of environmental conservation while gaining few benefits:** these groups have few incentives to conserve environmental resources in the course of their economic activity, because there is no economic gain to them from doing so. They may also be unable to afford to do so because conservation incurs economic losses to them. These groups require positive economic incentives for conservation, and may also need finance.

Distributional and policy analysis highlights the type and level of incentives and finance which are needed to achieve these goals, as illustrated in Figure 13.

- ⊛ ***Groups who gain high benefits from degrading the environment at low or no cost:*** these groups have few incentives to stop degrading the environment in the course of their economic activity because they gain higher benefits from environmental degradation than from conservation. They must be made to bear the economic costs they cause, and be provided with incentives to conserve rather than degrade the environment. Distributional and policy analysis highlights the type of disincentives which must be overcome, and the level of finance which can be raised, in order to achieve these goals as illustrated in Figure 13.
- ⊛ ***Groups who gain high benefits from environmental conservation while bearing few costs:*** these groups could potentially share in the costs of financing environmental conservation. Distributional and policy analysis highlights the type and level of finance which can be raised in order to achieve these goals as illustrated in Figure 14.

## 6. SETTING IN PLACE ECONOMIC INCENTIVE MEASURES FOR ENVIRONMENTAL CONSERVATION

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***Consideration of economic incentives forms a cross-cutting component of environmental planning and management. Unless people are provided with positive incentives to conserve the environment in the course of their economic activities, and the perverse incentives which encourage environmental degradation are overcome, environmental programmes and projects are unlikely to succeed.***

### 6.1 THE AIM OF ECONOMIC INCENTIVE MEASURES

Economic incentives aim to provide inducements for people to conserve the environment by making it more profitable or economically desirable for them to do so. They are a way of both overcoming the underlying policy, market and institutional failures and the direct imbalances in costs and benefits which lead to environmental degradation. Economic incentives basically operate in three areas:

- ✱ To ***ensure that tangible benefits accrue to the groups who bear the direct or indirect costs associated with environmental conservation***, and thus to present them with positive economic incentives for conservation.
- ✱ To ***penalise people for carrying out economic activities which contribute to environmental degradation***, and thus to either discourage them from damaging the environment or to raise sufficient funds to protect against or reverse this damage.

Incentive measures basically work in three areas to achieve these goals:

- ✱ ***Amending distorted policies*** which fail to promote environmental conservation or which encourage environmental degradation;
- ✱ ***Reforming weak institutions*** which fail to promote environmental conservation or which encourage environmental degradation;
- ✱ ***Setting in place markets, and improving prices***, for environmental goods and services so that people bear the full benefits of conservation and full costs of degradation in the course of their economic activities.

### 6.2 PROPERTY RIGHTS

Property rights deal with the fact that many groups, even when they have a major stake, interest or right in environmental resources and areas, are excluded from participating in their management by the absence of well-defined rights to do so. They aim to address institutional and policy failures. As long as people do not have a secure stake in environmental resources and areas, they will be precluded either from benefiting directly from their conservation or being forced to bear the implications of their degradation and loss. They thus also aim to address market failures. Property rights can take many forms, from outright ownership of an environmental resource or area, through rights to manage

or utilise particular resources to formal representation in management and decision-making bodies.

**Box 16: Community property rights to forest reserves in Tanzania**

In Babati District Tanzania local communities, through Village Government, have been given direct property rights to manage, utilise and administer Forest Reserves. Initially this involved degraded areas of natural woodland, where villagers prepared and implemented management plans. More recently this arrangement has been extended to community management of plantation and production areas.

### 6.3 RESOURCE UTILISATION

Permitting some level of resource utilisation can provide a powerful incentive for environmental conservation by ensuring that tangible benefits are generated. This can either comprise the continuation of existing sustainable resource utilisation activities or the provision of resource alternatives or substitutes in direct compensation for unsustainable activities foregone.

**Box 17: Developing new utilisation activities and markets for marine products in the Bazaruto Archipelago, Mozambique**

The Bazaruto Archipelago is one of Mozambique's most valuable marine areas, is rich in resources and is among the country's most vulnerable and fragile ecosystems. In order to ensure the long-term conservation of this marine area, a number of activities have been set in place which aim to stimulate sustainable use by local communities. These are focused on eco-tourism and artisanal resource use activities, which are being promoted specifically to compensate local villagers for the loss of land and fishing resources by the establishment of a National Park. Simultaneously a range of new activities are being introduced to villagers, including permaculture and vegetable farming projects, aiming to take pressure off marine resources.

*(Source: Reina, A., 1998, 'Bazaruto Project: a brief overview May 1998', in Salm, R. and Tessema, Y., (eds) 1999, Partnership for Conservation: Report of the Regional Workshop on Marine Protected Areas, Tourism and Communities, IUCN Eastern Africa Regional Office and Kenya Wildlife Service, Nairobi)*

### 6.4 DEVELOPING AND IMPROVING MARKETS

Developing new markets for environmental goods and services, and improving existing ones, aim to overcome market failures which make conservation relatively less profitable than conservation. It raises the overall economic gain from conservation. Developing and improving markets also provides a means of paying for environmental resources which are used or degraded in the course of economic production and consumption activities, and encourages producers and consumers to take account of the value of environmental resources and quality when they make decisions.

### 6.5 FISCAL AND FINANCIAL INSTRUMENTS

Fiscal and financial instruments both provide a means of channelling and distributing revenues for environmental conservation. They aim to make funds available to the groups who bear the costs associated with conservation. Fiscal instruments include a range of subsidies and differential taxes – for example to encourage investment in technologies and production processes which do not damage the environment, or to develop sustainable

resource utilisation activities. Various forms of loans, grants and funds can be made available as financial instruments to support environmental conservation, both to support directly sustainable utilisation and conservation as well as to encourage the development of production and consumption activities as alternatives to those which damage the environment.

### **Box 18: Energy taxes and subsidises as incentives for forest-saving technologies in Eritrea**

Deforestation due to over-exploitation of firewood is a major problem in Eritrea. In order to encourage people to change their energy consumption patterns and consume less woodfuel the Eritrean government has implemented a series of fiscal reforms in the energy sector, including subsidies to kerosene, the promotion of energy-efficient woodfuel stoves and the dismantling of duties on imported solar technology.

## 7. FINANCING MECHANISMS FOR ENVIRONMENTAL CONSERVATION

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*Financing mechanisms form an important part of environmental planning and management because they provide the basic funding which enables environmental projects, programmes and activities to be carried out.*

### 7.1 RAISING FINANCE FOR ENVIRONMENTAL CONSERVATION

Environmental conservation activities traditionally relies on three sources of finance for their operation – on tourism revenues, central government subventions and donor funding. All these sources provide an important means of financing conservation, but are often neither adequate or sustainable – both donor and government budgets are extremely limited and often subject to competition from other sectors and investment needs, tourism is not always a viable option and can be subject to unpredictable fluctuations.

Various possibilities exist for raising finance for environmental conservation which can be used to supplement – or replace – these conventional funding mechanisms, which are in many cases more appropriate and sustainable. All have the aim of simultaneously encouraging sustainable use and conservation, discouraging economic activities which degrade the environment and raising funds for conservation activities for governments, the private sector and local communities.

### 7.2 CHARGES, FEES AND MARKETS

Where environmental goods and services are being received freely or at low cost, fees can be established for their use and used to raise revenues. As well as initiating or raising charges, prices and taxes for the existing use of environmental resources this can involve developing new markets and fees – such as for ecosystem functions or for new types of environmental products and recreational activities, and initiating innovative forms of trading – for example by allocating franchises and concessions, tradable quotas and auctions in the use and provision of environmental goods and services.

#### **Box 19: Downstream water levies as a means of financing the conservation of Mount Kenya Forest**

In a recent appraisal of the Conservation and Management of Indigenous Forests Project for Mount Kenya Forest Reserve it was recommended that charges should be levied on downstream hydro-power schemes and allocated to the Forest Department. Mount Kenya forms the watershed for two of Kenya's perennial river systems, on which all of the country's major hydroelectric schemes are located. These schemes directly depend on the watershed catchment services provided by the forest.

### 7.3 BONDS AND DEPOSITS

Bonds and deposits are a special form of market establishment which are targeted specifically at ensuring that economic developments do not cause environmental damage. They are product surcharges which shift the responsibility for environmental degradation

to individual producers and consumers by charging in advance for the possibility of damage occurring – for example on mining, logging or construction activities. Imposing a refundable bond or deposit on activities, to be paid before that activity commences, ensures that funds are available to offset or overcome any environmental degradation and also present a clear incentive for developers to avoid causing damage occurring and thus reclaim their bond.

**Box 20: Interim concession deposit bonds on sustainable logging in the Democratic Republic of Congo**

A form of deposit bond on commercial forestry operations was established in the early 1990s in the Democratic Republic of Congo. It aimed to provide economic incentives for firms to avoid logging damage and encourage forest regeneration. This arrangement grants an “interim concession licence” to loggers to weed out speculators acquiring large forest concessions without making the necessary investments in sustainable forest management. The interim licence requires the satisfactory completion of various forestry planning and management operations, including forest inventory and investigation of efficient harvesting and processing techniques. It also requires the concessionaire to pay in advance for these activities. If the concessionaire does not make the necessary investments within 3 years, the interim licence is cancelled and monies are not refunded.

(Source: Panayotou, T., 1994, *Economic Instruments for Environmental Management and Sustainable Development*, UNEP, Nairobi)

## 7.4 ENCOURAGING PRIVATE INVESTMENT AND CONTRIBUTIONS

There are various ways in which the private sector can be encouraged to invest in, or contribute towards the costs of, environmental conservation, from both domestic and international sources. This can not only generate funds, it can increase public participation in conservation. For the private sector to be more fully engaged in conservation, it must be made into an attractive and accessible investment opportunity. The provision of credit and development of private property rights, franchises and concessions in environmental resources and natural areas can all encourage investment. Aside from direct use and enterprise, the private sector can also be encouraged to make charitable contributions or voluntary donations towards the costs of conservation activities and institutions, especially where they have a direct stake or interest in conserving the environment. Such donations can be attracted by a range of mechanisms such as allowing advertising and sponsorship deals, or providing tax relief on contributions.

**Box 21: Encouraging private sector investment in wildlife conservation around the Serengeti National Park, Tanzania**

A new wildlife tourism facility is in the process of being developed on Village land adjacent to Serengeti National Park. This camp will be run as a three-way joint venture between a commercial company, the local Village Council and a bilateral donor, who will provide the bulk of investment funds on a soft loan basis. A 40 year land lease, to be renewed every 5 years, has been agreed with the Village Council for the construction of the 30 bed camp. The terms of this lease and joint venture agreement include the allocation of equity in safari operations to the Village Council, a re-negotiable annual land rent of TSh 1 million and bed fees of US\$ 5 per visitor. The camp management has also committed to support village income and employment through sourcing foodstuffs locally, drawing staff – including management trainees – from the locality and establishing a micro-credit scheme for villagers. If a similar occupancy rate to other lodges in the Serengeti area is achieved, this may provide rental and bednight fees of some US\$ 20 000 a year for the Village, in addition to other local income and employment opportunities associated with the camp.

## 7.5 TRADABLE DEVELOPMENT AND PROSPECTING RIGHTS, OFFSETS AND CREDITS

Tradable development and prospecting rights, offsets and credits are a way of financing for environmental conservation which combine the development of new charges and markets. All offer for sale particular attributes, goods or services associated with the environment – for example in researching new developments and applications of genetic resources, in maintaining the pristine status of protected areas or in benefiting from the global environmental functions such as carbon sequestration or biodiversity conservation.

### **Box 22: Biodiversity prospecting concessions in Ghana, Madagascar, Tanzania and Zimbabwe**

A variety of governments in sub-Saharan Africa have entered into biodiversity or genetic prospecting concession arrangements with medical and pharmaceutical organisations regarding the search for naturally occurring biochemical compounds with commercial values. Concession fees and some proportion of promised royalties for any commercially valuable discoveries are paid in advance, and a certain proportion allocated to the *in situ* conservation of genetic resources. These include agreements between the British Firm Biotics Ltd and Ghana, and the US National Cancer Institute with Madagascar, Tanzania and Zimbabwe.

(Source:

As well as taking the form of direct charges or payments, such arrangements can be offered as quotas, offsets or credits which can be traded on domestic or international markets – for example the purchase of carbon credits by an industry whose activities release greenhouse gases, the preservation of a natural ecosystem by a land developer in order to offset developments made elsewhere or the sale of shares in natural forests to interested conservation agencies and non-governmental organisations.

### **Box 23: Tradable development rights in coastal environments in Cyprus**

Coastal areas of the Akamas Peninsula in north-west Cyprus have a high level of biodiversity, as well as containing several rare and endemic plant species. Part of the Akamas Peninsula has been zoned by the Government of Cyprus as a non-development area. So as to save costs in its conservation, raise funds and avoid conflicts with potential developers, a system of transferable development rights has been proposed. Under this scheme developers, rather than being compensated with cash for activities foregone, would retain their rights to development but not be able to exercise them on-site. Development rights could be traded for property in other areas, or sold to groups concerned with the conservation of the Akamas Peninsula.

(Source: Panayotou, T., 1994, 'Conservation of biodiversity and economic development: the concept of transferable development rights', *Environmental and Resource Economics* 4(1): 91-110)

## 7.6 INTERNATIONAL DEBT RELIEF AND COMPACTS

Various approaches to debt relief, such as debt rescheduling, debt forgiveness, debt-for-equity and debt-for-nature swaps can be used as a means of simultaneously generating funds, increasing private and NGO participation in environmental conservation and reducing national indebtedness. International compacts, rather than being linked to debt relief, usually involve a voluntary agreement made to engage in policy reforms or

environmental conservation in exchange for the transfer of financial or technological resources from international sources to support these reforms.

**Box 24: Debt-for nature swaps as a means of financing nature conservation in sub-Saharan Africa**

Several African countries have engaged in debt-for-nature swap arrangements, under which a portion of a country's debt is purchased at below face value by an outside agency – usually an NGO – and redeemed against local currency which is allocated to national conservation activities. These include swaps made in Madagascar with WWF and Conservation International (generating US\$ 6.1 million for conservation), Zambia with WWF (US\$ 2.3 million), Ghana with Conservation International (US\$ 1 million), Nigeria with Nigerian Conservation Foundation (US\$ 0.1 million).

## 8. ENSURING THAT ECONOMIC MEASURES FOR ENVIRONMENTAL CONSERVATION ARE APPROPRIATE AND SUSTAINABLE

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***Environmental planning and management takes place in many different social, cultural, institutional and ecological situations. Economic measures must be appropriate to these specific on-the-ground conditions if they are to be practically implementable.***

Identifying economic measures for environmental conservation and actually implementing them are two very different things. Not all of the potential sources of incentives and finance identified will be practically implementable, or will require modification so as to fit in with the real-world ecological, institutional, socio-economic and cultural characteristics of a particular resource or area. Choosing the most appropriate and sustainable economic measures, and integrating them into on-the-ground environmental planning and management always requires additional consideration of a number of issues and factors, including:

- ✱ Economic measures must be ***politically, economically and practically acceptable at all levels*** – within conservation agencies, central government, the private sector and local communities. Any measure which conflicts with the goals of these groups – for example by excluding stakeholders from participation in environmental management, by making people worse off or by contradicting wider social and economic ideologies – is unlikely to be appropriate or implementable in practice.
- ✱ Care must be taken in ***targeting economic measures at particular groups***. Economic measures will have little or no impact unless they act on the groups who are affected by, or whose actions have the potential to influence, the status and integrity of the environment.
- ✱ In the course of providing incentives for environmental conservation through benefit-sharing mechanisms, care must be taken in ***defining the nature of benefit to be provided***. Many attempts at benefit-sharing have failed because they do not provide real and tangible economic gain, meet the needs and aspirations of the groups they aim to assist, or directly compensate for the costs that marine protected areas incur. Of particular danger is the assumption that the provision of broad rural development benefits at the community level – such as schools, water or other social infrastructure – will offset individual or household-level financial losses associated with environmental conservation, and make people any more willing or economically able to support it.
- ✱ In the course of providing finance for environmental conservation through cost-sharing mechanisms, care must be taken in ***defining the nature of cost to be provided***. Where groups cannot afford to contribute cash, direct charges and fees are unlikely to be a realistic way of sharing in the costs of environmental conservation. Cost-sharing mechanisms should be flexible and firmly based on

people's ability to pay, and include the provision of contributions in kind as well as through cash payments.

- ✦ Economic measures should have attempt to ***minimise transaction, enforcement and participation costs***. They should be easy and cheap to implement for all the groups engaged in benefit and cost sharing, and for conservation managers. Any economic measure which is costly or difficult to implement or enforce – in terms of cash, time or other resources – runs the risk of failing.
- ✦ Economic measures should make efforts to ***avoid increasing the external dependency and decreasing the local or national sovereignty*** of the local communities, conservation agencies and host countries where environmental resources are found. They should be based on strong considerations of maintaining independence and ensuring sustainability in conservation.
- ✦ Economic measures must be ***consistent with, and supportive to, wider goals and activities specified in development or conservation plans***. Their overall aim is to support conservation and development, not to contradict or conflict with their aims and approaches.