# THE ECONOMICS OF ECOSYSTEMS AND BIODIVERSITY

TEEB for National and International Policy Makers

# Chapter 4: Integrating ecosystem and biodiversity values into policy assessment

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# Chapter 4
## Integrating ecosystem and biodiversity values into policy assessment

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# Key Messages of Chapter 4

**The main cause of the biodiversity crisis is unsustainable growth in consumption and production, exacerbated by a tendency to undervalue biodiversity and the ecosystem services it supports.**

**Current decision-making is biased towards short-term economic benefits because the long-term value of ecosystem services is poorly understood. Recognising the value of ecosystem services can lead to better more cost-efficient decisions and avoid inappropriate trade-offs. It is also an important step towards refocusing economic and financial incentives to achieve sustainability goals. Tools and techniques already exist for this purpose and are being constantly improved.**

## Understanding the value of ecosystem services

Decision-makers need to understand what ecosystem services are generated by natural capital in their zone of influence, what ecosystem services are (at risk of) being lost, the economic costs of losing them, who faces these costs, where and when. Valuation can help develop the necessary evidence base and should address spatial relationships between sources and beneficiaries of impacts and services. Countries should therefore cooperate to develop and integrate robust valuation procedures within their broader decision support systems.

Valuation procedures should, as a minimum, be based on a qualitative understanding of environmental and social impacts of changes to natural capital and associated ecosystem services. Building capacity to quantify and monetise such impacts is an essential step to make trade-offs explicit and increase transparency.

## Expanding monetary valuation of ecosystem services

Quantitative and monetary valuation needs to strengthen the focus on long-term impacts (positive and negative) of resource use decisions and compare them using an discount rate appropriate for ecosystem services.

Existing expertise should be maximised by building on past practice, undertaking more primary analysis and promoting benefits transfer of existing studies in accordance with available guidance.

## Integrating economic thinking into policy assessment

Valuation is a tool to guide decisions, not a precondition for acting to protect biodiversity. Decision-makers across all levels and sectors need to commit to systematic and timely analysis of proposed projects, programmes and policies through impact assessments, strategic environmental assessments and environmental impact assessments. The aim should be to have a fuller evidence base available at the right time to take the whole picture into account.

The precautionary principle should be applied in decision-making affecting biodiversity and ecosystem services where impacts cannot be predicted with confidence and/or where there is uncertainty about the effectiveness of mitigation measures.

Each country needs to develop and institutionalise a culture of analysis, consistent with recognised best practices. This can be done by developing capacity and having an accepted, functional and supported policy assessment system in place.

# 4 Integrating ecosystem and biodiversity values into policy assessment

"All decisions have costs and hence all decisions to incur that cost imply that benefits exceed costs. All decisions not to incur the costs imply that costs exceed benefits. Economic valuation is always implicit or explicit; it cannot fail to happen at all."

David W. Pearce (1941-2005)
OBE, Professor at the Department of Economics, University College London

Chapter 4 focuses on methods for valuing biodiversity and ecosystem services and ways to feed better information more effectively into national and international policy formation. **4.1** provides an overview of **different ways to analyse value** and how these can be linked through a Total System Value approach. **4.2** outlines **methodologies for monetary valuation** and demonstrates their practical application, before identifying certain limitations that need to be addressed. **4.3** shows how structured **assessment frameworks** can support more informed and balanced policy-making and sets out eight **best practices** to improve current practices. **4.4** considers **next steps** and the critical need to build valuation and assessment capacity.

# 4.1 UNDERSTANDING THE VALUE OF ECOSYSTEM SERVICES

Earlier chapters of this Report explained how current losses of biodiversity and associated ecosystem services, driven by unsustainable patterns of production and consumption, have significant economic costs for local, national and international communities. This begs an important question: if biodiversity loss is so detrimental, then why do we allow it?

Part of the answer lies in our failure to understand and incorporate the long-term value of ecosystem services when we make policy decisions that build in assessments of trade-offs. A much more robust approach is needed to correct the current bias in decision-making towards short-term narrowly-focused economic benefits.

## 4.1.1 THE NATURE OF VALUE AND VALUING NATURE

What do we mean by the 'value' of ecosystem services? When people think of value, they consider an item's usefulness and importance. This **value is rarely the price we actually pay for ecosystem services: on the contrary, these are often free to the 'user' or cost much less than their value to society as a whole**. Many ecosystem services tend to be outside traditional markets and so do not have a market price.

In a few cases, such as provision of timber or seafood, some output from an ecosystem does have a market price. This reflects the fact that those outputs are bought and sold on an open market where the price reflects what people are willing to pay for them. Even in this situation, the price charged does not necessarily reflect their true value as it will only be partial. More specifically, there are likely to be impacts on the wider ecosystem beyond those considered in the market transaction.

The absence of markets for most ecosystem services arises for a number of reasons, including the lack of clear property rights attached to such services (see Chapter 2). In many cases, ecosystem services have a 'public good' characteristic which would not be priced accurately by markets even if property rights were defined (e.g. genetic diversity of crops that has insurance value for future food security).

Difficulties in obtaining monetary estimates of ecosystem services mean that decisions tend to be based on incomplete cost-benefit assessments and, as noted, are biased towards short-term economic benefits. Because we underestimate the economic and social importance of such services, we have few incentives to safeguard them and society as a whole loses out.

## 4.1.2 THREE WAYS TO ANALYSE VALUE: QUALITATIVE, QUANTITATIVE AND MONETARY

**To put an economic value on changes to ecosystem services, we first need to understand what those changes are**. Figure 4.1 illustrates the series of steps that have to be considered in turn. Valuation usually comes at the end of the process and has to build on scientific information collected in the earlier stages.

**Figure 4.1: Understanding ecosystem changes**

Policy change → Impacts on ecosystem → Changes in ecosystem services → Impacts on human welfare → Economic value of changes in ecosystem services

*Source: Own representation, Stephen White*

**Analysis of ecosystem services can be done at three levels - qualitative, quantitative and monetary**. Qualitative analysis generally focuses on non-numerical information, quantitative analysis focuses on numerical data and monetary analysis focuses on translating this data into a particular currency.

**All three types of analysis are useful, but they provide different levels of information to a decision-maker**. We can illustrate this through the example of a scheme to increase agricultural production by converting grazing land to intensive cropping. If the financial benefits of intensification outweigh the financial cost of land clearance, this may seem appealing at first sight. However, this would only be a partial analysis as it only considers costs and benefits of the market transactions associated with the change of land use. To determine whether the policy would be beneficial at a societal level, we also need to consider non-market impacts, including impacts on untraded ecosystem services and biodiversity. For example, land conversion could release significant emissions of greenhouse gases and also reduce the land's capacity to absorb flood waters.

What would the different types of analysis deliver in this type of case?

- **Qualitative analysis** would simply describe the potential scale of these impacts (e.g. increased flood risk): the decision-maker would have to make a judgement as to their importance relative to any financial costs and benefits.

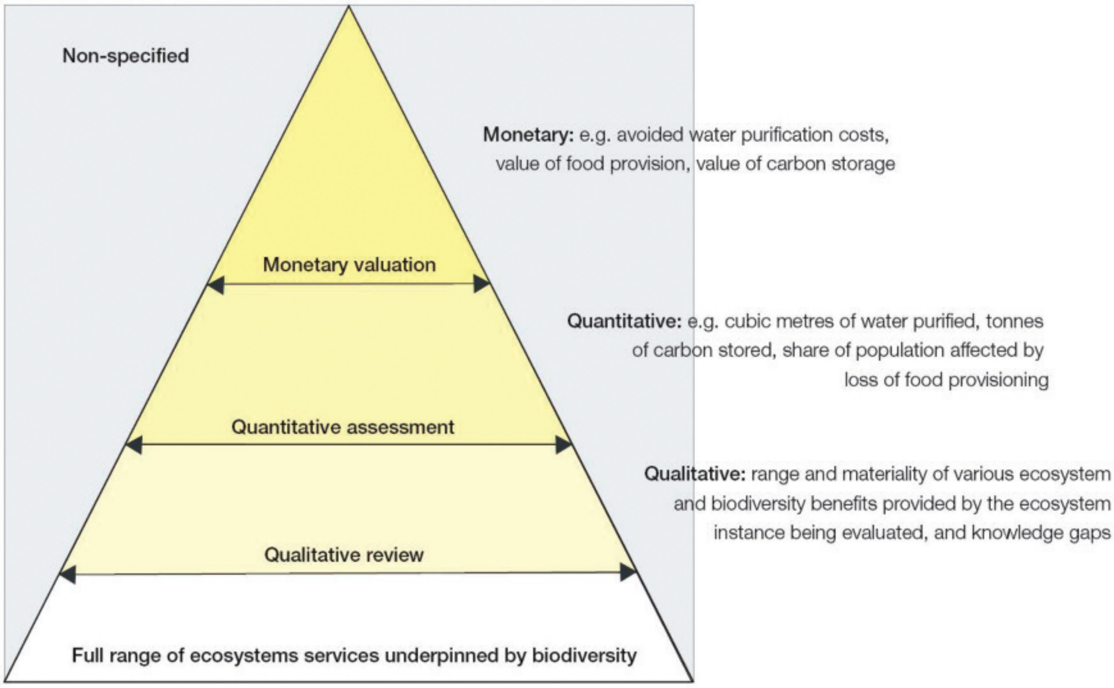
- **Quantitative analysis** would directly measure the change in ecosystem services resulting from the change in land use (e.g. frequency/volume of estimated increase in flood risk/carbon dioxide emissions). The decision-maker would then have a scientific measure of impacts to weigh up against financial costs and benefits.

- **Monetary analysis** attaches monetary values to the change in the flow of ecosystem services, to give an impression as to whether a policy is likely to have a net benefit to society as a whole. It usually builds on quantitative analysis.

**Which type of analysis to adopt will largely depend on the type of benefit being measured, the time and resources available and the significance of the decision**. Qualitative analyses are usually easier and less expensive to conduct than quantitative analyses. Likewise, quantitative analyses usually require fewer resources than monetary analyses.

*Source: Getty Images.*

**Figure 4.2: The benefits pyramid**




*Source: P. ten Brink: presentation at March 2008 workshop Review of Economics of Biodiversity Loss, Brussels*

Figure 4.2 illustrates the different levels of resources required for each type of analysis. As one goes up the pyramid, there are fewer ecosystem services that can be assessed without increasing time and resources. This insight is relevant because it may not always be practical to quantify changes in ecosystem services. In many cases, a qualitative assessment may be preferable: more resource-intensive analysis will inevitably be focused on the issues of most concern and potential value.

This highlights that valuation is only one input into the decision-making process but one that can be central. **A pragmatic approach to valuation can be summed up as follows: "always identify impacts qualitatively, then quantify what you can, then monetise (where possible)".**

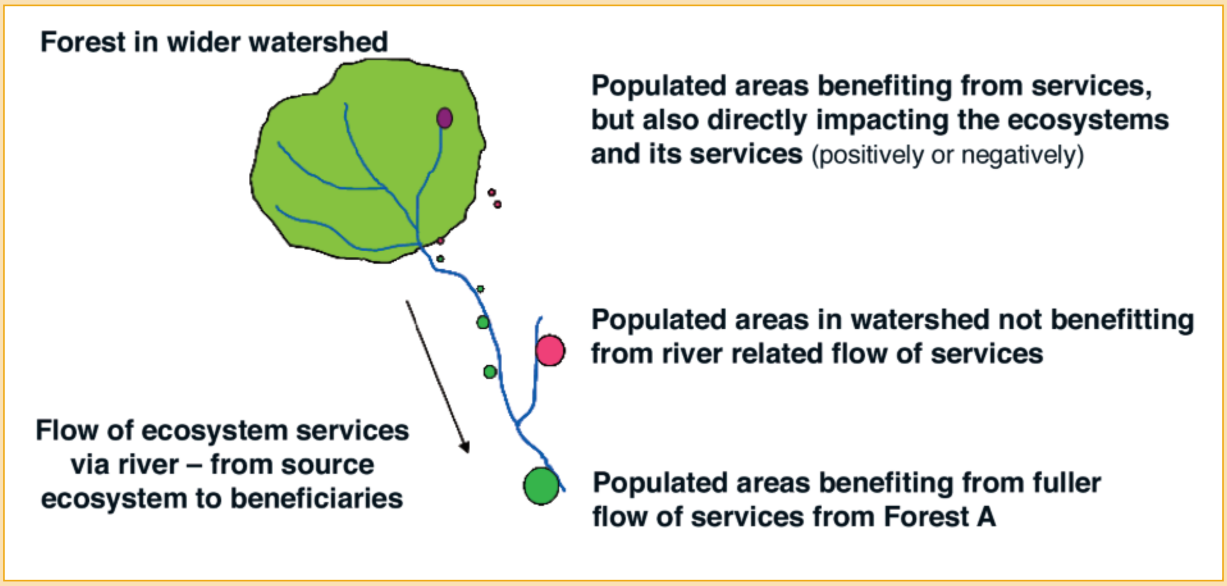
**In any type of analysis, it is important to understand the spatial relationship linking the source supplying the ecosystem service to the various beneficiaries.** This helps to identify impacts to be taken into account during the valuation and which stakeholders are likely to be winners or losers from any decision (or trend) (see Box 4.1).

Despite the importance of qualitative analysis, the main challenge for policy-makers is to promote more robust frameworks and capacity for quantitative and monetary analysis to reveal economic value of ecosystem services. This is the focus of the rest of this Chapter.

**Box 4.1: Mapping links between supply of ecosystem services and beneficiaries**

The diagram below shows how a partially forested watershed provides different services to different populations in the vicinity Some benefit downstream from the services it provides; others are in the area but do not benefit; and others not only benefit from those services but also influence them through activities that degrade or enhance the natural capital.

This type of information is useful to understand which stakeholders need to be involved or taken into account when designing ecosystem management approaches and choosing instruments to reward benefits (see Chapter 5), or avoid impacts (see Chapter 7).




*Source: Adapted from Balmford et al. 2008*

## 4.1.3 APPLYING TOTAL ECONOMIC VALUE FRAMEWORKS TO ECOSYSTEMS

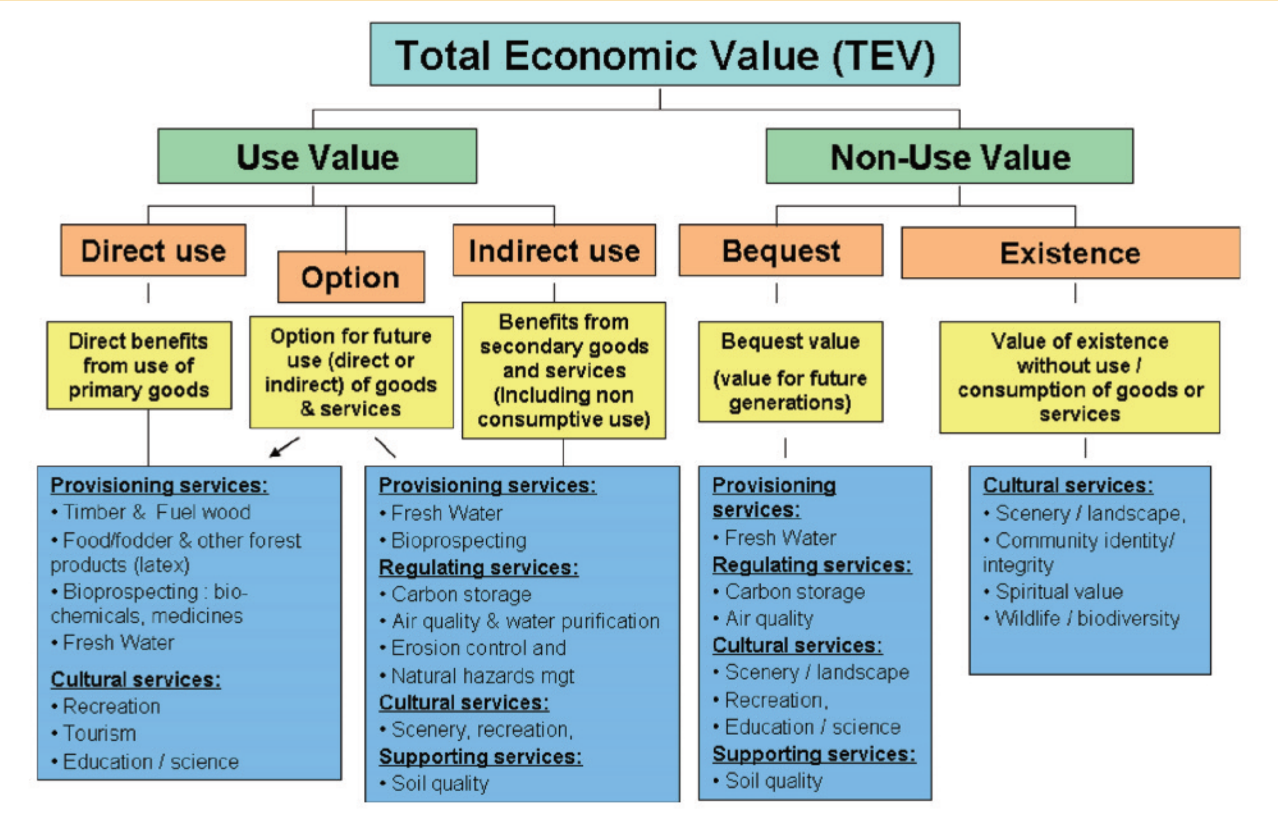
To correct the current distortion in policy trade-offs, valuation is a critical step towards ensuring that ecosystem services are given the right weight in decisions.

**The Total Economic Value (TEV) framework is a well structured way to consider all of the values that an ecosystem provides.** Figure 4.3 presents key elements of TEV, well known to some, and gives links to different ecosystem services)[1]. It is based on two broad categories of value:

- **'Use values'** include direct and indirect use of ecosystems and options for future use. ***Direct use value*** arises from the direct use of an ecosystem good or service and can include consumptive use (e.g. timber production) and non-consumptive use (e.g. wildlife viewing). ***Indirect use value*** refers to benefits derived not from direct consumption but from effects on other goods and services which people value (e.g. regulating services for water are valued because they protect people and property against flooding; pollination is important for food production). ***Option use values*** represent the value of having the option of using (both directly and indirectly) the ecosystem good or service in the future.

- **Non-use values** exist because people derive pleasure from simply knowing that nature and its elements (e.g. a rare species) exist, or because they wish to bequest it to future generations.

**Figure 4.3: Application of a Total Economic Value framework to ecosystem services**




*Source: Kettunen et al. 2009*

**Although** TEV in theory covers all benefits, in practice several benefits are still understood only in a partial way and some values have yet to be understood. In such cases, we can more usefully refer to **Total System Value (TSV) that combines all benefits, whether monetised, quantified or simply understood qualitatively.**

# 4.2 EXPANDING MONETARY VALUATION OF ECOSYSTEM SERVICES

## 4.2.1 HOW DO COMMON VALUATION METHODS WORK?

There are three main methods for determining the monetary value of ecosystem services, all linked to **'willingness to pay' (WTP)**. More details are provided in Annex 1 which shows how techniques can be applied to different ecosystem services.

**Market analysis** (i.e. revealed willingness to pay) is valuable for measuring a range of benefits and costs. Examples include explicit revenues generated from services (e.g. forest products), avoided expenditure needs (e.g. avoided cost of water purification and provision), replacement costs (e.g. artificial pollination), insurance costs (e.g. from natural hazards) and damage costs (e.g. damage from flooding).

Where market values are not directly available or usable, we can use two well-recognised groups of **non-market valuation techniques**:

- **'revealed preference methods'** (i.e. imputed willingness to pay) is demonstrated through e.g. increased house prices near parks, forest and beaches. These can lead to increased local government receipts);

- **'stated preference methods'** (e.g. expressed willingness to pay) can be used in relation to e.g. improving water quality (linked to water pricing) or protecting charismatic species (linked to funding or park entrance fees).

Box 4.2 shows how different valuation techniques can be combined to provide the fullest possible picture of an ecosystem's total value.

The above methods provide primary analysis for specific cases. The next section considers ways to adapt case-specific information for wider application.

*Source: Getty Images.*

**Box 4.2: Valuing ecosystem services to inform land use choices: example of Opuntia scrubland in Peru**

Opuntia scrublands in Ayacucho host cochineal insects, the source of carminic acid (a natural dye used in food, textile, and pharmaceutical industries) and are used by local farmers for animal grazing and food provision. They also perform a major environmental role protecting slopes against erosion and flooding and rehabilitating marginal lands by improving the levels of humidity and soil retention capability.

A mix of techniques from demand- and supply-side toolkits can be used to assess values associated with different ecological functions:

- ***Valuation of provisioning services.*** Direct use values of Opuntia (production of food, fruit, cochineal exports, manufactured dyes, fodder, fuel and ornamental goods) can be derived using **direct market prices** and, if necessary, the value of the closest substitute goods. For scrubland products (e.g. cochineal and fruit), once the yearly quantity and quality of yields and the size of the collection area are calculated, market prices can be used to derive the direct use value of the products collected in a given year. Scrubland use value as a source of fuel can be quantified considering the wage rate as a broad approximation of the opportunity cost of time employed by households in periodic working hours that generate supply of fuel.

- ***Value of regulating services.*** The value of the cash-crop depends on a parasitic insect living on Opuntia plants: farmers collect the cochineal by removing the insect from host plants. Insects not harvested are used to repopulate the scrubs for later harvests. The value of these nursery and refugium services can be quantified using a supply-side approach (based on the costs avoided by farmers if the host plants should be infested by hand at the prevailing labourers' wages that represent the opportunity cost of time).

- ***Value of supporting services.*** Indirect use values attach to erosion control services critical for farmers in the high-sloped Andean area. Soil loss affects crop productivity but changes only become apparent after many years of severe soil loss. Farmers' interest in soil erosion is mainly concerned with on-farm impacts e.g. increased production costs, decreased profitability owing to soil fertility decline, cost of implementing soil conservation measures. One way to quantify such benefits is to use a **Contingent Valuation method** e.g. stated preference techniques to obtain a broad monetary idea of households' WTP for erosion control services provided by the scrubland.

**The valuation found that even if only some of the intangible benefits are considered, the value of ecosystem services provided by Opuntia scrubland is higher than computable direct financial revenues from agriculture.** The proportion of farmers' income attributable to direct use value of scrubland products is as high as 36%. When indirect use values (regulation of soil erosion) are included, the value of scrubland for farmers rises to over 55% of income.

*Source: Adapted from Rodríguez et al 2006*

### 4.2.2 SCOPE FOR EXTENDING BENEFITS TRANSFER METHODS

'Benefits transfer' is a method of estimating economic values for ecosystem services by using values already developed in other studies of a similar ecosystem. It is a pragmatic way of dealing with information gaps and resource (time and money) constraints. This is important as there are rarely enough resources available to conduct a primary (or site specific) valuation study for every site, ecosystem or service being assessed.

**Box 4.3: Use of benefits transfer of values for non-timber forest products (NTFP)**

An analysis of studies undertaken suggests a clustering of NTFP values of a few dollars per hectare/year up to about $100/year. Suggested 'default' values have included $50-70/hectare/year. While it is useful to respond to the 'default values' by seeing if local natural capital has the same value, it would be a serious error to simply extrapolate these benchmark values to all forests. Typically, higher values relate to readily accessible forests whereas values for non-accessible forests would be close to zero in net terms due to cost of access and extraction. The key questions to consider are whether there are sufficient commonalities to allow a benefit transfer and also what 'weighting factor' may need to be applied, in the light of any differences, to make the benefits transfer sufficiently robust.

*Source: SCBD 2001*

Benefits transfer is not a new concept but can be considered as a practical solution to resource constraints. The basic rationale is that there may be sufficient commonalities between ecosystem services in different areas to allow values from one area to be transferred to another. However, this needs to be done with care as values can vary widely even amongst similar ecosystems (see Box 4.3).

Conditions under which benefits transfer can provide valid and reliable estimates include: i) that the commodity or service being valued is very similar at the site where the estimates were made and the site where they are applied; ii) that the populations affected have very similar characteristics; and iii) that the original estimates being transferred must themselves be reliable (CBD Decision VIII/26).

Benefits transfer is still a developing subject. Specific actions that need to be undertaken to make such methods more widely applicable include:

- **development of more primary valuation studies.** The more studies we have, the greater the statistical confidence with which a transfer can be undertaken - and the greater the policy-makers' confidence in the underlying techniques;

- **increased development and access to valuation study databases.** Some databases have been developed to make the technique of benefits transfer easier but existing databases tend either to be incomplete in their coverage of studies or are not freely available[2];

- **development of benefits transfer guidance.** Guidance on accounting for differences between the subject and object ecosystems and their beneficiaries should be developed to show best practice and indicate where benefits transfer can give a reasonable value of ecosystem services.

TEEB D0 (The Science and Ecological Foundations) has collated over a thousand valuation studies and is developing them into a matrix of ecosystem services values across ecosystems to help offer a publicly valuable tool (see Box 4.4 and TEEB D0, Chapter 7). This matrix will be completed in 2010.

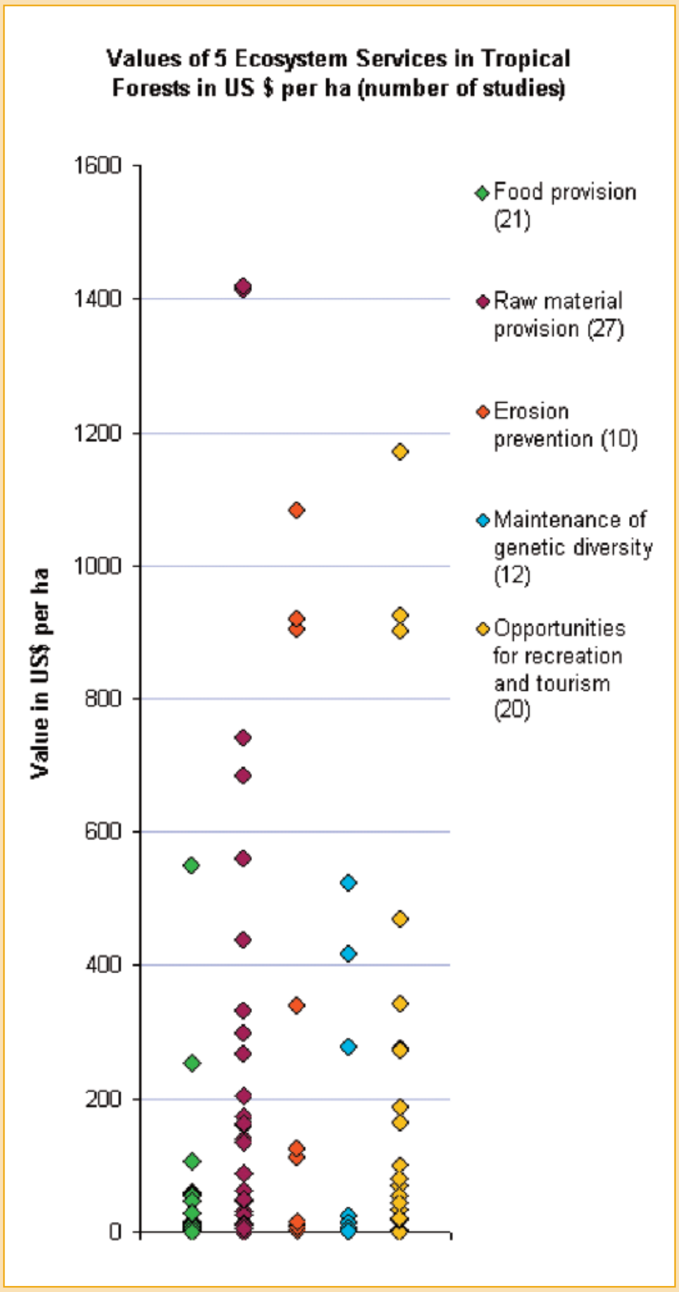
**Box 4.4: Collected evidence on the values of ecosystem services**

Over 1100 values have been collected to date, covering 10 biomes and 22 ecosystem services. Values are organised based on geographical and socio-economic criteria and are also influenced by the context of the valuation study.

The analysis so far shows that there are no easy answers. For most ecosystem services, it is not possible to 'plug and play' values from elsewhere without first considering the local characteristics. This was highlighted in Chapter 1 for tourism from coral reefs; figure 4.4 shows values for different ecosystem services in tropical forests.

In practice, the 'default assumption' is often that the value of forests is the timber, and that there is no value attached to the wide range of other ecosystem services. The reality is that the value of other services can be high. This shows the need to consider how an ecosystem serves people and the impacts of its loss. Understanding the services lost is an easy first step towards understanding the value at risk. Understanding the value is the basis for due commitment to and design of instruments that then turn the some of the 'valuation values' into 'real values' and hence change the practical incentives on the ground.

**Figure 4.4: Ecosystem Services values from forests – working insights from TEEB D0**




*Source: TEEB D0, Chapter 7*

### 4.2.3 EXAMPLES OF VALUATION IN PRACTICE

Perhaps the best way to demonstrate the 'value of valuation' is to show some of the many ways in which it is already used:

- to underline the value of natural assets and **help determine where ecosystem services can be provided at lower cost than man-made technological alternatives** e.g. water purification and provision, carbon storage, flood control (see Box 4.5 and also Chapters 1, 5, 8 and 9 of this report);

**Box 4.5: New Zealand: Values of Water Provision**

A 2006 study commissioned by the Department of Conservation found that Te Papanui Conservation Park (Lammermoor Range) provided the Otago region with water that would cost $136 million to get from elsewhere.

The 22,000 hectare tussock grass area acts as a natural water catchment, supplying water flows valued at $31 million for hydroelectricity, $93 million for the city of Dunedin's water supply and a further $12 million for irrigating 60,000 hectares of Taieri farmland. The $136 million corresponds to a one-off sum describing the avoided cost of having to suddenly get water currently provided free of charge by Te Papanui from somewhere else.

*Source: New Zealand Department of Conservation 2006*

- to **communicate the need for and influence the size of payments for ecosystem services (PES)**. Valuation can be useful for municipalities setting up PES for activities leading to clean water provision and at international/national level in discussions on design and future implementation of REDD (Reducing Emissions from Deforestation and Degradation) and REDD+ (see Chapter 5);

- to **evaluate damage to natural resources to determine appropriate compensation**, using non-market valuation techniques e.g. under liability regimes in the US and the EU this has proved of particular value for court decisions on liability (see Box 4.6);

**Box 4.6: Using valuation to assess levels of compensation**

**In 1989, response to the Exxon Valdez oil spill:**

- boosted efforts to evaluate environmental damage and helped to speed up development and use of new methodologies for capturing the value of biodiversity and ecosystems;
- spurred the introduction of policy responses consistent with the polluter pays principle i.e. compensation payments based on values of the biodiversity and ecosystem services that had been damaged;
- led to enactment of the US Oil Pollution Act 1990 and international maritime regulations;
- based on economic analysis, led to regulatory prescriptions for double-hull ship building measures. 79% of all oil tankers criss-crossing the globe are now of double-hull design.

**Indian Supreme Court and Forest Conversion Payments**

In 2006, the Indian Supreme Court set compensatory payments for the conversion of different types of forested land to non-forest use. The Court drew on an economic valuation study of Indian forests by the Green Indian States Trust (GIST 2006), to determine the rates. The study estimated the value of timber, fuel-wood, non-timber forest products and eco-tourism, bio-prospecting, ecological services of forests and non-use values for the conservation of some charismatic species (e.g. Royal Bengal tiger, Asian lion) for six different classes of forests. The compensatory payments are directed towards an afforestation fund to improve the country's forest cover. In 2009 the Supreme Court directed that Rs.10 billion (around 143 million EUR) be released every year towards afforestation, wildlife conservation and for creating rural jobs (see full analysis in Chapter 7).

- to **create political support for designing new fiscal instruments** e.g. to help set taxes at the level equivalent to the cost of environmental impacts of certain activities. One example is the UK landfill tax: the value of damage caused by using landfills for waste disposal (instead of incineration) was an element in setting the tax rate;

- to **set entry fees** for national parks, using the Travel Cost Method in particular (see Box 4.7 and also Chapter 8);

### Box 4.7: Entry Fees for Parks

Countries that face difficulties in mobilising public money for nature conservation often resort to entrance fees to national parks, which are important revenue sources (e.g. case of entry fees to the Biebrza National Park, Poland (OECD, 1999)). Charging special fees for specific activities in protected areas is quite common e.g. fees added to diving costs in marine reserves in the Philippines (Arin and Kramer 2002). Evaluation exercises help to identify the range of prices that a visitor will be willing to pay for access to a natural area and recreation or other activities there. Tourists are interested in preserving the sites they visit and a small increase in the fees they pay only amounts to a small fraction of the total cost of their trip.

- to **inform impact assessment of proposed legislation and policies**. Examples include the EU Water Framework Directive and new marine legislation in the UK which provides for the establishment of Marine Conservation Zones on the basis of the ecosystem service benefits they provide;

- to **reveal the relative importance of different ecosystem products**, especially those not traded in conventional markets (see Box 4.8).

### Box 4.8: Valuing ecosystem services at the country and regional level

**Mediterranean region:** A 2005 regional study valued the potential of non-timber forest products (NTFPs) as a source of livelihood and sustainable development. It estimated benefits for six major groups of NTFPs: firewood, cork, fodder, mushrooms, honey and other products. Valuation was based on a variety of techniques, drawing on official statistics, and supplemented by local surveys.

At the regional level, NTFPs were found to provide annual benefits of about €39/ha of forests i.e. about 25% of the total economic value of forests. The average estimate for southern countries (€54/ha) is considerably higher than for northern (€41/ha) or eastern countries (€20/ha). The study thus reveals the importance of NTFP benefits both for specific countries and for the region as a whole.

*Source: Croitoru 2005*



Biebrza National Park, Poland

## 4.2.4 LIMITS TO MONETARY VALUATION

When used according to best practice, valuation tools can provide useful and reliable information on changes in the value of non-marketed ecosystem services that would result from human activities. However, monetary valuation has its limits and to rely solely on this would be contentious and incorrect. Some of the main factors to be borne in mind are outlined below:

- **costs and required expertise can be significant**. Most assessment frameworks recognise this by recommending that scoping studies are prepared for 'light' analysis and that in-depth analysis is done later only if provides added value;

- valuation provides an essentially **static picture of value** i.e. what something is worth today. As ecosystem services become scarcer or support more marketed goods, then their value changes over time;

- it is only appropriate for **small changes**. Meaningful evaluation of the total value of global services is not feasible: particular care needs to be taken where threshold effects are possible;

- expertise in monetary valuation is concentrated in developed countries. It is less practiced in developing countries, which may also face other cultural or socio-economic challenges that require techniques to be adapted before application (see Box 4.9).

Overall, **there are clearly reasons for optimism about using non-market valuation techniques for the valuation of ecosystem services**. The thousands of studies already undertaken have led to considerable practical progress. However, **valuation needs to be used judiciously. It is only one of many inputs into decision-making**, given the complexity of the underlying ecosystem services that are being valued. In view of current constraints on quantification and valuation, we need to see **economic assessment as a tool to guide biodiversity protection, not as a precondition for taking action**.

**Box 4.9: Adapting valuation techniques to country-specific contexts**

A 2008 study considered economic and non-economic techniques for assessing the importance of biodiversity to people in developing countries. It found that standard approaches to valuation were unlikely to effectively reveal local preferences because it could be difficult for certain groups to express their value for natural resources via such methods.

Concrete recommendations to enable more effective valuation included:

- further research to develop appropriate best practice guidelines;
- further research on how to incorporate participatory and action-focused approaches into economic valuation;
- building local research capacity for all stages of design, administration and analysis of valuation studies.

*Source: Christie et al. 2008*

The TEEB D0 report will discuss these issues in more detail and provide recommendations on how to develop capacity and improve the use of valuation to decision-makers.

# 4.3 INTEGRATING ECONOMIC THINKING INTO POLICY ASSESSMENT

The role of all policy assessments[3] – including cost-benefit analysis – is to organise information in such a way that decision-makers can consider trade-offs and take better informed decisions. Valuation is an input to decision-making, but does not by itself provide the decision. It has a particular role for biodiversity, as the provision of ecosystem services is currently often not factored into decisions affecting ecosystems. The policy assessment techniques described in this chapter are feasible, practical and road-tested ways to correct this distortion.

*Source: André Künzelmann, UFZ*

## 4.3.1 WHAT CAN POLICY ASSESSMENTS CONTRIBUTE?

**A Policy Assessment Framework is a way to improve the quality and coherence of the policy development process, and better integrate biodiversity concerns.**

It is hard to measure their pay-off because, by definition, we do not know what would have happened in their absence. However, where properly conducted, assessments are generally found to be a worthwhile and often low-cost investment. The European Commission estimates that they change around two-thirds of its policies for the better and this finding is supported by broader analysis of Regulatory Impact Assessment (Evaluation Partnership 2007, Jacobs 2006).

Policy assessments come in many forms, from formal to informal, from up-front to reactive (to justify decisions already taken or at least check that there are no major negative impacts). They are in place for different levels of decision-making: local, regional and national. Box 4.10 describes the best-known formal procedures[4] .

**Box 4.10: The main Policy Assessment processes: EIA and SEA**

**Environmental Impact Assessment** (EIA) has a project focus. It is the process of evaluating the likely environmental impacts, including impacts on biodiversity, of a proposed project prior to decision-making. EIA is intended to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment and present the predictions and options to decision-makers. However, existing EIA tools often do not perform their full job as they are not applied early or thoroughly enough in the decision-making process, and their insights not always fully taken on board in subsequent project decisions.

**Strategic Environmental Assessment** (SEA)[5] has a broader sustainable development (economic, social and environmental) focus. It is a systematic and comprehensive process of identifying and evaluating the environmental consequences of proposed policies, plans or programmes to ensure that they are fully included and addressed early on in decision-making, along with economic and social considerations. SEA covers a wide range of activities, often over a longer time span. It may be applied to an entire sector (e.g. a national energy policy) or geographical area (e.g. a regional development scheme).

These two frameworks should complement each other. EIA is undertaken 'down-stream' whereas SEA takes place 'up-stream'. SEA does not usually reduce the need for project-level EIA but it can help to streamline incorporation of environmental concerns (including biodiversity) into the decision-making process, often making project-level EIA a more effective process.

EIA and SEA are familiar terms, but variants of SEA can be found in several contexts:

- UNEP - Integrated Assessment and Policymaking for Sustainable Development;
- Regulatory Impact Analysis (RIA) to examine and measure the likely benefits, costs and effects of proposals or amendments to policies and regulations;
- Trade Impact Assessment (sometimes referred to as Integrated Assessments (IA) or Sustainability Impact Assessment (SIA)) covers trade both in goods that can affect biodiversity and in commodities provided by biodiversity that are traded internationally.

Biodiversity and ecosystem services are also addressed in other policy fields such as social impact assessment and health impact assessments.

Although this range may seem wide, the processes are closely related. For example, Regulatory Impact Assessment, Impact Assessment and Integrated Assessments can all be seen as forms of SEA applied to specific institutional contexts.

Assessment frameworks ask common questions, tailored to the needs of the specific policymaking process. This commonality is no surprise because the broad questions that need to be asked to inform decisions are always the same, whether it is a decision on biodiversity or finance or at local or national level. What is the problem? What do we want to achieve? What are the options for addressing the problem? What are the impacts of different options?

This **commonality offers opportunities for learning from others and sharing best practice** in order to understand how a wide range of policies can impact biodiversity and ecosystem services. Box 4.11 outlines ways in which SEA has found to be useful in one region of the world.

**Box 4.11: Has SEA helped? Lessons learnt in the European Union**

A review of the way the 27 EU Member States implement the SEA Directive shows that application varies from country to country, reflecting different institutional and legal arrangements. Reported SEA costs vary widely, according to the type of plan or programme being assessed, ranging between EUR 3,000 and EUR 100,000.

Member States identify a large number of benefits of SEA, the main ones being that:

- SEA integrates environmental considerations into decision-making and makes plans and programmes 'greener';
- SEA supports participation and consultation of relevant public authorities and strengthens cooperation between different (planning and environmental/health) authorities;
- SEA increases transparency in decision-making through better stakeholder involvement;
- SEA makes it easier to comply with specific requirements of the policy concerned and check coherence with other environmental policies;
- SEA helps to identify relevant issues and knowledge of an area's environmental context and to share this knowledge between different actors.

*Source: COWI 2009*

All decision-making relies on information, even where no formal EIA or SEA has been undertaken. In the area of biodiversity and ecosystem services, information demands are complex. Common difficulties relate to measurement, data availability, lack of scientific certainty, the unidentified value of biodiversity and uncertainty over the relationship between biodiversity and ecosystem services. Moreover, impacts are often felt in the future or in distant places, and even expert knowledge can be uncertain or conflicting.

In practice, the question often boils down to a choice between uncertain value (biodiversity and ecosystem services) and the relative certainty of an alternative land use. This choice will almost always be weighted towards the alternative land use.

The need to better incorporate biodiversity into mainstream sectoral policy assessments is now receiving high-level attention. Box 4.12 provides an example of work being carried out at the agriculture-trade-biodiversity interface. Annex 2 sets out detailed advice on ways to ensure that biodiversity is covered in such assessments.


*Source: Adam C. Baker licensed under http://creativecommons.org/licenses/by/2.0/*

Fair trade Coffee growers in Tacuba in the Parque Nacional El Imposible, El Salvador

**Box 4.12: Making a case for biodiversity in mainstream policy assessment**

A synthesis of assessment frameworks used to identify the impact of trade liberalisation on agricultural biodiversity revealed several common challenges with respect to the integration of biodiversity into trade-related assessments[6].

The frameworks analysed offer entry points to explicitly integrate biodiversity into assessments as a way to move the issue up the policy agenda. However, practical application show that final recommendations tend to focus on wider environmental issues (deforestation, soil degradation, pesticide use or water quality) where impacts are obvious and information more easily available.

Particular challenges for the integration of biodiversity into the assessment, include:

- difficulties in establishing cause-effect chains of trade liberalisation on agricultural biodiversity;
- the multi-dimensional concept of biodiversity makes it harder to develop aggregated indicators that could be included in economic models;
- insufficient data availability and comparability;
- insufficient methodologies to measure biodiversity impacts;
- shortage of reliable scientific information.

Building on its earlier work on integrated assessment of trade-related policies (UNEP 2009a), UNEP has developed step-by-step guidance for incorporating biodiversity-related issues and actions at each stage of the assessment process (see Annex 2). This guide is accompanied by a reference manual describing the complex linkages that exist between trade in the agricultural sector and biodiversity.

*Source: UNEP 2009b, in progress*

## 4.3.2 HOW CAN WE MAKE BETTER USE OF AVAILABLE INFORMATION?

Good progress is now being made to develop the information base for biodiversity and ecosystem services (see Chapter 3). However, we also know that information needed is often available but not accessed. Involving stakeholders who do have information to hand is fundamental – not least because they may ultimately be the people most affected.

Decisions are always taken in the absence of perfect information. In practice, this is a question of degree. The reality in both developing and developed countries is that there are data gaps and a need for more systematic collection of biodiversity data. However, this lack of information should not be taken as an argument to delay action to protect ecosystem services, rather the opposite. A small amount of analysis can often allow decision-makers to protect biodiversity and ecosystem services in ways that can benefit the majority.

The strength of a policy assessment process is to provide a structured framework for systematically asking standard questions and requiring collection of necessary information. Table 4.1 shows some of the biodiversity-specific dimensions to these standard questions.

**Table 4.1: Adapting standard questions to cover biodiversity & ecosystem services**

| | |
|---|---|
| What is the problem? | - *how do we measure biodiversity?*<br>- *how do we measure biodiversity loss?*<br>- *how does loss of biodiversity translate into lost ecosystem services?*<br>- *are there threshold effects including critical thresholds that might be breached?*<br>- *what are the relationships between biodiversity in this site and elsewhere?* |
| What are the objectives? | - *are there national biodiversity objectives?*<br>- *is there a national biodiversity strategy?* |
| What are the main policy options? | - *how could biodiversity loss be mitigated against?* |
| What are the economic, social and environmental impacts of those options? | - *how much biodiversity would be lost or gained with a particular action?*<br>- *what is the value of ecosystem services?*<br>- *how do we account for loss of biodiversity far into the future?*<br>- *how do we take account of distributional impacts?*<br>- *how do we account for the fact that biodiversity loss may affect people in other areas or countries?*<br>- *how do we value ecosystem services that are either 'options' or even unidentified so far?* |
| What is the most favourable option? | - *how do we ensure decisions take into account the lack of certainty over biodiversity?*<br>- *how do we balance potential biodiversity impacts against other potential impacts (balancing various policy options)?* |
| How will it be monitored and evaluation in the future? | - *how do we monitor and ensure implementation of 'preservation area' or rules?* |

## 4.3.3 BEST PRACTICES FOR MORE EFFECTIVE ASSESSMENT FRAMEWORKS

This section sets out 'building blocks' to improve assessment frameworks and shows how and when information on the economics of ecosystems and biodiversity can be fed into the process.

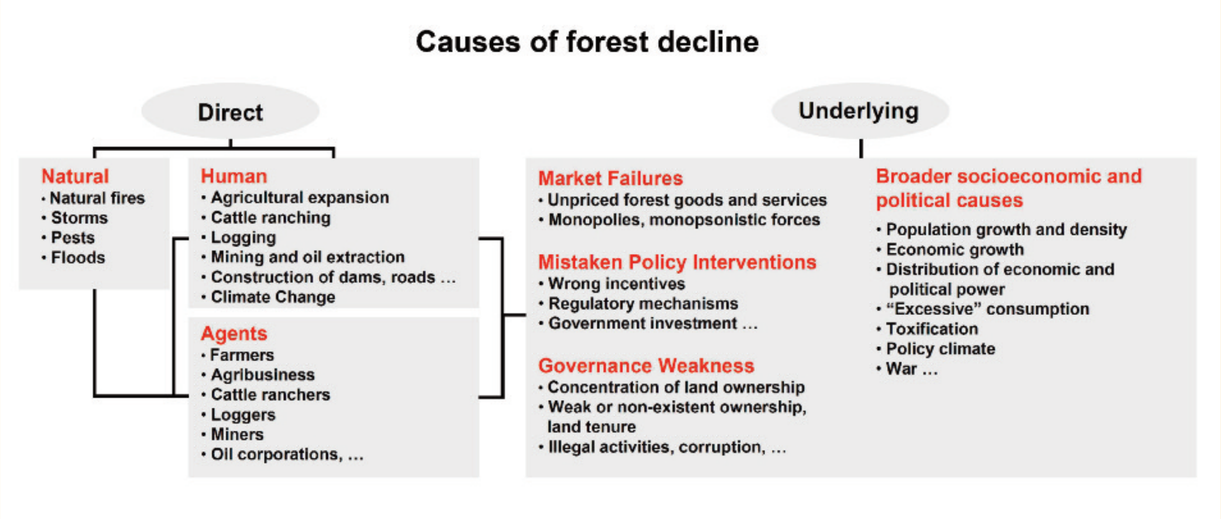
### BEST PRACTICE 1 - UNDERSTAND CHANGES IN ECOSYSTEM SERVICES

There is a need to understand **what is currently happening** (sometimes called the problem definition). This means understanding the state of existing biodiversity and the ecosystem services that it provides. There is also a need to understand **what is driving current trends**, including the degradation or loss of biodiversity (see Box 4.13).

For any policy, there is ultimately a need to understand what ecosystem services will be lost and what this means for different stakeholders and what actions will tackle the problem.

**Box 4.13: Example of drivers of biodiversity loss analysis**

Understanding the combination of direct and indirect factors leading to biodiversity loss allows for better targeted and more cost-efficient policies to be put in place. In this example, a mixture of economic, institutional, political, natural and social factors constitute the drivers of deforestation and degradation. Understanding that the reasons for continued conversion of tropical forest land are interrelated, and their relative importance in a specific country, is the first step in designing a policy response.




*Source: Contreras–Hermosilla 2000*

## BEST PRACTICE 2 – UNDERTAKE AN INTEGRATED ANALYSIS

Information is of little use if it does not influence decisions. In the same way, having information on biodiversity and ecosystem services impacts is of little use if it is not considered with information on other economic, social and environmental impacts (see Box 4.14). The best approach is always **a fully integrated assessment**. EIA and SEA are the best-known processes for delivering such integration, They can be extremely effective but current EIA implementation is often weak which leads to problems on the ground.

For assessment processes focused on other types of impact, one way to force biodiversity impacts to be considered is to **require environmental assessment** (or more specifically biodiversity assessment).

**Box 4.14: Improving rural livelihoods and biodiversity conservation through an integrated landscape approach in India**

Social and environmental issues are addressed together through the Biodiversity Conservation and Rural Livelihood Improvements Project, currently being implemented by the Government of India with the support of the Global Environment Facility.

The project is designed at a landscape level which encompasses Protected Areas (PA), non-PA forests and other land uses. It signals a shift from PA-based conservation approaches, which largely managed PAs as 'islands' surrounded by other land uses, which were often not compatible with conservation goals and outcomes. Through its integrated approach, the project influences development and conservation in lands surrounding the PAs by promoting rural livelihoods and addressing biodiversity concerns, This strengthens the management and viability of core PAs, thus expanding conservation efforts to the landscape level. See also Chapter 8.

*Source: BCRLIP 2009*

## BEST PRACTICE 3 – QUANTIFY AND MONETISE ECOSYSTEM SERVICE IMPACTS WHERE POSSIBLE

Decision-making is always based on a broad comparison of costs and benefits, even in cases where costs and benefits are not all monetised (i.e. balancing pros and cons). **Biodiversity and ecosystem services are too often left out of the decision when they cannot be quantified or monetised.**

We therefore need a framework that begins by identifying all costs and benefits. This can then be developed by including qualitative information on their nature and scale, then through quantification and valuation. Where only partial quantification and valuation is possible, this still helps to highlight which relevant costs and benefits have been included and which omitted.

Once we have quantification and valuation in monetary terms (see 4.2), we usually have to **compare costs and benefits both now and over time by using a discount rate**. 'Discounting' is the practice of attaching a lower weight to future costs and benefits than to present costs and benefits (e.g. a social discount rate of 4 per cent means that society values €1 today as equivalent to €1.04 in a year's time[7]). It essentially reflects society's preference to enjoy a positive experience today and postpone any pain to the future.

There are different views over what the discount rate should be: even if there is a right number, it probably varies between countries (see Box 4.15). A useful way forward may be to set out a relative order of importance: do an analysis - quantify as far as possible - have a discount rate - choose a discount rate.

### Box 4.15: The choice of the discount rate

Discounting is important to the analysis of long-term projects. For instance, a 100-year project, yielding benefits of €22,000 on completion, is worth around €8,000 today at a 1 per cent discount rate but only €1 at a 10 per cent discount rate.

In general, a lower discount rate will favour ecosystem services as they are expected to continue into the far future, and this increases the weighting placed on them. However, this is not always the case as a low discount rate will favour any project with large upfront costs and benefits further in the future, including schemes such as road building that might compete with projects to preserve biodiversity and ecosystem services.

Practice varies considerably. An OECD survey of its Member Countries found that the social discount rate used was usually around 4-5% but varied from 3% in Denmark to 10% in Australia. Some countries allowed for declining rates (usually after 30 years). In practice, what is most surprising is **how infrequently the benefits of ecosystem services are recognised, quantified and monetised**. This – rather than the choice of discount rate – may well be the biggest analytical bias against the preservation of ecosystem services.

Some argue that the social discount rate should be lower. Most notably, the Stern Review on the Economics of Climate Change argued for a discount rate lower than any of those used currently used by a government, though this is challenged by the mainstream economics position. TEEB D0 will provide further advice on this issue.

What is clear is that we need to better understand the benefits of ecosystem services for the future – which means not forgetting or neglecting them when taking decisions now. Doing so biases decisions towards short-term actions and often away from preserving biodiversity.

*Source: OECD 2006a*

## BEST PRACTICE 4 - COMPARE PROS AND CONS (OR COSTS AND BENEFITS)

When considering an option, we need **to consider all the relevant positive and negative impacts together**. What are the trade-offs? What ecosystem services might be lost and what would we gain in their place?

Comparing trade-offs is simple enough when there is a full financial cost-benefit analysis: all economic, social and environmental impacts are expressed in monetary terms and can be easily added up or subtracted. However, this is rarely possible. In practice, we have to consider positive and negative impacts, only some of which will be quantified.

As discussed above, there is a strong case for quantifying and valuing in monetary terms more often than we do now. Even where this happens, there will still be questions about the impact on different groups and on distributional impacts. This reminds us that policy assessment serves to inform decision-makers and help them weigh up the pros and cons of different options, but not to take decisions for them.

Analysis may often take the form of a partial cost-benefit analysis where some elements are quantified and monetised. The identified net benefits can then be compared with the qualitative assessment of remaining costs and benefits. Several analytical frameworks can help in such cases, including Multi-Criteria Analysis. All methods are designed to ensure that the main impacts have been identified and then compare their pros and cons.

## BEST PRACTICE 5 – IDENTIFY WHO WINS AND WHO LOSES FROM CHANGES IN ECOSYSTEM SERVICES

**Knowing what the impacts are is not enough: we also need to understand who is affected and when.** If the loss of ecosystem services affects one group disproportionately, this needs to be taken into account: it might lead to measures to protect that group or the biodiversity they depend on. Different actions could leave existing inequalities unchanged, aggravate them or help to reduce them.

Table 4.2 uses the example of forestry to show how different elements of Total Economic Value may vary in their importance to different groups.

**Table 4.2: Distributing Total Economic Value from forestry between stakeholders**

| Stake-holders | Extractive direct use values | Non-extractive direct use values | Indirect use values | Preservation values |
|---|---|---|---|---|
| Land forest users | Forest and agricultural products (sale, subsistence and inputs into the farming system, e.g. fodder, litter etc. | Cultural and spiritual values | Microclimate, hydrological, soil conservation and nutrient cycling | Preserving use values for descendants |
| Commercial interests | Timber, commercial NTFPs, genetic material for pharma-ceutical development | Tourism | Downstream irrigation/water benefits to commercial farmers, water and electricity companies, and other businesses | Undiscovered commercial potential of biodiversity |
| National and forestry department interests | Forest revenue and foreign exchange | Recreation, tourism, education, science | A range of watershed protection services | Future biodiversity values |
| Global society interests | Globally traded products | Science (especially medical, education) | Global environmental services, e.g. carbon sinks | Existence values, future medicinal discoveries |

Distributional analysis can reveal areas where we need to **align local decisions with social benefits at the national or even international level, using mechanisms such as REDD**. Under current systems, incentives for different groups are often incompatible. For example, deforestation may be in the interests of a regional community, but against those of an indigenous community and the international community.

**Box 4.16: Identifying the three different levels of stakeholders**

**Beneficiaries:** target groups that make use of or put value on known ecosystem services which will be deliberately enhanced by the policy, plan or programme under consideration;

**Affected (groups of) people:** people that experience intended or unintended changes in ecosystem services they value as a result of the policy, plan or programme;

**General stakeholders:**

- national or local government institutions having *formal responsibility* for management of defined areas (town and country planning departments, etc.) or ecosystem services (fisheries, forestry, water supply, coastal defence, etc.);
- formal and informal institutions *representing affected people* (water boards, trade unions, consumer organizations, civil rights movements, ad hoc citizens committees, etc.);
- formal and informal institutions *representing (the intrinsic value of) biodiversity* (non-governmental nature conservation organisations, park management committees, scientific panels, etc.);
- the *general public* that wants to be informed on new developments in their direct or indirect environment (linked to transparency of democratic processes); and
- stakeholders of *future generations* who may rely on the biodiversity under consideration.

*Source: CBD and NCEA 2006*

## BEST PRACTICE 6 – INVOLVE AND ENGAGE STAKEHOLDERS

One of the best ways to understand who wins and loses is to **involve all potentially affected groups in the appraisal process** (see Box 4.16). As highlighted in Chapter 2, stakeholders are a source of expertise, data and opinions. The indigenous knowledge of people who are the stewards of biodiversity is immensely rich and an essential complement to technology-based data generation (GIS, remote sensing etc).

**Developing stakeholders' sense of ownership and building trust in the people undertaking the policy assessment makes it easier to feed their perceptions and knowledge into the decision-making process.** This has many advantages, particularly because biodiversity issues are often 'hidden' to all but a few expert or local stakeholders.

**Chapter 3 has already emphasised that it is often the poorest in society who depend most on biodiversity and ecosystem services** and are most vulnerable to changes in such services (e.g. availability of fuel or water for private use). Consulting such groups presents challenges but neglecting them in decision-making can undermine the effectiveness of adopted policies (e.g. resistance, weak implementation and/or adverse social side-effects).

The need for better participatory practices and more transparency is now widely acknowledged (see Box 4.17) and there are many examples of good practice in both developing and developed countries (see Chapters 5 to 9). Where done well, these are a relatively easy way to improve decision-making processes and improve understanding of the final policy choices.

**Box 4.17: International backing for public participation in environmental decision-making: the Aarhus Convention (1998)**

The UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters establishes legally-binding rights and obligations with regard to governmental decision-making processes on matters concerning the local, national and transboundary environment. It has so far been signed by around 40 (primarily European and Central Asian) countries and the European Community and been described as "the most ambitious venture in the area of environmental democracy so far undertaken under the auspices of the United Nations".

*Quote: Kofi A. Annan, former Secretary-General of the United Nations (1997-2006)*

**Stakeholder consultation and transparency, alongside good governance** (see Chapter 2), **are essential to limit abuse or non-use of available information** (e.g. in cases where decision-makers benefit from a situation that has negative impacts for the majority). Well-designed processes can promote effective public participation provided that they specifically address common constraints such as:

- **poverty:** involvement means time spent away from income-producing tasks;
- **rural settings:** distance make communication more difficult and expensive;
- **illiteracy or lack of command of non-local languages** can inhibit representative involvement if print media are used;
- **local behavioural norms or cultural practice** can inhibit involvement of groups who may not feel free to disagree publicly with dominant groups (e.g. women versus men);
- **languages:** in some areas a number of different languages or dialects may be spoken, making communication difficult;
- **legal systems** may be in conflict with traditional systems and cause confusion about rights and responsibilities for resources;
- **interest groups** may have conflicting or divergent views and vested interests;
- **confidentiality:** can be important for the proponent, who may be against early involvement and consideration of alternatives (CBD and NCEA 2006).

## BEST PRACTICE 7 – IMPLEMENT THE ECOSYSTEM APPROACH

Assessment processes can be linked to the ecosystem approach, a paradigm for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. The ecosystem approach can be applied to a specific sector (e.g. by the FAO for fisheries) or in a more generic way as under the Convention on Biological Diversity[8].

The ecosystem approach is based on the application of appropriate scientific methodologies focused on levels of biological organisation which encompass the essential processes, functions and interactions among organisms and their environment. Box 4.18 provides an example of how human uses, cultural diversity and established economic practices can be recognised through an ecosystem-based approach to assessment.

**Box 4.18: Applying SEA at the ecosystem level through the Sperrgebiet land use plan, Namibia**

The Sperrgebiet is a biodiversity-rich desert wilderness in southwest Namibia which includes a diamond mining area. In 1994, recognising conflicting demands on the fragile ecosystem, an agreement was reached between the government, Namdeb (the mining licence holder) and NGOs to formulate an integrated land use plan to safeguard the region's long term economic and ecological potential. An SEA-type approach was used, involving several steps:

- a thorough literature review with gaps filled through consultations with specialists;
- development of sensitivity maps for various biophysical and archaeological parameters;
- extensive public consultation (public workshops, information leaflets, feedback forms, land use questionnaires);
- identification of different land use options for the area and their evaluation in terms of environmental opportunities and constraints;
- formulation of a vision (declaration of the entire Sperrgebiet as a protected area);
- development of an interim zoning plan to guide immediate decisions, followed by a technical specialist workshop to refine the final zoning plan;
- a preliminary economic analysis of the main land use options;
- development of an administrative framework covering land proclamation, management advisory committee, ecotourism models, zoning, future access control and integration into the surrounding political and economic structures;
- for each potential land use, guidelines were prepared outlining what needs to be included in a project-specific EIA and the Environmental Management Plan.

The Land Use Plan was finalised in 2001 and the Sperrgebiet proclaimed a National Park in 2004, after the Plan's recommendations were accepted.

*Source: OECD 2006b*

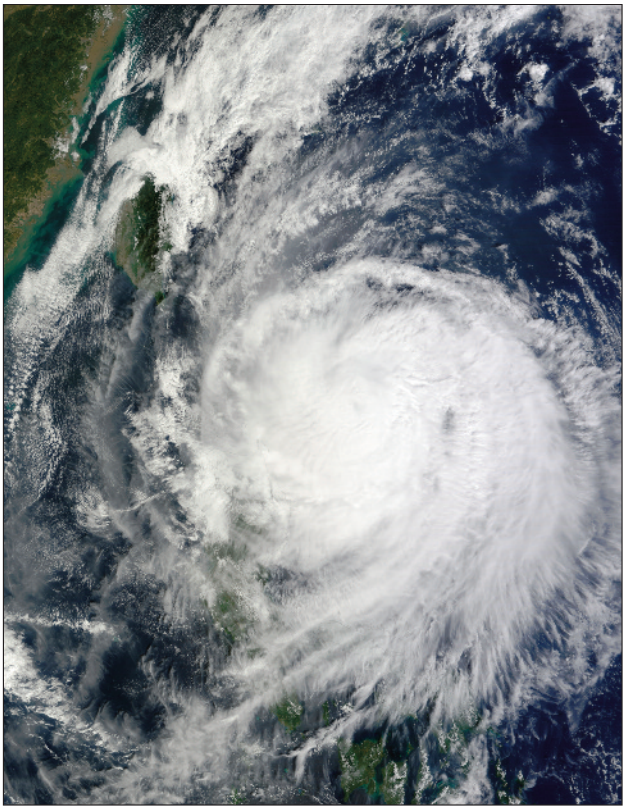
## BEST PRACTICE 8 - ACCOUNT FOR RISKS AND UNCERTAINTY

**Risks to biodiversity:** Since we know relatively little about biodiversity, there are often significant risks attached to policies that impact on it. It is important to **identify these risks, their likelihood, and the probable consequences** (i.e. the impact, extent of the damage, and costs), generally using different risk scenarios. Risks can rarely be reduced to zero without incurring large costs, but there are often **measures to reduce them in an efficient way**.

The **'precautionary principle'**[9] requires decision-makers to take a cautious approach where impacts on biodiversity cannot be predicted with confidence and/or where there is uncertainty about the effectiveness of mitigation measures. This obviously presents major challenges e.g. for risks of invasive alien species impacts (species displacement, predation, lost output from agriculture), of fish stock collapse from overfishing or of loss of entire ecosystems (e.g. from coral reef loss due to pollution or climate change) (see Chapter 1). The biggest potential costs of biodiversity loss come from ecosystem collapse (see TEEB Climate Issues Update with regard to coral reefs), but it is extremely difficult to estimate the probability of this happening. Even at a local level, critical thresholds can mean change is unpredictable - ecosystems could be resilient but after a threshold become vulnerable to even small changes.

**Risks from natural hazards,** on the other hand, are well known - e.g. risks of flooding, storm surges on coasts, fires, drought, spread of disease via animal vectors – and there is also fairly good understanding, based on historical precedents, of where the areas at risk are. Much less well understood is the exact timing and scale of these impacts and, when it comes to diseases or invasive alien species spread, the exact pathway or pathogen involved.

It is increasingly clear that natural capital can significantly reduce the risk and scale of impact and damage (see Chapters 8 and 9). A valuable tool to manage the risk involves creating 'risk maps' to identify at-risk zones (e.g. for flooding). Looking to the future, identifying where natural capital (e.g. wetlands, mangroves, protected areas) can play a role in mitigating risks will be a critical part of risk maps and risk mitigation strategies. This can also contribute directly to strategies to adapt to climate change and reduce the risk of impacts. Links to spatial planning tools and policies will be of critical importance to help reduce the risks.



*Source: NASA Earth Observatory. URL: http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=40869*

Typhoon Lupit hitting the coast of Philippine island Luzon in October 2009

# 4.4 NEXT STEPS: THE NEED TO BUILD ASSESSMENT CAPACITY

Throughout the world, policy-making processes are closely tied to social structures, cultures and established political, legal, and administrative systems. These all have their own built-in rigidities. The priority now is to **establish a culture of analysis and data collection and institutionalise it**. This is challenging but it is possible and is already happening in several countries.

The best way forward often involves **step-by-step improvements**. Even though the most detailed policy assessment frameworks can seem daunting in terms of effort, there are often 'low hanging fruit' i.e. a small amount of analysis can quickly pay dividends. We already have good examples that can be replicated and frameworks that can be adopted – most importantly some form of SEA.

**A successful assessment process needs support and resources.** Capacity-building programmes need to be country-specific and tailored to cultural, socio-economic and legal characteristics on the ground (see example in Box 4.19).

Capacity is most likely to develop if there is an **accepted, functional and supported policy assessment framework** that creates a demand for it. Ad-hoc assessments may be good some of the time, but are unlikely to be systematically good or to allow for institutional learning.

*Source: Melanie Hartwig, UFZ*

**Box 4.19: Capacity-building for integrated assessment by UNEP**

UNEP guidance for integrating assessment of trade-related policies and biodiversity in the agricultural sector (see Box 4.8) is built on the practical experiences of six African, Pacific and Caribbean (ACP) countries (Cameroon, Jamaica, Madagascar, Mauritius, Uganda and Papua New Guinea).

Between 2005-2009, these countries received support to design and undertake an integrated assessment of a trade policy affecting the agricultural sector and, based on the results, to implement policy recommendations and adjust tools and techniques to country-specific contexts. Pilot projects were designed and led through national institutions (a core team of researchers and decision makers, supported by national steering committees and stakeholders invited for consultations and review). In-country learning was complemented by international workshops for core team members (acting as multipliers) and by expert input at key stages.

The main project focus was on (i) understanding trade and biodiversity linkages (ii) conceptualising trade policy impacts based on the Millennium Ecosystem Assessment Framework (iii) incorporating biodiversity into integrated assessment tools and techniques and (iv) developing and implementing policy responses. Positive results of the initiative can be seen at different levels:

- collection of baseline data, development of biodiversity indicators, identification of data gaps and commitment to fill these gaps;
- establishment of government-research partnerships and a formalised process for stakeholder consultation, including those that represent biodiversity;
- commitment to more systematic screening of policies, degrees, laws and existing assessment procedures to better incorporate biodiversity considerations;
- enhanced promotion of farming systems that support conservation and/or sustainable use of biodiversity (e.g. through training in sustainable management practices, development of strategic sectoral plans, land-use plans and/or sustainability standards);
- initiation of further training in integrated assessment for policy makers at national level;
- expressed interest to apply the integrated assessment to other policies and sectors.

Efforts to monetise biodiversity and ecosystem services through the UNEP programme fell short of initial expectations, due to lack of easily accessible data and insufficient resources under the projects to fill the gap. However, the benefits of valuation as a way to better communicate the importance of biodiversity and ecosystem services to decision makers were well understood and the countries expressed interest to extend capacity in this specific area.

*Source: UNEP 2009b*

**Chapter 4** has shown how and why knowledge gaps can create a systematic bias in decision-making against biodiversity and ecosystem services. The techniques, frameworks and tools described above provide a starting point for countries to **develop and strengthen a robust culture of valuation and assessment** tailored to national needs and characteristics. This needs to become embedded within the policy-making process.

**Chapters 5 to 9** shift the focus to the **range of solutions available to policy-makers** and consider how to create markets for ecosystem services to fully integrate them within the economy.

## Endnotes

[1] Even with such a structured analysis, there is a risk of undervaluing the benefits of biodiversity. For example, there is a question as to whether secondary benefits of an ecosystem that favour another ecosystem are always properly covered.

[2] Three of the best known databases for ecosystem valuation are: EVRI database http://www.evri.ca/; RED database http://www.red-externalities.net/; and Ecosystem Services Database or ARIES database http://esd.uvm.edu/.

[3] Policy assessment is a participatory process of combining, interpreting and communicating knowledge. It usually involves setting out a cause-effect chain – involving environmental, social, and economic factors -- associated with a proposed public policy to inform decision-making. Including information on biodiversity and ecosystem services in this process means it is considered in decisions. Source: http://www.unep.ch/etb/publications/AI%20guidance%202009/UNEP%20IA%20final.pdf p.5

[4] This is not meant to be a full list. There are other tools (e.g. life cycle analysis which compares the environmental and social impacts of products and services) that are not mentioned but are also a form of policy assessment targeted at a particular need.

[5] See e.g. UNECE protocol for SEA at http://www.unece.org/env/eia/sea_protocol.htm.

[6] http://www.cbd.int/doc/meetings/cop/cop-07/information/cop-07-inf-15-en.pdf. The Synthesis included the assessment frameworks used by the OECD, UNEP, The North American Commission for Environmental Cooperation and the European Commission, the Canadian National Framework for Conducting Environmental Assessments of Trade Negotiations and the US Guidelines for Environmental Review of Trade Agreements.

[7] The social discount rate is the weight placed on all estimates of costs and benefits. When environmental impacts are monetized and included in a cost benefit analysis, they are discounted using the same discount rate applied to all other costs and benefits.

[8] http://www.cbd.int/ecosystem/.

[9] As expressed in the Preamble to the CBD, this provides that "where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat."

[10] For example, the contribution of a given ecosystem service (e.g., regulating service) to the value of another service (e.g., provisioning service) or commodity which is in turn associated with a price in the marketplace.

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## ANNEX 1: OVERVIEW OF METHODOLOGIES USED IN ASSESSING VALUE OF ECOSYSTEM SERVICES

This Annex provides information on the most commonly used valuation methods (economic and non-economic) used to assess the value of ecosystem services.

**Market Analysis**

Market valuation methods are divided into three main approaches: (a) price-based approaches; (b) cost-based approaches which are based on estimates of the costs if ecosystem service benefits had to be recreated through artificial means; and (c) production function-based approaches that value the environment as an input[10]. Their main advantage is that they are based on data associated with actual markets, thus on actual preferences or costs by individuals. Moreover such data – i.e. prices, quantities and costs - are relatively easy to obtain. Examples include where a product is traded, such as timber or fish, or where ecosystem services contribute to marketed products, such as the value of clean water that is used as an input to local companies.

**Revealed Preference Methods**

Revealed preference methods use data from actual (past) behaviour to derive values. They rely on the link between a market good and the ecosystem service and the fact that demand for the market good is influenced by the quality of the ecosystem service. People are 'revealing' their preferences through their choices. The two main methods are (a) the travel cost method and (b) the hedonic pricing approach.

The travel cost method is mostly used for determining the recreational values related to biodiversity and ecosystem services. It is based on the rationale that recreational experiences are associated with a cost (direct expenses and opportunity costs of time). It is most commonly used to measure the recreational value of a site, and to assess the value that might be at risk if the site were to be damaged.

Hedonic pricing uses information about the implicit demand for an environmental attribute of marketed commodities. For instance, houses or property in general consist of several attributes, some of which are environmental in nature (e.g. proximity of a house to a forest or the view of a nice landscape). It would most commonly be used to measure the prices of houses near, say, a forest, and to compare them with those further away.

**Stated Preference Methods**

Stated preferences techniques are based on the demand for a given ecosystem service (or a change in its provision) measured by means of a hypothetical market simulated through the use of surveys. These methods require people to rate or rank trade-offs. Typically, the responses are collected using survey questionnaires of a representative sample of people. These valuation techniques can be used in situations where use and/or non-values are to be estimated and/or when no surrogate market exists from which value can be deduced.

However, there are difficulties in constructing hypothetical markets, and so criticism of valuation techniques is greatest for stated preference techniques, where it is felt by critics that it can often be unclear exactly what people were valuing (one service, all services etc) and whether they were making strategic responses.

The main forms of stated preference techniques are:

(a) *Contingent valuation method:* This method uses questionnaires to ask people how much they would be willing to pay to protect or enhance ecosystems and the services they provide, or alternatively how much they would be willing to accept for their loss or degradation.

(b) *Choice modelling:* Individuals are faced with two or more alternatives with shared attributes of the services to be valued, but with different levels of attribute (one of the attributes being the money people would have to pay for the service).

(c) *Group valuation:* A newer and rarer form of technique that combines stated preference techniques with elements of deliberative processes, to explore value, such as value pluralism, incommensurability, non-human values, or social justice.

**Box 4.A1: An example of 'stated preference': the Exxon Valdez oil spill (1989) – *further details***

This oil spill affected 200km of Alaskan coastline - one of the largest spills in United States history and one of the largest ecological disasters. The subsequent court case included a claim for both use and non-use values with the values being claimed in compensation calculated through a contingent valuation study. The survey was developed over 18 months, including field testing, work with focus groups and pilot surveys and then around 1600 people were interviewed. The statistical analysis of these responses gave a $2.8 billion lower bound willingness to pay to avoid the damages. Eventually, Exxon settled its lawsuit with the US Government for $1 billion and agreed to spend around $2 billion on clean up, and later settled a class action lawsuit for additional amounts. These costs were consistent with the estimates from the valuation study.

What makes this now rather old example stand out, is the debate it sparked on the reliability of contingent valuation. The conclusion, of a panel of eminent and neutral economists, was that the method is sound and delivers useful results when well implemented.

Table 4.3 below sets out in more detail the methods used, and their applicability to different ecosystem services.

**Table 4.A1: Valuation methods in more detail (adapted from Defra 2007)**

| Economic valuation methods | Description | Ecosystem services valued |
|---|---|---|
| **Revealed Preference methods** | | |
| Market prices | These can be used to capture the value of ecosystem services that are traded e.g. the market value of forest products. Even where market prices are available, however, they may need to be adjusted to take account of distortions such as subsidies. Market prices can act as proxies for direct and indirect use values but do not capture non-use values; the price will be a minimum expression of the willingness to pay. | Ecosystem services that contribute to marketed products, e.g. timber, fish, genetic information, value of clean water that is an input to local companies |
| Averting behaviour | This approach focuses on the price paid by individuals to mitigate against environmental impacts. | Depends on the existence of relevant markets for the ecosystem service in question. For instance, the cost of water filtration may be used as a proxy for the value of water pollution damages; or costs of buying pollution masks to protect against urban air pollution (although this will only represent part of the damage value). |
| Production function approach | This focuses on the relationship that may exist between a particular ecosystem service and the production of a market good. Environmental goods and services are considered as inputs to the production process and their value is inferred by considering the changes in production process of market goods that result from an environmental change. | Regulating and supporting services that serve as input to market products e.g. effects of air or water quality on agricultural production and forestry output. |
| Hedonic pricing | This assumes that environmental characteristics (e.g. a pleasant view or the disamenity of a nearby landfill site), as well as other property features, are reflected in property prices. The value of the environmental component can therefore be captured by modelling the impact of all possible influencing factors on the price of the property. | Ecosystem services (e.g. regulating cultural and supporting services) that contribute to air quality, visual amenity, landscape, quiet i.e. attributes that can be appreciated by potential buyers. |
| Travel cost method | This is a survey-based technique that uses the costs incurred by individuals taking a trip to a recreation site (e.g. travel costs, entry fees, opportunity cost of time) as a proxy for the recreational value of that site. | All ecosystems services that contribute to recreational activities. |
| Random utility models | This is an extension of the travel cost method and is used to test the effect of changing the quality or quantity of an environmental characteristic at a particular site. | All ecosystems services that contribute to recreational activities. |
| **Stated Preference methods** | | |
| Contingent valuation | This is a survey-style approach that constructs a hypothetical market via a questionnaire. Respondents answer questions regarding what they are willing to pay for a particular environmental change. | All ecosystem services. |
| Choice modelling | This is a survey-style approach that focuses on the individual attributes of the ecosystem in question. For example, a lake may be described in terms of water quality, number of species etc. Participants are presented with different combinations of attributes and asked to choose their preferred combination or rank the alternative combinations. Each combination of attributes has a price associated with it and therefore the respondents reveal their wiliness to pay (WTP) or willingness to accept (WTA) for each attribute. | All ecosystem services. |

| **Cost based approaches** | These approaches consider the costs in relation to provision of environmental goods and services and only provide 'proxy' values. Examples of cost-based approaches are those that infer a value of a natural resource by how much it costs to replace or restore it after it has been damaged. | |
|---|---|---|
| Opportunity cost | This method considers the value forgone in order to protect, enhance or create a particular environmental asset (e.g. opportunity cost of agricultural production lost if land is retained as forest). | Depends on the existence of relevant markets for the eco-system service in question. Examples include man-made defences being used as proxy for wetlands storm protection; expenditure on water filtration as proxy for value of water pollution damages. |
| Cost of alternatives/ substitute goods | This approach considers the cost of providing a substitute good that has a similar function to the environmental good. For example, wetlands that provide flood protection may be valued on the basis of the cost of building man-made defences of equal effectiveness. Given that wetlands provide a range of ecosystem services, this costing would be a minimum estimate of the value of a wetland. | |
| Replacement cost method | This technique looks at the cost of replacing or restoring a damaged asset to its original state and uses this cost as a measure of the be-nefit of restoration. The approach is widely used because it is often easy to find estimates of such costs. | |
| **Non-economic valuation methods** | **Description** | **Ecosystem services valued** |
| Focus groups, in-depth groups | Focus groups aim to discover the positions of participants regarding, and/or explore how participants interact when discussing, a pre-defined issue or set of related issues. In-depth groups are similar in some respects, but they may meet on several occasions, and are much less closely facilitated, with the greater emphasis being on how the group creates discourse on the topic. | All ecosystem services. |
| Citizens' Juries | Citizens" juries are designed to obtain carefully considered public opinion on a particular issue or set of social choices. A sample of citizens is given the opportunity to consider evidence from experts and other stakeholders and they then hold group discussion on the issue at hand | All ecosystem services. |
| Health-based valuation approaches | The approaches measure health-related outcomes in terms of the combined impact on the length and quality of life. For example, a quality-adjusted life year (QALY) combines two key dimensions of health outcomes: the degree of improvement/deterioration in health and the time interval over which this occurs, including any increase/ decrease in the duration of life itself. | All ecosystem services. |
| Q-methodology | This methodology aims to identify typical ways in which people think about environmental (or other) issues. While Q-methodology can potentially capture any kind of value, the process is not explicitly focused on 'quantifying' or distilling these values. Instead it is con-cerned with how individuals understand, think and feel about environmental problems and their possible solutions. | All ecosystem services. |
| Delphi surveys, systematic reviews | The intention of Delphi surveys and systematic reviews is to produce summaries of expert opinion or scientific evidence relating to particu-lar questions. Delphi relies largely on expert opinion, while systematic review attempts to maximise reliance on objective data. Delphi and systematic review are not methods of valuation but, rather, means of summarising knowledge (which may be an important stage of other valuation methods). | All ecosystem services. |

# ANNEX 2: STAGES OF A POLICY ASSESSMENT, PROPOSED ACTIONS AND WAYS TO ADDRESS BIODIVERSITY (UNEP 2009B)

| Stages | Actions proposed | How to address biodiversity and related aspects |
|---|---|---|
| A. Understanding the policy context | A1. Identify the purpose of the IA | 0. Define the purpose, main objectives and sectoral focus. Define objectives in terms of ex-ante assessment and influencing decision-makers to maximise positive outcomes on biodiversity and other sustainability issues. |
| | A2. Review the proposed policy and context | 1. Identify environmental and biodiversity oriented policy objectives, commitments or agreements relevant for the study focus (area, commodity). Understand the policy process that is being assessed. |
| | A3. Identify participants and stakeholders | 2. Identify relevant stakeholders and biodiversity specialists, and ensure they are involved in the study. |
| | A4. Identify and review available information | 3. Identify and make an overview of relevant (biodiversity and trade-related) documents for the country / region concerned. |
| B. Determining the focus | B1. Develop a conceptual framework | 4. Make a summary of key issues and create a conceptual framework. Include critical biodiversity components and ecosystem services, social and economic issues and cause-effect chains. |
| | B2. Identify priority sustainability issues | 5. Identify the main sustainability issues (related to problems and opportunities) as associated with the conceptual framework.. |
| C. Assessing the impacts | C1-3. Identify criteria relevant to the main issues, develop ESE indicators and determine the baseline | 6. Identify objectives or criteria and associate indicators to assess baselines and trends. Assessment of trends should be done using selected indicators. Define the status and trends of the most important indicators for the focal sectors of the assessment. Scenarios can be developed for expected changes. This is followed by a causality analysis to identify specific drivers of change and explaining possible outcomes for biodiversity and ecosystem services. |
| | C4. Identify policy options including most likely option | 7. Identify policy options for which to assess impacts. There may be three policy options: baseline, existing policy measures (subject of the assessment) and proposed positive policy. |
| | C5. Analyse impacts using appropriate tools and techniques | 8. Analyse the impacts of defined policy options on biodiversity, as well as social and economic indicators. Assess the likely impacts of policy options with the baseline scenario. If possible, quantify expected (positive or negative) changes in biodiversity and ecosystem services. |
| D. Developing policy recommendations | D1. Finalise assessment of trade-offs and draw conclusion | 9. Draw conclusions as regards the most desirable and realistic policy options. Consider alternative trade policy options to maximise overall positive sustainability outcomes. These are preferred over policy measures for mitigation or compensation of impacts on biodiversity and ecosystem services |
| | D2. Develop policy recommendations | 10. Define policy recommendations in line with the assessment results. Consider the most effective mechanisms for communicating results, using stakeholder input. |