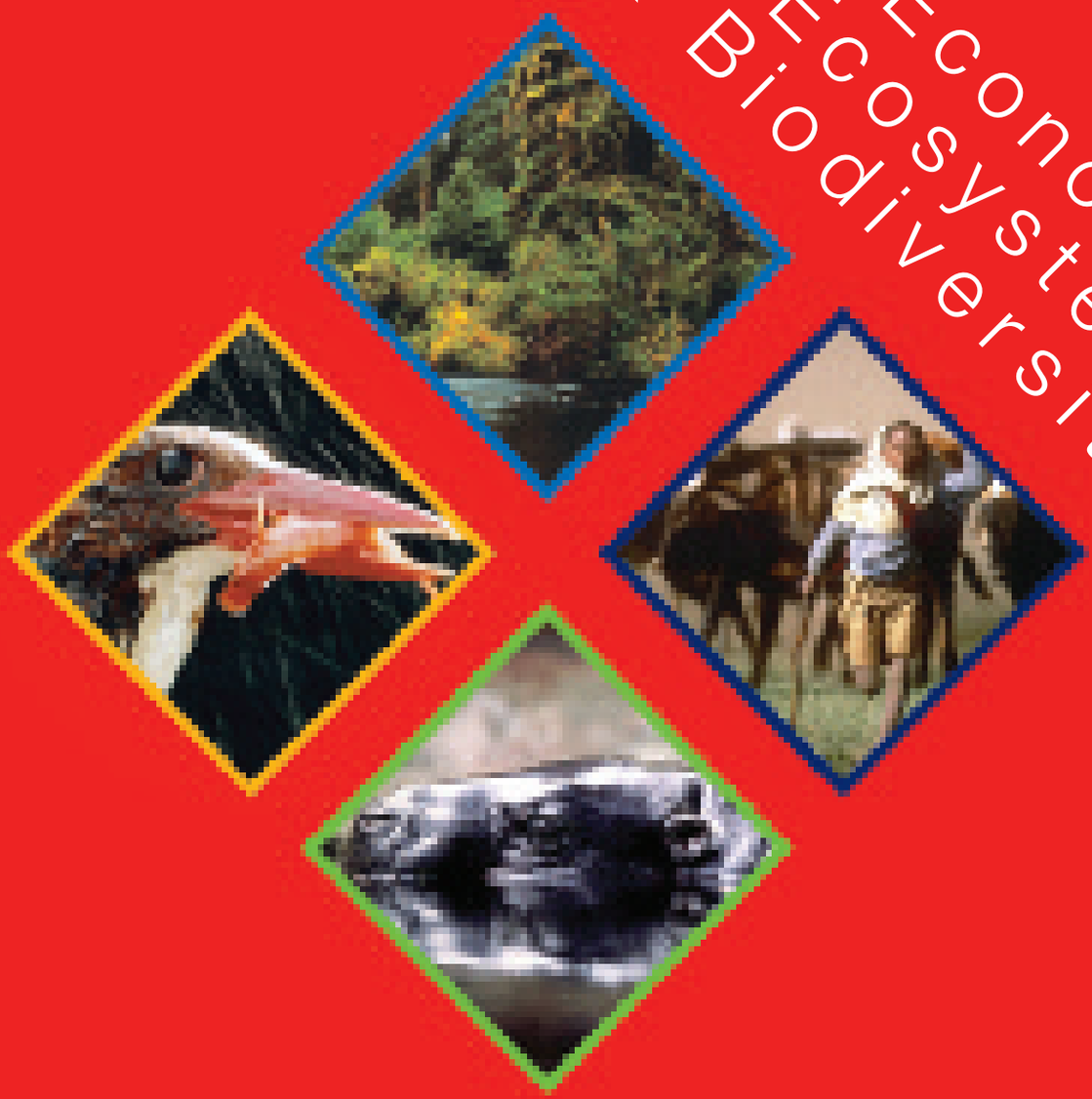
Ecosystem Services Icons

Provisioning Food	
Provisioning Raw Materials	
Provisioning Fresh Water	
Provisioning Medicinal Resources	
Regulating Local Climate	
Regulating Carbon Sequestration	
Regulating Extreme Events	
Regulating Waste Water Treatment	
Regulating Soil Erosion and Fertility	

Regulating Pollination	
Regulating Biological Control	
Habitats for Species	
Habitats for Genetic Diversity	
Cultural Service: Recreation	
Cultural Service: Tourism	
Cultural Service: Aesthetic appreciation	
Cultural Service: Spiritual Experience	

The Economics of Ecosystems & Biodiversity



TEEB FOR LOCAL AND REGIONAL POLICY MAKERS

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The Economics of Ecosystems & Biodiversity

THE ECONOMICS OF ECOSYSTEMS AND BIODIVERSITY
FOR LOCAL AND REGIONAL POLICY MAKERS

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PREFACE

Pavan Sukhdev, Study Leader

As a young banker working in Asia's emerging markets through the 1990's, I saw the blossoming of many 'tiger' economies, many fast-growing cities, and I saw entrepreneurs make vast private fortunes. At the same time, I could not ignore the palpable ongoing loss of Asia's ecology and its effect on lives and on its common wealth. The Yellow River ran dry for 9 months in 1997, the Yangtze flooded disastrously in 1998. Vast smoke clouds from burning peatlands in Sumatra repeatedly clogged the air in Singapore, where I lived. But what grabbed the headlines globally was the Asian debt crisis, the collapse of Thailand's stock markets, the riots in Indonesia, and Malaysia tearing up its international currency and replacing it with exchange controls. What was it about Natural Capital that made it so invisible, so unlike the Financial Capital of my world of global markets? Why was private wealth worth chasing, and worth reporting if it was lost, but not public wealth?

These questions made me understand that we really did not measure what we thought we managed: human well-being. Asian economies were declared 'tigers' based on high percentage rates of GDP growth. No account was taken of simultaneous losses of natural capital. This led me to start a private inquiry to account for 'real' growth in India, my home country, as against 'GDP growth': a 'Green Accounting' project was born (www.gistindia.org). My project partners and I understood that to draw any conclusion about India as a whole would be meaningless: it would be too big, everybody's problem, hence nobody's problem. So we decided to conduct our economic inquiry at the State level – forming a 'Green Indian States Trust' to conduct this inquiry. This was the appropriate level to provide information that was actionable by policy makers.

So my belief in the importance of the local government in addressing the problems of economic invisibility of nature goes back over a decade – and this is why I believe that this Report, TEEB for Local and Regional Policy Makers, is so vitally important a part of the TEEB suite of reports.

The TEEB Approach

'The Economics of Ecosystems and Biodiversity' study was commissioned by the G8+5 and launched in 2007 by Germany and the EU Commission. It builds on the analysis of the Millennium Ecosystem Assessment and takes the analysis further by demonstrating the economic significance of biodiversity loss and ecosystem degradation in terms of negative effects on human well-being.

In order to make the economic value that nature provides visible, we need to estimate and disclose values for nature's goods and services (or so-called 'ecosystem services'). These estimated values can inform policy choices, executive actions, business decisions and consumer behaviour.

TEEB suggests a tiered approach to analyzing problems and ascertaining suitable policy responses. We find that, at times, it suffices simply to recognize value – be it intrinsic, spiritual or social. Recognition can stimulate policy response. At other times, policy makers may need to demonstrate the economic value of a service in order to respond – wetland conservation near Kampala, for example, was taken up as an alternative to reclaiming land for agriculture because of the wetland's natural sewage treatment function (Chapter 4 this volume). TEEB also focuses on instruments that capture value by rewarding and supporting good conservation – through measures such as payment for ecosystem services (PES).

Evaluations of any kind are a powerful 'feedback mechanism' for a society which has distanced itself from the biosphere, upon which its very health and survival depends. Economic valuations, in particular, communicate the value of ecosystems and biodiversity and their largely unprized flows of public goods and

services in the language of the world's dominant economic and political model.

TEEB does not propose that placing a value on ecosystem services means that they should be traded on the market. Such decisions are socially and ethically complicated. TEEB does not suggest placing blind faith in the ability of markets to optimize social welfare by privatizing the ecological commons and letting markets discover prices for them. What TEEB offers is a toolkit for integrating good stewardship because it's good economic practice.

TEEB has created several publications with different end users in mind – see inside cover. This volume is primarily for local governments and decision makers. It is preceded by a volume on the ecological and economic foundations of TEEB, which synthesizes today's 'state of the art' valuation methodology. It is also accompanied by three other publications: one for national and international policy makers, one for business and enterprise, and a website for citizen. Targeting these large groups of end users we hope will 'mainstream' the economics of ecosystems and biodiversity.

ABOUT THIS BOOK

Examining nature's importance for human well-being is a tricky thing. This planet has so many different faces and places! A report for local and regional policy makers should capture this diversity. We have not succeeded in considering the many particularities in local policy around the world. Within 200 pages this would be squaring the circle. But you may find it an inspiring starting point for thinking policy in a new way: We cannot risk taking nature for granted. Too many opportunities would be lost.

What does it take to explore this message for local policy makers around the world? What we did succeed in was bringing together a group of very experienced professionals from complementary backgrounds to form a dedicated Core Team. This team took much effort in developing the ideas, structuring and finally writing the report, bringing in the expertise of their large networks. Thanks to them, this report took shape.

Walking through local policy areas in different contexts was made possible by several enthusiastic partners: they facilitated more than 30 stakeholder consultations in all continents over the past year. TEEB consultations provided substantial input and corrective feedback to the ideas in this report – even if not all comments could be taken up explicitly. Particularly helpful here was the collaboration with the UNDP initiative "Biodiversity and Ecosystems: Why these are Important for Sustained Growth and Equity in Latin America and the Caribbean". In addition, the responses to our initial call for evidence helped enlarge the report's focus, and different contributors took great effort in providing valuable case studies.

Once the draft texts were on the table, each chapter was commented by 9 to 16 reviewers from local to international organisations within just a few weeks. Tilman Jaeger (IUCN), Wairimu Mwangi (ATPS) and Nik Sekhran (UNDP) took the pain to revise the entire draft report. We are indebted to all of them for their tremendous support.

The full list of authors, contributors, facilitators, reviewers, editors and resource persons who helped in producing this report are acknowledged on the last page. We would especially like to thank Augustin Berghöfer, who has made it happen: organized the core team calls, co-ordinated the stakeholder review process and initiated the case collection. Finally, we thank the Norwegian Ministry of Foreign Affairs, for their financial support, and the Ministry of Environment in Japan for their help at various stages.

TEEB for local and regional policy makers uses three formats: this report, a collection of more than 100 two-page case studies (available at TEEBweb.org), and a book, published by Earthscan in 2011, which is geared to environmental management students – the experts of tomorrow.

Many people have mentioned to us: "We need capacity building! Give us training in how to assess nature's values." This report meets the request in a slightly different way: You can learn what tools are available, how they work and what experiences others have had with them. Throughout the book you will be referred to further guidebooks and manuals. But in addition – and after many discussions with people applying these concepts – we feel it is important to point you to some nuts and bolts, to the limitations as well as to the potential of valuing nature (summarised in the last chapter).

We sincerely hope that with this orientation you are well-equipped for appraising nature's benefits.

Heidi Wittmer and Haripriya Gundimeda

Coordinators
TEEB for Local and Regional Policy Makers

EXECUTIVE SUMMARY

This report highlights the enormous potential for securing and enhancing human well-being by taking nature's benefits into account. It provides orientation, guidance and inspiration for local policy makers who want to include these benefits in their policies in order to help create a sustainable future for local communities.

I. THE OPPORTUNITY: THE VALUE OF NATURE FOR LOCAL DEVELOPMENT

All economic activity and most of human well-being is based on a healthy, functioning environment. By focussing on the various benefits from nature – ecosystem services – we can see more clearly the direct and ndirect ways that human well-being depends on the natural environment. Nature's benefits are multiple and include all our food; our water; safe places for living; materials such as timber, wool and cotton; and many of our medicines. Healthy natural systems regulate our climate, protect against hazards, meet energy needs, prevent soil erosion, and offer opportunities for breathtaking recreation, cultural inspiration and spiritual fulfilment.

For local development, considering ecosystem services in policy making can help save on future municipal costs, boost local economies, enhance quality of life and secure livelihoods. This approach also helps tackle poverty as it discloses the distribution of scarce and essential resources and services upon which people depend.

So far, nature's benefits have played a minor role in policy. Policies and public investments for a functioning environment are often considered a luxury rather than life insurance. Why is this the case? It is largely due to the fact that many ecosystem services are poorly visible and their continuous availability is often falsely assumed. Also, many of nature's benefits are public goods – such as pollination – belonging to all, so there is little incentive to take action on behalf of 'everyone'. Finally, other needs and objectives may seem more pressing and desirable and decisions are often made without knowing the environmental consequences.

This is a problem because our natural capital is diminishing. Wasteful use of resources and limited concern for natural systems drive its loss. Ecosystems have their tipping points. After this point, restoration or seeking alternatives for benefits lost, can consume considerable time, money and effort. It takes years for a replanted mangrove belt to provide effective coastal protection again. While many pressures are beyond the local scope, local policy makers still have to deal with their consequences.

TEEB suggests a shift in focus. Economic analysis indicates that maintaining healthy ecosystems is often a better, less expensive, option. Appraising ecosystem services provides a full picture, outlining the costs and benefits of different policy options and highlighting the best local strategy for enhancing human well-being and economic sustainability

II. THE TOOLS: APPRAISING ECOSYSTEM SERVICES

When appraising nature's benefits we should seek answers to these questions: **Which** ecosystem services are central to my local/regional society and economy? **Who** depends on these services? Which services are at risk? **How** will a policy action affect these services? Local knowledge and dialogue among colleagues and stakeholders can generate first answers that help orient policy.

This report provides a hands-on overview of frameworks for considering nature. These frameworks structure our take on nature in economic, ecological or developmental terms.

On that basis, different tools allow for appraising and valuing ecosystem services. Qualitative tools describe the connections between ecosystem services and human well-being. They also capture the appreciation people attach to nature's benefits. Quantitative tools examine amounts, intensities and impacts of different

ecosystem services. Monetary tools attach monetary values to both the presence and loss of ecosystem services.

The report also introduces three decision support methods by which appraisal and valuation of ecosystem services can directly inform policy choices: cost-benefit analysis, participatory appraisal and multi-criteria analysis. The strengths, weaknesses and requirements of each are discussed.

TEEB's stepwise approach

A stepwise approach helps navigate through the different assessment options available. This approach is not a fixed recipe, but is intended to guide policy makers in designing their own processes for appraising and considering nature's benefits in their policy decisions:

(i) Specify and agree the policy issue with stakeholders to avoid misunderstandings during decision making and implementation.
(ii) Identify which ecosystem services are most relevant to the policy issue in order to focus analysis.
(iii) Define the information needs to tackle your issue and select appropriate methods for assessment.
(iv) Assess ecosystem services, expected changes in their availability and distribution.
(v) Identify and appraise policy options based on your assessment.
(vi) Assess distributional impacts of policy options on different groups in your community.

III. THE PRACTICE: ECOSYSTEM SERVICES IN POLICY AND MANAGEMENT

Knowing their natural capital and the services it provides can help local policy makers in rural and urban management, in spatial planning, and in protected areas management. It allows to refine government regulations and to develop market-based instruments. This report explores reasons for and examples of applying a focus on nature's benefits in these local policy areas.

Cities depend on nature. Ecosystem services can provide cost-effective solutions to municipal services, such as wastewater treatment by wetlands. City managers can enhance the flow and benefits of ecosystem services by influencing modes of production, procurement and creating incentives.

In rural development, we often promote ecosystem services with high market value to the detriment of regulating services that are equally important, but less obvious. Local officials play a key role in implementing, adjusting and informing sustainable practices in forestry, fisheries, agriculture and tourism.

Planning frameworks and environmental impact assessments can proactively include ecosystem services. This allows the identification of economic potentials, rather than simply identifying constraints.

Protected areas can be an important local as well as national asset. To enhance local benefits, protected areas need to be connected with the management of the surrounding landscape. A focus on ecosystem services is instrumental in zoning, management and fundraising.

Locally adapted payment schemes for ecosystem services, as well as certification and labelling, can reward good stewardship of natural capital. What works well in theory may be demanding in practice. A successful market-based instrument should build on transparent, credible governance and incorporate effective monitoring and enforcement.

IV. THE LESSONS: HOW TO MAKE IT HAPPEN

Three issues, beyond the appraisal of ecosystem services itself, need attention if you wish to make natural capital work for local development:

(i) The distribution of rights to nature's benefits. Policy changes often affect service distribution or access – and this needs to be considered during decision making.
(ii) The optimal use of available scientific and experience-based knowledge. The ecosystem services framework provides a common language to capture diverse views.
(iii) Well-informed facilitation of participatory processes. Stakeholder engagement is needed to bring all these facets together, to prioritize and to develop feasible and effective local policy action.

This report is to be treated as a catalyst for further thinking – a starting point for adopting ways to make your natural capital flourish. In addition to the examples used in this report, www.teebweb.org hosts a collection of more than 100 short case studies which illustrate a focus on ecosystem services in diverse settings.

GUIDANCE FOR READING THIS REPORT

TEEBcase: The TEEBcases are examples that illustrate how ecosystem services have already been taken into account in local and regional policy making. Coming from all over the world, these cases were collected by different means: the stakeholder consultations; the TEEB Call for Evidence; literature review, or indication by practitioners and researchers in the field. All case descriptions contain full references, were reviewed by independent experts, and are going to be available at **TEEBweb.org** (check the website also for additional cases not cited in the report).

Glossary terms: The terms indicated with an arrow (→) are further defined in the glossary.

Ecosystem Services Icons: Described in Box 1.4 in Chapter 1, these icons are used along the whole report to indicate where specific ecosystem services are mentioned or discussed. When the arrow points to the left (←) the reference to the ecosystem service is found in the left column, to the right (→) indicates a service mentioned in the right column.

Provisioning Food	*Regulating Pollination*
Provisioning Raw Materials	*Regulating Biological Control*
Provisioning Fresh Water	*Habitats for Species*
Provisioning Medicinal Resources	*Habitats for Genetic Diversity*
Regulating Local Climate	*Cultural Service: Recreation*
Regulating Carbon Sequestration	*Cultural Service: Tourism*
Regulating Extreme Events	*Cultural Service: Aesthetic appreciation*
Regulating Waste Water Treatment	*Cultural Service: Spiritual Experience*
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Content of this chapter

This report is aimed at policy makers involved in local and regional policy and public management. It **showcases how decision makers can promote local development by explicitly considering nature and the services it provides for human well-being**. This chapter explains what nature provides us (section 1.1), why nature's benefits are not fully recognized (1.2), and what can be done about it at the local level (1.3). It describes how ecosystems provide different types of services and what happens if development efforts only consider a few of them (1.4). We also explore how biodiversity and ecosystems are impacted by climate change and how a resilient environment can help mitigate the impacts, or adapt to them (1.5). Finally it provides a guide to readers of this report (1.6).

Key Messages

- **Nature provides more than one solution.** To provide a good quality of life for citizens local governments have many needs to address. Maintaining and enhancing natural capital can significantly contribute to better the provision of municipal services, improve public health and help lower the cost of energy.
- **More than a nice sunset.** Nature is an important asset for local economies and livelihoods. Asessing the services porvided by nature – so called 'ecosystem services' – can make this asset visible and help to identify cost-effective solutions.
- **Small changes have a remarkable impact.** Poor people, especially in rural areas, rely most directly on nature's services. Addressing the loss of ecosytem services can significantly contribute to reducing poverty.
- **Just because you don't see it, it doesn't mean it isn't there.** Ecosystem services with high market value tend to be promoted to the detriment of other services, such as flood regulation or water filtration that are less visible but equally important for local development.
- **It's a matter of priority.** Maintaining healthy ecosystems is more urgent because of global climate change.

> "More and more, the complementary factor in short supply (limiting factor) is remaining natural capital, not manmade capital as it used to be. For example, populations of fish, not fishing boats, limit fish catch worldwide."
>
> Herman Daly, former chief economist with World Bank in 2005

With this report we hope to provide:

1. A **source of inspiration** for improving local development by means of explicitly considering biodiversity and ecosystem services in local decision making. We have collected examples from around the world to illustrate the options and opportunities that can make a difference at the local level.

2. A **how-to guide** and resource kit to **adequately assess and value ecosystem services**.

3. An **overview of how taking the economic value of nature's services into account can** help **improve** local development while maintaining biodiversity. We highlight potential policy instruments and **decision-making** tools for **public management tasks** at the local level. In six chapters, we outline the potential, the challenges and the institutional prerequisites for explicit consideration of biodiversity and ecosystem services in decision making.

1.1 LOCAL DEVELOPMENT'S BIGGEST ASSET

Forested water catchment areas provide water for both drinking and irrigation. Green spaces in cities improve both urban climates and air quality. Mangrove belts secure coastal protection against floods. Unspoilt beaches improve local quality of life and attract tourists. What do these examples have in common? In all of them local policy makers recognize the benefits that natural assets provide for local development (see Box 1.1).

Typically, **local policy makers have to provide multiple services simultaneously**. These include: public infrastructure; water and waste management; promoting local economic development; education and health care. Their challenge is to maintain and improve

the quality of life for citizens when financial resources and capacities are often severely limited.

The good news is that **nature has a tremendous potential to achieve exactly this**. Protecting natural resources and biodiversity is sometimes perceived as an impediment to local development when, in fact, it could actually enhance it:

- A municipality can save money by securing water provision, waste-water treatment, and protection against erosion or floods more effectively and efficiently through natural rather than technical solutions.
- In most places in the world, nature is the single most important input to local economies and →*human well-being* providing materials, clean water and good environmental conditions for industry, agriculture and the services sector.

Box 1.1 Nature provides local benefits at a lower cost than technical solutions

New York: By purchasing and restoring the Catskill watershed for US$ 2 billion, New York has secured its source of drinking water. A comparable pre-treatment plant would have cost US$ 7 billion (Elliman and Berry 2007).

India: Environmental authorities in Jaipur, a city of 3.3 million people, are enlarging urban green spaces as a cost-effective way of reducing surface run-off and replenishing ground water during the monsoon. Water withdrawal from thousands of boreholes has resulted in a serious decline in the water table in the city, and surface run-off caused flooding (Rodell et al. 2009; Singh et al. 2010).

Australia: Local authorities in Canberra have enhanced urban quality of life by planting 400,000 trees. Besides making the city greener, the trees are expected to regulate the microclimate, reduce pollution and thereby improve urban air quality, reduce energy costs for air conditioning as well as store and sequester carbon. Combined, these benefits are expected to amount to the equivalent of US$ 20–67 million for the period 2008–2012 in terms of the value generated or savings incurred to the city (Brack 2002). On www.treebenefits.com you can calculate the economic and ecological value of trees.

Vietnam: Since 1994, local communities have planted and protected mangroves in northern coastal regions of Vietnam, where more than 70% of the population is threatened by natural hazards (Dilley et al. 2005). Restoration of natural mangrove forests is more cost-effective than building artificial barriers. An investment of US$ 1.1 million has saved an estimated US$ 7.3 million a year in sea dyke maintenance (IFRC 2002). During typhoon Wukong in 2000, the project areas suffered significantly less damage than neighboring provinces (Brown et al. 2006).

Nicaragua: Large-scale deforestation in Nicaragua is being driven by clearance for livestock grazing. However traditional grazing regimes on deforested land are often unsustainable. In Matiguas, silvo-pastoral systems have been introduced, and degraded pastures planted with improved grasses, fodder shrubs and trees. This improved habitat reduces surface runoff and soil erosion on steep slopes, benefits local wildlife and, crucially, is also able to support a much higher density of cattle per hectare (FAO 2006).

Burkina Faso: For decades management strategies in the Sourou Valley wetland focussed on promoting agriculture. IUCN conducted an economic valuation of the products obtained. The assessment revealed that only 3% of the value relate to agriculture while other products generated by the wetland like forest products, fodder, and fisheries accounted for more than 80%; several other benefits provided were not included in the study. Local decision makers are now starting to integrate the valuation of ecosystem services in development plans (Source: Wetland valuation changes policy perspectives, Burkina Faso. TEEB-case, see TEEBweb.org).

- Keeping and maintaining well-functioning natural ecosystems is the best strategy for local policy makers to deal with future pressures and threats, for example, those linked to climate change.

We all depend on nature for our well-being. Ecosystems provide us with food, fresh water, fuel, fibre, fresh air and shelter. →*Biodiversity* is defined as the variety of →*ecosystems* and ecological processes, and the diversity of plant and animal species, as well as different varieties and breeds within each species. It is critical for maintaining the →*resilience* of ecosystems, that is, their ability to function and provide critical services under changing conditions.

Our dependency on nature is sometimes directly visible, as with agriculture, fisheries and forestry. At other times, it is less visible; the water supply of urban areas, the food sold in supermarkets, and the clean air we breathe also relies on functioning ecosystems.

In cities, urban parks and green spaces lower the summer temperature, improve air quality, reduce the amount of flooding after heavy rains, and also significantly increase the recreational value of city life and the real estate value of adjacent property. In addition, ecosystems and biodiversity provide inspiration and are often an important basis of local culture.

The Millennium Development Goals, agreed upon by world leaders at the United Nations, commit nations to a new global partnership to reduce extreme poverty (see www.un.org/millenniumgoals/). Without safeguarding ecosystems and biodiversity, several of these goals cannot be achieved (see Table 1.1)

"Poverty is not simply about having a low income: it is multidimensional deprivation – hunger, undernutrition, dirty drinking water, illiteracy, having no access to health services, social isolation, and exploitation" (CPRC 2004:1).

These multiple aspects of poverty are connected to each other and to a range of further political, economic and natural causes. As yet, we know little about how different causes jointly drive poverty in different settings (Agrawal and Redford 2006).

Box 1.2 The importance of nature's benefits

Forests resources directly contribute to the livelihoods of 90% of the 1.2 billion people around the world living in extreme poverty (World Bank 2004) and 500 million people depend on coral reefs for their livelihood (Wilkinson 2004). About 80% of the population in developing countries relies on traditional medicine that is mainly derived from herbal plants (*WHO* 2008). Also, 50% of modern pharmaceuticals are derived from or based on natural compounds (MA 2005). A large number of plant and animal species still lie undiscovered and their potential benefits are yet unknown. These plants and animals may contribute to curing diseases in the future, help to find new materials for industry, or provide solutions for other future problems. There are, therefore, many good reasons to consider nature: economic; cultural; ethical and social.

Increasingly, global environments around the world are at risk of degradation:

- the Millennium Ecosystem Assessment found that 15 out of 24 assessed ecosystem services are being degraded or used unsustainably (MA 2005).
- 52% of global commercial marine fish stocks are fully exploited whilst an additional 17% are overexploited (FAO 2005).
- 20% of coral reefs have been destroyed and an additional 20% are seriously degraded (MA 2005).
- Already one billion city dwellers around the world live without clean water or adequate sanitation, despite this being recognized by the international community as a basic right. Over 2 million children die each year as a result. Currently 700 million people globally live with water stress, meaning the access to water quantity is insufficient. This is expected to increase to about 3 billion people by 2025 (Human Development Report 2006).

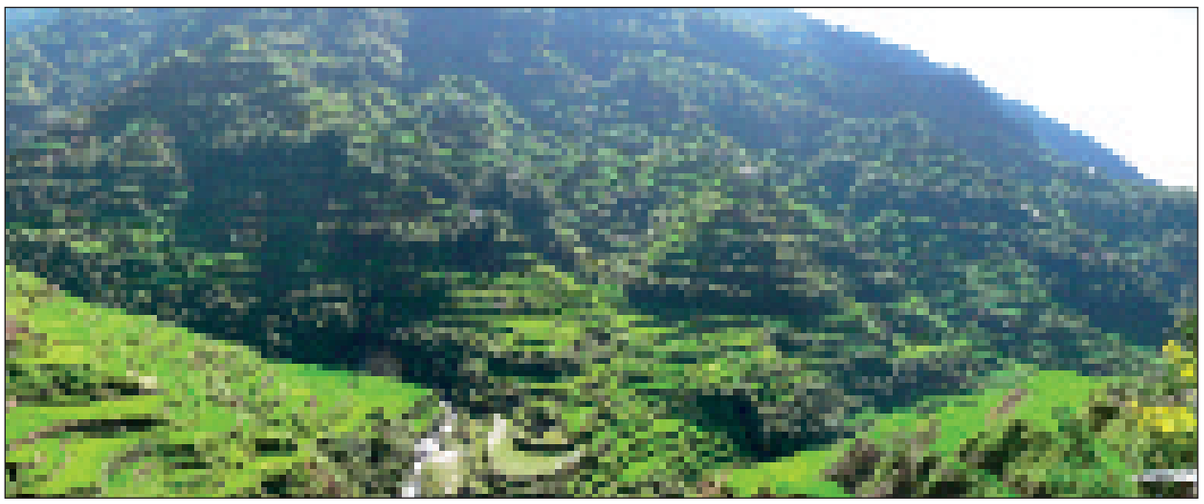
Table 1.1 The Millennium Development Goals (MDG) and ecosystem services

MDG	Ecosystem services linked to targets
MDG 1: Eradicate extreme poverty and hunger	The availability of food, fuelwood, water and biodiversity directly influences people's minimum standard of living and hence the incidence of poverty and hunger.
MDG 3: Promote gender equality and empower women	The availability of fuelwood and water reduces the burden that falls mainly on women and helps to improve gender equality (see Box 1.3). Women's income is often directly dependent on ecosystem services, for example collection of non-timber forest products.
MDG 4 and 5: Reduce child mortality Improve maternal health	Availability of clean water, clean air, plants for medicinal use, and biodiversity can all reduce the spread of diseases. Healthy ecosystems help to provide all the above.
MDG 7: Ensure environmental sustainability	The natural capacity for wastewater treatment, soil formation and other regulating and supporting ecosystem services help maintain the resilience of ecosystems and biodiversity.

Source: Adapted from TEEB (2008)

Nature's benefits are often neglected in policy although the least well-off people in many countries depend substantially on nature's benefits. Ecosystem services account for a large proportion of the goods and services consumed by the rural poor in developing countries. For example, for 480 million people in India, almost half of the population, ecosystem services account for 47% of goods and services consumed. In Brazil, the rural population relies on ecosystem goods and services for up to 90% of their total consumption. This has been calculated as the 'Gross Domestic Product (GDP) of the rural poor'. (TEEB in National Policy, Chapter 3.5).

In a vicious circle, poverty can increase dependence and pressure upon ecosystem services, further speeding up environmental degradation and exacerbating the livelihood situation (Shackleton et al 2008). In consequence, it appears a sound strategy for local policy makers to seek to secure the access to and continued availability of ecosystem services most essential to essential to poor citizens. Efforts against poverty should certainly aim beyond maintaining people's sources of basic subsistence – the issue for local policy makers is to ensure that policies and projects do not unintentionally degrade those ecosystem services which are currently essential for the poor. (Box 1.3).



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1.2 A POTENTIAL NOT FULLY RECOGNIZED

Local governments are continually faced with short-term challenges in the delivery of municipal services. There may be immediate political imperatives, or a shortage of financial resources. Environmental concerns are often considered to be unpopular or costly, and the value of nature can be sidelined in policy debates for a variety of reasons:

- **Development strategies focus on economic growth** without recognizing the role of functioning natural systems for local well-being.
- **Services that nature provides are often not visible.** Wetlands are a good example; conserving wetlands appears to provide few benefits and few economic costs are associated with their conservation and loss. Consequently wetlands are converted or degraded in favor of more profitable options such as dams or irrigation schemes. But the problem is not that wetlands have no economic value, but rather that this value – eg waste water purification and water regulation is poorly understood, and frequently overlooked in decision making (Emerton 2005). Local planners are often unaware that many natural solutions are available and are more cost-effective than technical solutions.
- **Competing demands on nature.** While conserving nature in its own right is very important to some people, others consider it to be a luxury. A growing population increases the demand for all kinds of services and this leads to more intensified use of natural ecosystems. Even where populations are not increasing, there are often conflicting interests. Some groups may benefit from cutting a forest while others lose important sources of income. Some interest groups are well-organized and in a position to directly influence policy makers whilst poorer groups are usually not.
- **Time lags.** The loss of biodiversity and the degradation of ecosystems may not have an immediate impact. The rapid increase of urban areas, for example, can result in a slow and prolonged loss of nature's benefits until a critical tipping point is reached. The loss of vegetation that helps stabilize slopes and retain rainwater in soils, is only noticed

Box 1.3 Poverty, gender, and biodiversity in Africa

- In Zimbabwe 'environmental income' (including forage for livestock production) formed some 40% of total income for the poorest households relative to 29% for more well-off households (Cavendish 2000).
- Women in particular are dependent on a wide range of wild harvested products, from fruits to craft materials, as a source of cash income. For poor women in the northeast of South Africa income from sales of traditional brooms contributed more than 75% of cash income for one-third of households surveyed. In Botswana, for example, basketry (from palm fronds) forms a crucial source of income for thousands of poor women (Cunningham and Terry 2006).
- Open surface water is the major source of drinking water for 29% of Kenyan households, almost all of them in rural areas. Families using untreated surface water are relying completely on the regulating services of ecosystems to provide uncontaminated water in sufficient quantities.
- About 89% of rural Kenyans rely on firewood for their energy needs with more than 80% of households obtaining firewood within a 5-kilometer radius of their home.
- In the desert of Southern Namibia, the pastoral Topnaar people rely on the wild melon as their most important food source during summer months. This plant grows extensively near the river Kuiseb. In recent years, the construction of a dam has significantly reduced the flooding of the river essential for the wild melon. In consequence, harvesting has sharply declined (Mizuno and Yamagata 2005).

Source: adapted from Shackleton et al. (2008)

once the vegetation disappears and landslides or flooding occurs. On the other hand, immediate needs are often so urgent that there is little room for long-term considerations. Land conversion or logging creates short-term revenues.

- **Poor understanding of natural cause and effect.** The long-term impacts of destroying ecosystems are sometimes difficult to anticipate. The benefits provided by biodiversity in meeting future developmental challenges are often difficult to apprehend and information is not readily available.
- **Public versus private benefits.** Whilst the return on private investment from exploiting nature is more easily quantifiable, the public benefits are often taken for granted. For example: coastal protection; water regulation; or regional climate regulation.

Furthermore, the local capacity to respond to the value of nature is constrained. **Decision making is often fragmented** and those concerned with natural resources lack power and money in government ministries and departments.

Under the standard economic growth model, incentives are often provided for activities that (unintentionally) lead to destroying ecosystems (see TEEB in National Policy, Chapter 6 on harmful subsidies). Identifying and implementing policies that effectively protect and conserve ecosystems and biodiversity requires the **collaboration of many agencies at different levels** and other stakeholders. If the need for collective action is not understood, coordination becomes a challenge. This is often hindered by the lack of institutional capacity and effective governance mechanisms.

1.3 WHAT CAN LOCAL POLICY MAKERS DO?

Environmental governance operates at different scales. International agreements shape many areas of environmental policy. National legislation sets the legal framework for local decision making and issues general directives. However, the decision where to build a new factory, or whether to cut down a forest, is generally made at the local and regional level. It is here that laws are implemented and regional and/or local bodies have discretion.

A large number of officials are involved in local policy decision making: mayors, municipal councilors, planners, and developers. Citizens have roles as advocates, conservationists or protestors. Regulating agencies approve projects or monitor compliance with health standards or environmental regulation, while the legal system plays a role in planning and dispute resolution.

So how can the importance of a well-functioning ecosystem be adequately and effectively considered in decision making? The concept of ecosystem services provides an action-oriented framework that systematically explains the diverse ways that nature contributes to human well-being. By making use of this concept (explained below), local policy makers can fully utilise nature's assets for local development. They can:

1. Make **good use of available instruments** and procedures: There are a number of assessment procedures and public management tools that can have a direct impact on ecosystem services. These include: Environmental Impact or Strategic Environmental Assessments; Cost-Benefit Analysis for public infrastructure; local and regional tax incentives; spatial planning; regulation of natural resource use such as forestry or fisheries, as well as extension programmes.

2. **Develop local solutions:** Experience around the world has shown that local and provincial laws and policy instruments, alongside local recognition of value, has helped to address biodiversity issues. New instruments to improve biodiversity related decision making include local Payment for Ecosystem Services (PES), Reducing Emissions from Deforestation and Forest Degradation (REDD) pilot scheme and Clean Development Mechanism projects.

3. **Advocate environmental concerns at higher policy levels:** Local and regional levels of government can play important roles in advocacy and

thereby try to influence national level policy making and public attitudes. Thailand, for example, has a community forestry law that has been created through the initiative of local committees with the support of NGOs (Birner and Wittmer 2003).

1.4 ECOSYSTEM SERVICES: AN OVERVIEW

We can distinguish between provisioning, regulating, supporting and cultural services provided by ecosystems (MA 2005). In this section, we identify typical bundles of services in different types of ecosystems. We then characterise two key features of ecosystem change – trade-offs and tipping points – before considering the social impact of such changes.

Box 1.4 Different types of ecosystem services

Provisioning Services *are ecosystem services that describe the material or energy outputs from ecosystems. They include food, water and other resources.*

1. **Food:** Ecosystems provide the conditions for growing food. Food comes principally from managed agro-ecosystems but marine and freshwater systems or forests also provide food for human consumption. Wild foods from forests are often underestimated.

2. **Raw materials:** Ecosystems provide a great diversity of materials for construction and fuel including wood, biofuels and plant oils that are directly derived from wild and cultivated plant species.

3. **Fresh water:** Ecosystems play a vital role in the global hydrological cycle, as they regulate the flow and purification of water. Vegetation and forests influence the quantity of water available locally.

4. **Medicinal resources:** Ecosystems and biodiversity provide many plants used as traditional medicines as well as providing the raw materials for the pharmaceutical industry. All ecosystems are a potential source of medicinal resources.

Regulating Services *are the services that ecosystems provide by acting as regulators eg regulating the quality of air and soil or by providing flood and disease control.*

5. **Local climate and air quality regulation:** Trees provide shade whilst forests influence rainfall and water availability both locally and regionally. Trees or other plants also play an important role in regulating air quality by removing pollutants from the atmosphere.

6. **Carbon sequestration and storage:** Ecosystems regulate the global climate by storing and sequestering greenhouse gases. As trees and plants grow, they remove carbon dioxide from the atmosphere and effectively lock it away in their tissues. In this way forest ecosystems are carbon stores. Biodiversity also plays an important role by improving the capacity of ecosystems to adapt to the effects of climate change.

7. **Moderation of extreme events:** Extreme weather events or natural hazards include floods, storms, tsunamis, avalanches and landslides. Ecosystems and living organisms create buffers against natural disasters, thereby preventing possible damage. For example, wetlands can soak up flood water whilst trees can stabilize slopes. Coral reefs and mangroves help protect coastlines from storm damage.

8. **Waste-water treatment:** Ecosystems such as wetlands filter both human and animal waste and act as a natural buffer to the surrounding environment. Through the biological activity of micro-organisms in the soil, most waste is broken down. Thereby pathogens (disease causing microbes) are eliminated, and the level of nutrients and pollution is reduced.

9. **Erosion prevention and maintenance of soil fertility:** Soil erosion is a key factor in the process of land degradation and desertification. Vegetation cover provides a vital regulating service by preventing soil erosion. Soil fertility is essential for plant growth and agriculture and well-functioning ecosystems supply the soil with nutrients required to support plant growth.

10. **Pollination:** Insects and wind pollinate plants and trees which is essential for the development of fruits, vegetables and seeds. Animal pollination is an ecosystem service mainly provided by insects but also by some birds and bats. Some 87 out of the 115 leading global food crops depend upon animal pollination including important cash crops such as cocoa and coffee (Klein et al. 2007).

11. **Biological control:** Ecosystems are important for regulating pests and vector borne diseases that attack plants, animals and people. Ecosystems regulate pests and diseases through the activities of predators and parasites. Birds, bats, flies, wasps, frogs and fungi all act as natural controls.

Habitat or Supporting Services *underpin almost all other services. Ecosystems provide living spaces for plants or animals; they also maintain a diversity of different breeds of plants and animals.*

12. **Habitats for species:** Habitats provide everything that an individual plant or animal needs to survive: food; water; and shelter. Each ecosystem provides different habitats that can be essential for a species' lifecycle. Migratory species including birds, fish, mammals and insects all depend upon different ecosystems during their movements.

13. **Maintenance of genetic diversity:** Genetic diversity is the variety of genes between and within species populations. Genetic diversity distinguishes different breeds or races from each other thus providing the basis for locally well-adapted cultivars and a gene pool for further developing commercial crops and livestock. Some habitats have an exceptionally high number of species which makes them more genetically diverse than others and are known as 'biodiversity hotspots'.

Cultural Services *include the non-material benefits people obtain from contact with ecosystems. They include aesthetic, spiritual and psychological benefits.*

14. **Recreation and mental and physical health:** Walking and playing sports in green space is not only a good form of physical exercise but also lets people relax. The role that green space plays in maintaining mental and physical health is increasingly being recognized, despite difficulties of measurement.

15. **Tourism:** Ecosystems and biodiversity play an important role for many kinds of tourism which in turn provides considerable economic benefits and is a vital source of income for many countries. In 2008 global earnings from tourism summed up to US$ 944 billion (see Chapter 5). Cultural and eco-tourism can also educate people about the importance of biological diversity.

16. **Aesthetic appreciation and inspiration for culture, art and design:** Language, knowledge and the natural environment have been intimately related throughout human history. Biodiversity, ecosystems and natural landscapes have been the source of inspiration for much of our art, culture and increasingly for science.

17. **Spiritual experience and sense of place:** In many parts of the world natural features such as specific forests, caves or mountains are considered sacred or have a religious meaning. Nature is a common element of all major religions and traditional knowledge, and associated customs are important for creating a sense of belonging.

For further details on ecosystem services see: MA 2005; TEEB Foundations Chapters 1 and 2; de Groot et al. 2002.

Icons designed by Jan Sasse for TEEB

ECOSYSTEMS PROVIDE MULTIPLE SERVICES

All ecosystems naturally produce multiple ecosystem services. Figure 1.1 illustrates this for different ecosystems: mountains; lakes; grasslands; cities; and coastlines.

ENHANCING PRODUCTION OFTEN REDUCES OTHER SERVICES

We often promote those provisioning services with high market value to the detriment of other services that are less visible but equally important.

Figure 1.1 Ecosystems and their services

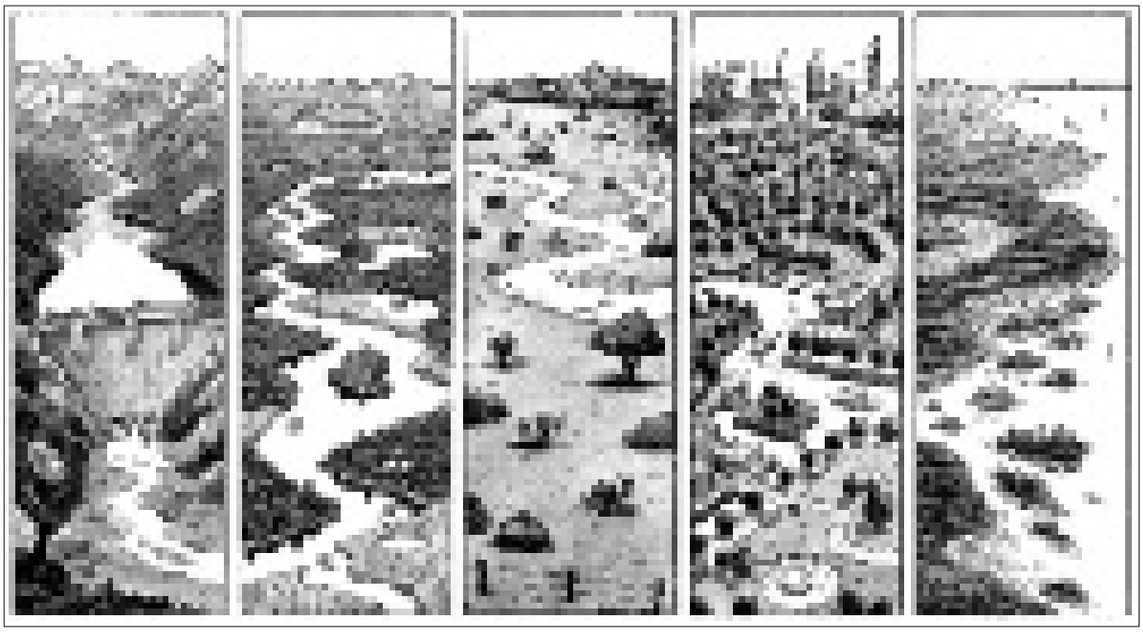


Illustration by Jan Sasse for TEEB

A. Mountains B. Lakes and rivers C. Grassland D. Cities E. Coasts

A. **In mountainous areas**, watershed protection and prevention of soil erosion are even more important than in flatter areas. These ecosystems are often fragile and therefore degradation can take place more rapidly.

B. **Lakes** provide fish and water which can be used for irrigation and recreation, and for cooling industrial plants, whilst **rivers** can provide electricity and wash away waste. Floodplains and lakes are often overlooked as reservoirs of fresh water and buffers against floods. They also play an important role in purifying water. However, many of these services are mutually exclusive; a polluted river will contain fewer fish and will not be able to provide clean drinking water.

C. **Grasslands** support many different wild animals and livestock production. When intact, they protect against soil erosion and land degradation, and they sequester carbon, a service that is especially prominent in peatlands.

D. Heavily modified landscapes such as **urban areas** can still provide several of the ecosystem services outlined above. Parks can improve a city's micro-climate, offer health and recreational services for residents and provide a habitat for an increasing amount of wildlife that is becoming adapted to living in cities.

E. **Coastal areas** contain different ecosystems such as mangroves, dunes, coral reefs or tidelands. These ecosystems protect the coastline against storms and flooding, may provide spawning grounds for fish and crabs, and habitats for migrating species. Often they provide other products such as wood, fodder or building materials and play an important role for recreation and tourism. Marine systems are home to fish and many other species.

Management can influence which services are increased and which are reduced. Obvious impacts include converting natural areas to roads or housing, or the pollution of air and water by industry. Other changes affecting ecosystem services are less obvious. For example, agricultural potential has, for centuries, depended on clearing land whilst irrigation systems increased yields. As long as ecosystems functioned well and were abundant, yields were the prime concern. Nature provided its other services abundantly and, seemingly, for free.

The figures below illustrate **three different land use intensities** for a forest landscape. A natural forest provides a wide range of different products that can be used by people. This includes timber, fuel, fruits, wild animals, fodder or litter for domestic animals, honey from wild bees, rattan or branches for making baskets or furniture, medicinal plants and mushrooms. All of these are provisioning services as they provide people with goods.

Additionally, the same forest also ensures water purification, and watershed protection, whilst evapotranspiration results in clouds that can transport rain and therefore maintain rainfall patterns far away. By providing shade, the temperature throughout the forest is moderated and the soil is protected against erosion from heavy rainfall and wind. These are examples of regulating services.

The forest is also home to many wild plants and animals – a habitat service. The diversity of plants and animals ensures that the forest can resist storms or regrow quickly after fire damage.

Figure 1.2 Land use intensity - A

Illustration by Jan Sasse for TEEB

The second illustration shows that clearing part of the forest and draining wetlands for agriculture increases the amount of food produced in the same area. Likewise, if trees are systematically planted, production is increased eg timber or fruits. However, the amount of other services provided is reduced, and less plants and animals can survive.

Figure 1.2 Land use intensity - B

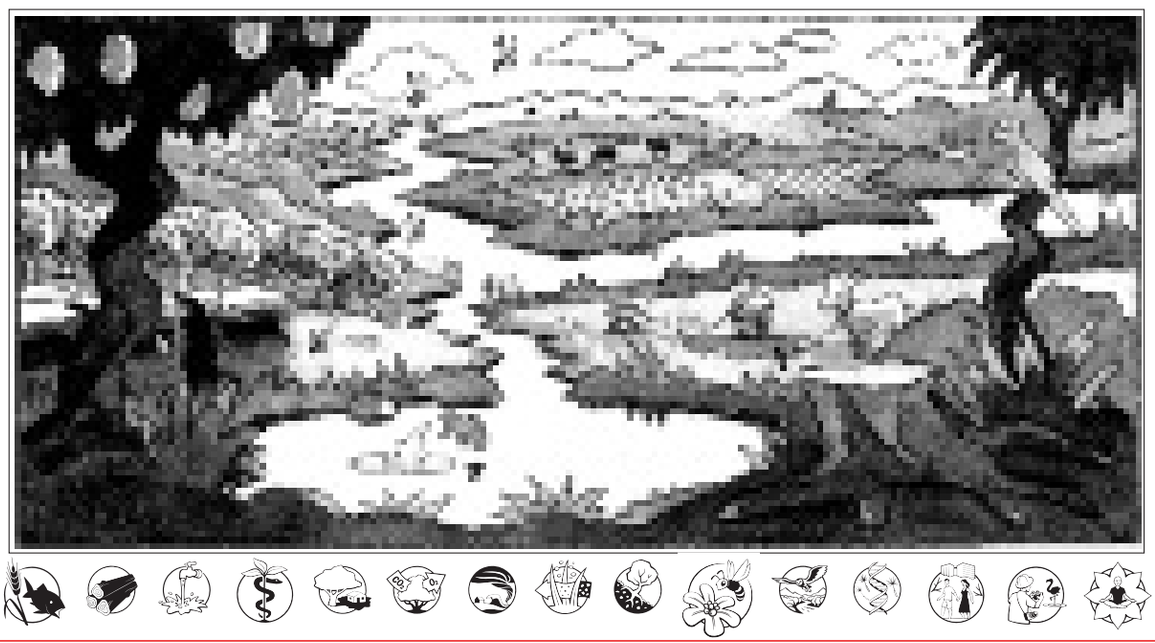


Illustration by Jan Sasse for TEEB

The final illustration shows that if land use practices maximize the yield of single services – in this case forest plantations and intensive agriculture – then other services are often greatly reduced. This can even create negative effects in neighboring areas. If soil is no longer protected by vegetation cover then it might erode into water courses, or be transmitted as dust; runoff from chemical fertilizers and pesticides can reduce water quality; and if too much forest is cut down, rainfall patterns may change – in extreme cases this can lead to extensive land degradation.

Carbon sequestration might be high in fast-growing forest plantations, however, intensive agriculture releases considerable amounts of carbon.

Figure 1.2 Land use intensity - C

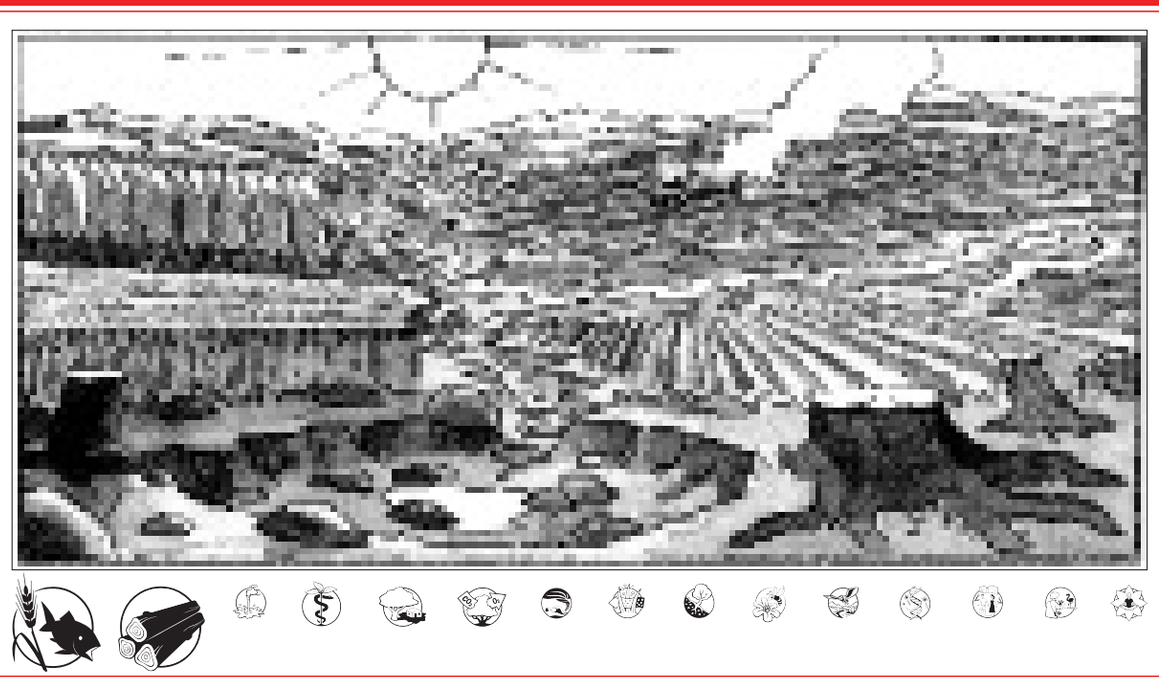


Illustration by Jan Sasse for TEEB

WHEN ECOSYSTEMS REACH TIPPING POINTS, THEIR SERVICES CAN CHANGE DRASTICALLY

Ecosystems have a capacity to adapt to change and to recover from disturbance, but when tipping points are reached they can change character – and **no longer produce certain services**. Ecosystems change naturally due to events like forest fires, diseases or natural climatic variability, all of which can influence ecosystem components and thus the flow of services. However, human impact on ecosystems is now the greatest driver of ecosystem transformation; increasing population density and changing consumption patterns can lead to air, soil and water pollution, the conversion of natural ecosystems for agriculture or mining, for urban expansion or infrastructure development. The introduction of new plant and animal species from other areas plus human-induced climate change can all lead to major changes in ecosystems and the services they provide.

These changes are often gradual, and to a certain extent plants and animals are able to adapt to them. However, if human impact exceeds the capacity of ecosystems to regenerate they can degrade or even collapse and can no longer provide the desired combination or quantity of services.

The **unsustainable use of one service (eg water) can cause the entire ecosystem to degrade leading to the loss of other important ecosystem services**. Once ecosystems are heavily damaged, restoration is very costly and takes a long time, and in some cases is impossible.

Other ecosystems are just as vulnerable. In the Amazon, tropical forest rainfall patterns can change if the forest cover is reduced to a point where not enough moisture is evaporating. The loss of the 'Amazon waterpump' would severely affect agricultural production in Argentina, Brazil and the neighboring Andean states – it would also shut down Itaipu, one of the world's largest hydropower facilities (see TEEB Foundations, Appendix 1).

In many parts of the world rising ocean temperatures have reached a critical point, causing the large-scale death of coral reefs. Mangroves are also very susceptible to pollution (from industry or shrimp farms) and to reduced freshwater inflow which increases salinity. This causes the loss of habitat for many species and of important services such as coastal protection against storm surges and sea-level rise.

Assessing ecosystem services allows us to recognize the values they provide. However, it does not tell us how ecosystems function, or when tipping points are imminent. This leads to considerable uncertainty about how far we can intensify use before causing irreversible harm. In such situations, **precaution is imperative**. In many cases, a more balanced use leads to more balanced well-being and reduces the risks of serious degradation.

WHO IS AFFECTED? LOCAL COSTS AND GLOBAL BENEFITS

Conserving natural capital is often a local task which can result in considerable financial costs though the benefits are often felt far beyond the local level.

As public goods, many of nature's services such as fresh air and clean water are provided free to everyone. As long as natural ecosystems have been abundant, little thought will have been given to their long-term sustainability. Increasing conversion of land for intensive and specialized uses, however, results in these natural services becoming scarce and therefore more costly to provide.

The reality is that intensive land use that generates commercial outputs results in greater benefits for the owner of the natural resource, compared with improving regulating services such as water provisioning or flood prevention that are freely provided to the public. Agriculture is one example.

The challenge many local decision makers face is that if they conserve nature by using it less intensively, they often provide benefits not only to their own citizens but to others beyond their local community. Watershed protection in uplands, for example, can significantly increase both water quality and quantity far downstream. Again, as long as natural ecosystems are abundant this is not an

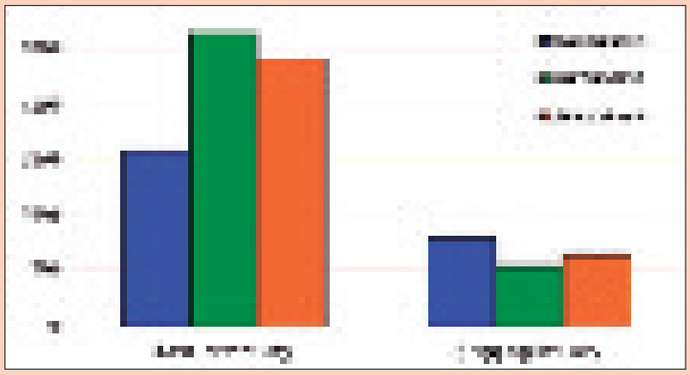
issue, but restoring degraded ecosystems can be expensive. Even if the overall benefits may outweigh these costs, there is **often no incentive at the local level to provide services to other communities if they do not share the costs**.

Local communities are best placed to bear the costs for improving conservation as well as ensuring good development practice, if the benefits provided to the regional, national – or even the global level – are recognized and rewarded. Policy measures and financing programmes are increasingly providing this kind of transfer or compensation. This can create incentives for local authorities who could conserve natural resources if they do not have to bear the costs alone.

Box 1.5 Comparing different strategies of resource use in Indonesia

Faced with rapid degradation of Leuser National Park, its Scientific Director commissioned a valuation study to compare the impact of different ecosystem management strategies on the province's potential for economic development until 2030.

The study estimated that conservation and selective use of the forest would provide the highest return for the region over the long-term (US$ 9.1-9.5 billion). Continued deforestation would cause the degradation of ecosystem services and generate a lower overall economic return for the province (US$ 7 billion).



By analyzing who would benefit and lose in each scenario, the valuation exercise clearly demonstrated that logging the tropical forest not only worked against overall economic growth and development, but provided limited financial gains to a few logging companies at the expense of hundreds of rural forest communities.

Source: Forest valuation stimulates green development policies, Indonesia. TEEBcase based on van Beukering et al. (see TEEBweb.org)

1.5 LINKING LOCAL POLICY, ECOSYSTEM SERVICES AND CLIMATE CHANGE

Why should local policy makers invest in ecosystems, if mitigating and adapting to climate change is now the most important global priority? The answer is that **climate change makes investing in nature even more important, urgent and worthwhile**. Climate change is considered to be one of the most important threats to biodiversity, and dealing with the impacts of climate change is becoming a key challenge for local policy makers. Maintaining and improving the functions of healthy ecosystems is a cost-effective strategy in mitigating and adapting to climate change.

HOW ECOSYSTEMS MITIGATE CLIMATE CHANGE

Atmospheric carbon is sequestered through natural processes; plants and trees take up carbon through the action of photosynthesis whilst the oceans soak up carbon dioxide in a dissolved form.

Ecosystems store an enormous amount of carbon: the atmosphere holds 800 gigatonnes of carbon; vegetation stores 550 gigatonnes, or nearly 70% of

atmospheric carbon; soils store up to 2,300 gigatonnes, nearly three times more than that of atmospheric carbon; and the oceans store around 38,000 gigatonnes, nearly 20,000 times the amount of atmospheric carbon (Houghton 2007). Peatlands are the most space-efficient carbon storage of all ecosystems; they cover only 3% of the terrestrial earth surface yet store 550 gigatonnes of carbon (Parish et al. 2008). The carbon stored in terrestrial ecosystems is released when ecosystems are destroyed or converted, for example into farmland, or when peat is extracted for horticulture. Currently land use is causing the loss of about 1.5 gigatonnes of carbon a year (Houghton 2007). **Avoiding the degradation and conversion of natural ecosystems therefore contributes to climate change mitigation.**

HOW ECOSYSTEMS HELP US TO ADAPT TO CLIMATE CHANGE

Maintaining nature's capacity to provide products such as food, fuel and fibre and to mitigate impacts of extreme events is critical for adapting to climate change not only because of the multiple benefits for human well-being but also because it offers cost-effective solutions.

The cost for developing countries to adapt to a 2°C warmer climate is estimated to be in the range of $ 70 billion to $ 100 billion a year for the period 2010 to 2050. Securing infrastructure, protecting coastal zones, managing water supply and flood protection account for the bulk of the expected costs. Managing water supply and flood protection offer the greatest potential for reducing costs (World Bank 2010).

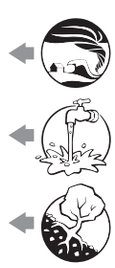
Investing in green infrastructure, like parks, wetlands and forests can provide multiple services for climate change adaptation such as help protect urban areas during heat waves and **drain storm water**. This has been strategically integrated in urban planning for **flood management** in Curitiba, Brazil and Miami, USA (TEEBcase in Chapter 6). Protecting forests also helps to secure **water supply** and to control **floods and erosion**. Quito (Box 8.3, TEEBcase) and other cities in Latin America have established water funds, which pay land-users to maintain forests for providing these services (Chapters 8). Certain natural hazards are increasing and are expected to increase in frequency and severity in the coming decades. As the example from Vietnam shows (Box 1.1), mangroves can be more cost-effective than dykes for the **protection of coastal zones**. Green areas help protect urban areas during heat waves. For further examples see Chapter 5.

Changes in temperature and precipitation will also have significant negative impacts on crop yields. **Maintaining genetic diversity** of crops can offer varieties better adapted to future climate conditions. Investing in soil fertility and water retention capacity can likewise increase ecosystems' capacity to continue to provide services under changing climatic conditions and therefore valuable for **food security** (World Bank 2010).

As climate change is expected to increase the pressure on ecosystems, safeguarding them now can considerably lower the risk of their future collapse. Anticipating the impact of climate change has two distinct advantages: protecting ecosystems today is more cost-effective than attempting to repair them after damage has occurred; and improved ecosystems can provide immediate benefits as they deliver multiple services.

A WINDOW OF OPPORTUNITY

From a policy perspective, the current debate on climate change can provide interesting opportunities. In many countries, strategies to mitigate or adapt to climate change are currently being developed or refined, and this often creates opportunities for policy change and dialogue between different agencies and actors. The investment programs set up in many countries after the financial crisis can create further opportunities to invest in protecting or restoring nature. Emerging carbon markets will also create opportunities for funding.



1.6 A 'ROADMAP' TO THE REPORT: A GUIDE FOR DIFFERENT USERS

WHAT IS IN THIS REPORT?

In Part II – The Tools : Chapters 2 and 3 we show **how ecosystem services can be assessed and valued**, in order to include them more explicitly in decision making.

Part III – The Practice: Chapters 4-9 covers those areas where local decision making plays an important role in man-agement, in planning, or by setting up or supporting new instruments such as payments for ecosystem services or certification and labelling schemes. These chapters show **how recognizing nature's services** at the local level **can lead to better development opportunities** and aid the long-term conservation of biodiversity and ecosystem services.

Part IV – Conclusion: Chapter 10 discusses **how to make it happen**; the chapter highlights some common challenges encountered in previous chapters concern-ing how to include the assessment and valuation of ecosystem services in decision-making processes.

All chapters explain how ecosystem services and biodiversity can be impacted, and they showcase examples of how to explicitly recognize these challenges in decision making. They contain tools or instruments to facilitate these tasks, and provide links to further useful sources of information. The appendix contains an overview of relevant tools for mapping and valuing services as well as databases with further case examples.

WHO COULD BENEFIT FROM THIS REPORT?

Below we highlight which chapters might be most useful for you to focus on, depending on what role you play in local development.

If you work for a **local authority**, or are a member of a city council, you will find Chapters 4-9 useful, depending on the area you are most concerned with.

If you are directly involved in preparing different decision options then Chapters 2 and 3 on tools and Chapter 10 on "how to make it happen", which includes practical questions on ecosystem assessment, will also be relevant to you.

The most relevant chapters for **regulating authorities** are Chapter 4 on urban management and municipal service provision, Chapter 5 on natural resource management, and Chapter 6 on spatial planning and environmental impact assessment. If you are also interested in assessment and valuation tools then please refer to Chapters 2, 3 and 10.

If you belong to a **sector agency** which is typically responsible for natural resource management, or are involved in extension programmes for agriculture, forestry or fisheries or are in charge of disaster prevention, then Chapter 5 will be of specific interest. You may also find Chapter 6 to be of interest since it focuses on how to better include ecosystem services in spatial planning and in environmental impact assessment.

If you are a **planner**, then Chapter 6 is directly relevant, but you might also find Chapters 4 and 5 helpful as they relate to municipal service provisioning and natural resource management. Also relevant is Chapter 7 on protected areas, and how to protect the most sensitive parts of ecosystems.

As a **citizen, NGO, resident forum or village council** member you often play a decisive role in communication, advocacy and awareness raising. Depending on the issues in your area you may find interesting examples in all chapters.

FOR FURTHER INFORMATION

Ecosystem services guides for decision makers
WRI (2008) Ecosystem Services: A guide for decision makers. This easily accessible report provides frames the link between development and ecosystem service, points out risk and opportunities and explores future trends in ecosystem services. http://pdf.wri.org/ecosystem_services_guide_for_decisionmakers.pdf

National ecosystem assessments
Chevassus-au-Louis, B. et al. (2009) Approche économique de la biodiversité et des services liés aux écosystèmes. This comprehensive report on ecosystem services and biodiversity points out policy implications and opportunities. (in French) www.strategie.gouv.fr/IMG/pdf/Rapport_18_Biodiversite_web.pdf

WRI (2007) Nature's Benefits in **Kenya**: An Atlas of Ecosystems and Human Well-Being. This illustrated report summarizes the current state and future trends of Ecosystems in Kenya. http://pdf.wri.org/kenya_atlas_fulltext_150.pdf

CONABIO (2009) Capital Natural de **Mexico**. This very comprehensive report (5 volumes) presents the current knowledge on biodiversity, the state of conservation, policy implications, and future scenarios. http://www.biodiversidad.gob.mx/pais/pdf/CapNatMex/Capital%20Natural%20de%20Mexico_Sintesis.pdf

UKNEA/UNEP-WCMC (forthcoming) **United Kingdom** National Ecosystem Assessment. Following the example of the Millennium Ecosystem Assessment the study assesses the natural capital of the United Kingdom http://uknea.unep-wcmc.org

Further regional and local ecosystem assessments from around the globe are available on the Millennium Ecosystem Assessment website www.millenniumassessment.org/en/Multiscale.aspx

Climate Change
The World Bank (2009); Convenient Solutions to an Inconvenient Truth: Ecosystem-based Approaches to Climate Change. The report highlights ecosystem-based measures of adaptation to and mitigation of climate change. http://siteresources.worldbank.org/ENVIRONMENT/Resources/ESW_EcosystemBasedApp.pdf

UNEP (2009) The Natural Fix: The role of ecosystems in climate mitigation This brochure with many figures and maps illustrates the contribution of the various ecosystems the climate change mitigation. http://www.unep.org/pdf/BioseqRRA_scr.pdf

Poverty and gender
UNDP-UNEP (2008) Making The Economic Case: A Primer on the Economic Arguments for Mainstreaming Poverty-Environment Linkages into National Development Planning www.unpei.org/PDF/Making-the-economic-case-primer.pdf

IUCN (2009) Training manual on gender and climate change. This easily accessible report provides information on gender mainstreaming in climate change adaptation; including 18 case studies. http://www.iucn.org/dbtw-wpd/edocs/2009-012.pdf Factsheets, reports and handbooks on the link between gender issues, ecosystems and climate change are available on the Global Gender and Climate Alliance website http://www.gender-climate.org/resources.html

Alkire S, ME Santos. 2010. Acute Multidimensional Poverty: A new Index for Developing Countries. OPHI working paper no. 38. Oxford Poverty & Human Development Initiative (OPHI). This academic report introduces the Multidimensional Poverty Index (MPI); incl. many graphs and figures. www.ophi.org.uk/wp-content/uploads/ophi-wp38.pdf

Option values of biodiversity
Biomimicry is an emerging discipline that studies nature's best ideas and then imitates these designs and processes to solve human problems. Inspiring examples are available at www.biomimicry.net

Identifying Policy Responses
Millennium Ecosystem Assessment 2005. Response Assessment. The Report assessed the effectiveness of various types of response options, both historical and current, examining the strengths and weaknesses of various response options that have been used to manage ecosystem services. It also identifies some promising opportunities for improving human well-being while conserving ecosystems. http://www.millenniumassessment.org/en/Responses.aspx

UNDP - United Nations Development Programme (2010) Biodiversity and Ecosystems: Why these are Important for Sustained Growth and Equity in Latin America and the Caribbean. This report examines economic trends and policy initiatives focusing on natural capital in South America (launch: September 2010)

2 CONCEPTUAL FRAMEWORKS FOR CONSIDERING THE BENEFITS OF NATURE

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Content of this chapter

Key Messages

- **You can chose.** There are a number of different frameworks available to identify and assess ecosystem services and biodiversity.
- **Make the implicit explicit.** A stepwise approach allows local policy makers to explicitly include nature's benefits in decision making.
- **Context is everything.** Decision making needs the full picture. The strengths of the Millennium Ecosystem Assessment and the Total Economic Value frameworks are that they include the broad range of ecosystem values and services.
- **It's more than what's at stake. It's who's at stake.** The Sustainable Livelihoods Approach makes the effects that ecosystems have on well-being at the local and individual level visible. This approach helps address the distribution of benefits amongst stakeholders.

"Quality of life does not only measure availability of material goods, but allows human beings a life in dignity."

Amartya Sen, Noble Prize Winner Economic Sciences in 1998

This chapter shows **how different frameworks can be used so that ecosystem services and biodiversity can be taken into account in local development**. One of the main reasons for the continued degradation of →*ecosystems* and →*biodiversity* is that the benefits of conserving them go unrecognised. Raising awareness of the benefits amongst stakeholders is important, as is incorporating local people's needs into conservation proposals.

Each framework discussed in this chapter focuses on different aspects of values and development. **Which framework** or combination of frameworks **is most useful** will depend on various factors including:

- **The policy area** (a different approach is required for land-use planning compared with the provision of better health care from medicinal plants);
- **The local context** (whether it is an urban or rural setting, or in a developing or industrialised country);
- **Institutional and social conditions** (data availability, the degree of development of the planning process and legal system).

The key objective for each of these frameworks (the added value for local policy makers), is to make benefits visible. The chapter presents a stepwise procedure for explicitly incorporating →*ecosystem services* into local decision making (2.1) and provides a broad overview of the frameworks linking them to these steps (2.2). Each framework is considered in turn: the Millennium Ecosystem Assessment; Total Economic Value; Ecological approaches and a more developmental approach. Finally, action points are suggested (2.3).

2.1 HOW TO ASSESS NATURE'S BENEFITS: A STEPWISE APPROACH

Whilst different policy contexts imply different opportunities and priorities, there are questions common to all local planning decisions:

1. What does nature provide us at the local level?
2. How valuable is this?
3. How do we evaluate these ecosystem services or value them in monetary terms?
4. Who is affected by changes in services?
5. How might those affected by these changes alter their behaviour?

The steps set out below should be treated as complementary to other types of assessments or financial feasibility studies. Other assessments might fail to record changes in ecosystem service provisioning and undervalue the key role that biodiversity and ecosystems play in delivering them.

STEPS TO INCLUDE NATURE IN DECISION MAKING

The six steps (adapted from the World Resources Institute 2008) are explained with reference to a generic example – namely a marked deterioration in water quantity and/or quality.

Step 1: Specify and agree on the problem

The first and most fundamental question is: Do the policy makers and affected →*stakeholders* perceive the problem in the same way?

The deterioration in the water quality and quantity could be the cumulative outcome of many factors impacting on local ecosystems.

- Do all stakeholders see it this way?
- Do stakeholders have enough basic understanding of hydrology and river basin management to understand the potential root causes of the problem? What are the pressures on the ecosystem?
- If the stakeholders lack understanding, can they be convinced that further, more focused assessment is required?

Whilst the answers to these questions may be 'no', it is important to appreciate that successfully implementing an ecosystem approach depends on cooperation and shared understanding and expectations.

Step 1 is likely to be coordinated by the decision maker but it may be driven forward by another stakeholder such as an environmental Non-Governmental Organisation (NGO).

Step 2: Identify which ecosystem services are relevant to the decision

A starting point is provided by the Millennium Ecosystem Assessment (MA 2005). It presents a list of ecosystem services some of which may be monetized. Broadly speaking there are two ways in which services can influence policy:

- The **policy or decision might depend upon** the provision of **ecosystem services**. For instance, the development of tourism, flower farms or agribusiness might depend on water availability and quality.
- The **policy or decision might affect** the provisioning of **ecosystem services**. For instance, a switch from extensive to intensive agriculture that uses irrigation and fertilizer inputs might affect water availability and quality downstream.

An appropriate scoping exercise in terms of both time and spatial scale is needed for Step 2. Water quantity and quality may be low today because of actions taken ten years ago, whilst actions today might have an impact ten years or more into the future. The spatial scale may be large - water availability in the Serengeti in Tanzania depends in part on the extent of deforestation in the Mao forest in neighbouring Kenya.

Step 2 is likely to be carried out by internal technical staff or external consultants.

Step 3: Define the information needs and select appropriate methods

The type of decision to be made determines the kind of information needed. Assessments of ecosystem services can differ in various ways: services to be considered, depth of detail, time horizon, spatial scope, monetization of the results, or the format of the information. The better such aspects can be defined beforehand, the easier it will be to select the method for analysis and interpret the findings. Methodologies that place a monetary value on ecosystem services are set out in Chapter 3. The question of whether or not to apply a monetary measure-of-account should not obscure the fact that a system needs to be applied to determine **how important one ecosystem service is relative to others.** Using 'money' is one way, but not the only way. An alternative approach (multi-criteria analysis) is also discussed in Chapter 3.

Determining information needs is likely to be led by the decision maker; if valuation is to be implemented, this is likely to be the domain of a technical expert.

Step 4: Assess the expected changes in the flow of ecosystem services

The key questions relating to this step are:

- To what extent is the policy or decision viable without the availability of ecosystem services? Is there a substitute and is the supply of this substitute dependable? If the water supply is required for a hydroelectric power plant, is there an alternative oil-fired generator available in the event of water shortage?
- To what extent will the policy or decision impact upon ecosystem services? What will be the expected change in ecosystem service availability? To what extent will this affect local livelihoods? If water is diverted for irrigation, what will be the effect on users downstream and how will their productivity be affected?

Ecosystems respond to changes in a non-linear way: if implementing a policy or decision, consider whether it will result in any critical 'tipping point' being passed. A relatively small increase in fertilizer may lead to a massive change in water quality if an 'algal bloom' is triggered. The biological frameworks described below can help to identify tipping points.

Box 2.1 Using a 'report card' system

WRI (2008) outline a 'report card' system which is useful for step 4. This technique involves identifying:

- The affected ecosystem services (list them);
- How much the local area depends on the provision of each service;
- Recent trends in the provisioning of each service (are they stable, decreasing, or increasing?);
- The strength of the impact of drivers (how significant have the recent cumulative impacts been? high, medium or low).

For our water example, the 'report card' responses might be:

- Regulation of water flows/waste treatment;
- High (demand from agri-business)/high (water treatment facilities incapable of dealing with increased sedimentation or pollution);
- Decreasing (water availability)/increasing (pollution)
- High (land-use change: deforestation)/high (agricultural intensification).

Even if tipping points are not reached, the supply of the ecosystem service relative to demand needs consideration, including cumulative impacts. Using 10% of available water supply for irrigation in water-rich Scotland is likely to have a lower impact than the same percentage being extracted in water-poor Cyprus.

Step 4 is likely to be carried out by analysts, consulting with stakeholders, including the decision-maker, but it could also be carried out by an NGO or local policy staff.

Step 5: Identify and assess policy options

Step 5 is the key evaluation procedure of the policy option(s). A similar report card system might be applied as in Step 4, but simply evaluating high, medium, or low may be insufficient unless the decision is relatively clear-cut. If monetization was decided upon in Step 3, this would be applied in the assessment of available options. If not, the alternative measure would be employed.

A risk assessment, as part of this step, will reflect the risks inherent in implementing different option strategies. 'Sensitivity analysis' is discussed further in the context of cost-benefit analysis in Chapter 3. A conventional SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) can also be carried out for each option.

Step 5 is likely to be carried out by either an experienced member of the local policy team or an external technical expert in collaboration with the decision maker.

Step 6: Assess distributional impacts of policy options

The final step assesses **which stakeholders are likely winners or losers from a policy proposal**. It is important for determining whether the livelihoods of vulnerable individuals or communities are being negatively impacted. Again, a score card system might be used, to establish how much each stakeholder is affected and to identify their vulnerability to this change. Do alternatives exist?

Distributional aspects relate to poverty and the impacts on the less well-off in society. This analysis should be carried out for ethical reasons irrespective of whether the poor can influence implementation.

Step 6 is likely to be carried out by an analyst with input from the decision-maker.

A summary of the steps

These **six steps** are presented with the core TEEB vision in mind: to provide an improved basis for local decision makers when considering projects and policies that impact upon natural ecosystems. According to the specific situation, some steps are more important than others. The following frameworks can provide inputs and help adapt the steps to specific needs. Taken together, adapted to local needs, and incorporated into the decision making procedures in place, **these steps are a systematic way to include ecosystem services, and thereby natural capital, in local policy**.

2.2 AN OVERVIEW OF THE FRAMEWORKS

These frameworks have been developed to better understand how →*human well-being* depends on nature and/or what is required to maintain well-functioning ecosystems.

Each of the following five frameworks has a different focus according to whether they are based on an economic, ecological or developmental approach (Table 2.1). Which framework is most relevant will depend on specific policy contexts and user requirements.

A broad distinction exists between these different frameworks based on whether they include:

1. Purely monetary values: Total Economic Value.
2. Non-monetary values: Key Biodiversity Areas; Critical Natural Capital.
3. Combination of monetary and non-monetary values: Millennium Ecosystem Assessment; Sustainable Livelihoods Approach.

It has been argued that using →*monetary valuation* of ecosystems and biodiversity buys into the very

Table 2.1 Summary of frameworks for valuing and evaluating ecosystems and biodiversity

Focus	Framework	Purpose and objectives
Socio-ecological	Millennium Ecosystem Assessment (MA)	Classifies ecosystem benefits into categories (e.g. supporting and regulating services) which can in some cases be monetized. Explicit accounting for systemic effects such as resilience.
Economic	Total Economic Value (TEV)	Conventional economic approach to valuing ecosystems in monetary terms. Considers intrinsic values, i.e. conservation for its own sake, irrespective of benefits to people. Scale of analysis is generally at the individual project-level. Does not integrate systemic issues.
Ecological	Key Biodiversity Areas (KBA)	Designates priorities for conservation, but based purely on ecological criteria. Can be used in conjunction with economic analyses but is 'stand-alone'. Links to the MA – focuses on biophysical processes.
	Critical Natural Capital (CNC)	System of prioritizing conservation and environmental protection. Based on assessment of ecological values and human pressures that affect their provision.
Developmental	Sustainable Livelihoods Approach (SLA)	A socio-cultural approach that considers capacity-building and exposure to risks. Relates to benefits and economic values but in a different way than TEV.

Box 2.2 Distributional issues: winners and losers from a conservation policy?

There are both ethical reasons and pragmatic reasons for taking distributional issues into account. For instance, is it fair to force a landowner to stop using their land so as to protect a threatened species? Such a policy may be in society's interests, but the regulatory cost burden falls solely on the landowner, whereas the environmental and social benefits are shared by all of society. If the livelihood of the landowner is affected, there is an ethical case for compensation. There is also a pragmatic case, as the landowner is likely to oppose and resist such a change if their livelihood will be negatively affected.

free-market system that is the root cause of biodiversity loss in the first place, or that sustainable management of biodiversity may well be possible without monetary valuation (see eg O'Neill 1997). A pragmatic response to this challenge is that policy makers usually have a strong preference for assessments that are expressed in monetary terms.

Another distinction between the frameworks is whether or not distributional issues are considered. A local decision maker is likely to want to know not just the overall picture, for example, the pros and cons of a particular conservation option, but also what the option means for specific stakeholders. How policy options impact on the poorer members of society is addressed in the section on 'Frameworks addressing impacts on livelihoods' below.

The Convention on Biological Diversity (CBD) has formulated a set of guiding principles called the Ecosystem Approach (Box 2.3). The principles are formulated in an abstract manner, and provide guidance on how decisions concerning ecosystems and biodiversity should be made in society. Increasingly the approach is being put into practice in different countries and this experience is available on the web.

Box 2.3 The Ecosystem Approach

The Ecosystem Approach was adopted by the fifth Conference of the Parties of the CBD in 2000 as the main framework for action to achieve its three objectives: conservation, sustainable use and fair distribution of nature's benefits.

Many governments have adopted a framework which brings together concerns for the use and for the protection of nature's goods: the Ecosystem Approach is a set of 12 principles and five operational guidelines which integrate the objectives and activities in the wider landscape, so that they are mutually supportive. Instead of focussing on single goods (eg fish) and relying on one type knowledge only (eg fish stock assessments), the Ecosystem Approach examines the functioning of the entire system (eg coastal ecosystem), and to consider human beings and their knowledge as part of that system (eg fishing communities - their needs, rules and practices). This approach emphasizes adaptive management to overcome fixed sector perspectives as well as participatory decision making rather than a top-down model.

Local authorities can benefit from the ecosystem approach. It goes further than just analysing service flows. A focus on ecosystem services orients attention to the connections between the natural assets and the social system and can thus help to make best use of ecosystems in local development.

For guidance on how to apply or implement the Ecosystem Approach consult

- the IUCN manual for implementation: The Ecosystem Approach, Five steps to implementation (data.iucn.org/dbtw-wpd/edocs/CEM-003.pdf),
- the CBD Beginners Guide (www.cbd.int/ecosystem/sourcebook/beginner-guide)
- and the CBD collection of case studies where the Ecosystem Approach was applied (www.cbd.int/ecosystem/cs.shtml)

Figure 2.1 Linkages between ecosystem services and human well-being

Source: MA 2005, page VI

THE MILLENNIUM ECOSYSTEM ASSESSMENT

The Millennium Ecosystem Assessment (MA) framework was launched by UNEP in 2003. The MA describes the linkages between ecosystem services and how these impact on →*human well-being* and →*poverty* (MA 2005). The linkages are illustrated in Figure 2.1, which shows that ecosystem services directly affect human livelihoods and that we affect the amount of ecosystem services available by our socio-economic choices.

The way in which ecosystem services provide 'useful things' is illustrated in Figure 2.2. Local decision makers act under resource constraints and conservation policy options often need to be justified on the basis of 'usefulness'. Many people benefit from the 'useful things' that ecosystem services provide without realising it. They may be willing-to-pay (WTP) for some services or may already implicitly be doing so, for example, government-funded projects that are paid for through taxation. If an assessment framework can be used to make people aware of these benefits, then it is more likely that they will be taken into account in decision making.

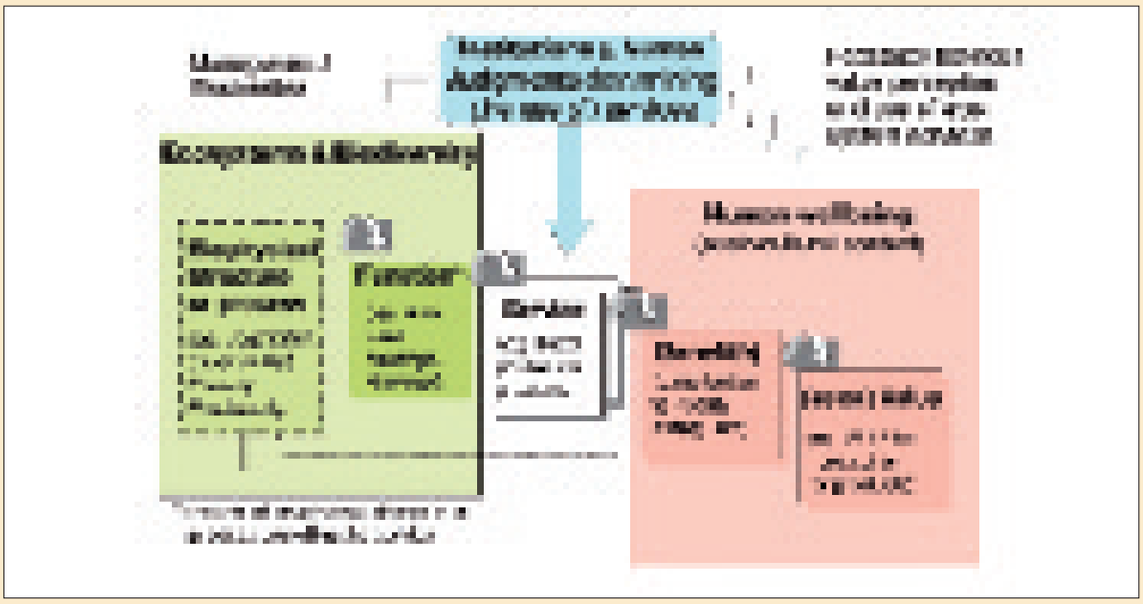
What we focus on in this report is the **level of ecosystem service** in Figure 2.2, which provides the benefit to human well-being that has a value which may or may not be recognised and expressed. We should also be aware that the service of say 'cereal provisioning' which is then consumed by humans depends upon the function of 'biomass production' which in turn depends upon the underlying biophysical structure of 'primary productivity' depending on fertile soil, water, and plants.

A detailed case study application using the ecosystem service approach proposed by the MA to assess marine ecosystems in the UK is outlined in Chapter 3; an economic analysis was conducted and the high values identified resulted in the designation of marine protected areas.

TOTAL ECONOMIC VALUE

Both the MA framework and the Total Economic Value (TEV) framework are similar in that they are both concerned with 'human endpoints', in other words what affect nature has on our well-being. The difference is nuanced: TEV focuses almost exclusively on economic

Figure 2.2 The TEEB pathway from ecosystems and biodiversity to human well-being



Source: TEEB Foundations 2010, Chapter 1

endpoints that can be measured in monetary terms (the 'human well-being' box in Figure 2.2).

The TEV framework presents **categories of ecosystem benefits** which fit into a standard economic frame of reference. It is the dominant framework for analysis of monetized benefits from ecosystems. Its strength is that all benefits that humans obtain from nature and even the value of nature in its own right (the intrinsic value) can be captured by one of the subcategories used in this approach. All inputs to the framework are required to be in quantitative monetized terms and are therefore directly comparable. A weakness is that any benefits from conservation that cannot, or should not, be monetized are easily sidelined and forgotten. TEV contains different categories of benefits or values which are outlined below:

- **Direct use value:** The value derived from the direct extraction of →*resources* from the ecosystem (fuelwood), or the direct interaction with the ecosystem (recreational use).
- **Indirect use values:** Those values that support economic activity. For instance, the watershed protection function of a forest leads to improved water quality which might in turn affect a flower grower downstream. There is a clear link here with the potential for Payments for Ecosystem Services discussed in Chapter 8 (see also TEEBcase Water fund for catchment management, Ecuador).
- **Option use values:** Preserving an ecosystem or biodiversity so that its direct and indirect use values can be potentially 'consumed' in the future. Such a value may be placed on avoiding species extinction in wild variants of commercially-grown crops as this genetic diversity may be valuable in the future.
- **Non-use values:** These values differ fundamentally from the other value-types as they are not linked to economic activity, either directly or indirectly. Non-use values are also termed 'existence values' and refer to conservation for its own sake. For instance, we may value polar bears just because they are living creatures that we share the earth with and feel that we have a moral duty to preserve the habitats that support them.

The total economic value of an environmental asset is the sum of the different value categories.

TEV is a useful approach even if we cannot determine monetary values for all the categories of benefit. Having a monetary value for only some of the benefit categories may be enough justification for choosing a conservation option over a more resource-exploitative alternative. In most cases, a partial monetization is

more likely, more feasible and quite possibly less risky. By less risky we mean that any analysis must be credible if stakeholders are to accept its findings. For a more detailed discussion of TEV and how to best apply it to biodiversity and ecosystem services see TEEB Foundations (2010, Chapter 5); on valuation methods see Chapter 3, this volume.

ECOLOGICAL APPROACHES

The term 'ecological approaches' may be misleading as it implies that other approaches do not have a clear ecological dimension. We use this term because the following approaches clearly prioritize ecological values, and are not designed in a way that economic values can easily be assessed. Rather the focus is on identifying areas that are valuable from an ecological point of view. The two approaches discussed below can be thought of as 'ecological stock-taking' and can support step 4 above: assessing the expected changes in the flow of ecosystem services.

Key Biodiversity Areas

The Key Biodiversity Areas Approach (KBA) is a rapid assessment methodology that identifies local areas which are globally important for species conservation. Areas are classified using simple and standardized criteria including references to a species' status and distribution. These criteria address the strategically important issues of →*vulnerability* and irreplaceability (Langhammer et al. 2007).

Some existing initiatives include Birdlife International's Important Bird Areas program and Important Plant Areas run by Plantlife International in collaboration with IUCN.

Critical Natural Capital Approach

Natural capital is a general term for the stock of natural resources; hectares of forest or litres of freshwater, for example. As we produce and consume products of natural capital, it is an input to the production process. In some cases we may think we can find substitutes for natural capital, using plastic instead of wood to make a chair, for example, but plastic itself is a product of natural capital – petrochemicals.

Critical Natural Capital (CNC) differs from other types of natural capital in that it performs important and irreplaceable ecosystem services that cannot be substituted (Chiesura and de Groot 2003). An example of CNC is the ozone layer. Were we to lose or severely deplete the ozone layer, as might have happened but for the 1989 Montreal Protocol, it is difficult to conceive of a viable technological-fix that might perform its functions. Whether we categorize a type of natural capital as critical depends on its importance and the degree of threat. There are at least six domains under which natural capital is evaluated as critically important: 1) socio-cultural, 2) ecological, 3) sustainability, 4) ethical, 5) economic and 6) human-survival.

An important issue to consider here is →*resilience*, as CNC does not only refer to global issues like ozone protection. Diverting a river in order to build a dam and allow irrigation might mean that an ecosystem downstream cannot be preserved in its current form – it is not resilient to the change and there would be irreversible damage. Depending on the context, the river might be considered to be a form of CNC (Brand 2009). There may also be critical areas for species survival or the functioning of a particular ecosystem so that it can continue to provide its services (Box 2.4).

Box 2.4 Critical value – restoration of salmon habitats, USA

Investment in restoration of two acres of salmon habitat in North Wind Weirs proved critical. The decision makers' options were either to convert the prime location to industrial use, or to conserve and restore critical salmon habitat.

A simple analysis of the direct costs and benefits on-site showed that the option of restoring habitat did not break even. However, the off-site impacts, in particular the critical nature of this area for salmon restoration throughout the entire catchment, make this option a 'bargain'. Treating these two acres as the constraining factor in restoration efforts, it would be worth paying up to US$ 47 million per hectare to secure the restoration. Although the opportunity cost of the land is potentially high, the area is argued to be critical natural capital. Industry could be located elsewhere, whereas salmon habitat must be situated where freshwater meets tidal salt water.

Source: Batker et al. 2005

FRAMEWORKS ADDRESSING IMPACTS ON LIVELIHOODS

Both the MA and TEV frameworks assess policy impacts at a societal level, and operate on the premise that policies aim to maximize social well-being. However the impact of an ecosystem change can have a very different impact on an individual or on different groups within society.

Any policy change, even one that is 'clearly' good for society, is likely to leave some people worse off. Securing land tenure for farmers, for example, may lead to a more →*equitable* society; improve the health of the ecosystem as the farmers now have a stronger incentive to take care of the land and increase income levels. However, the former landowner is unlikely to be as well off as before the change. There is therefore a 'loser'. Virtually all policy options will have both winners and losers.

Changes in the environment may involve **tradeoffs between individual versus community strategies**. It may well be sensible for community to adopt a policy which leads to a few years of poor harvest, if it is compensated by years of plenty. If reserves can be stockpiled, or the poor harvest dealt with in some other way, this may be a good strategy. An individual may, however, be risk-averse and rationally prefer a lower average harvest yield with fewer annual fluctuations.

The frameworks discussed in this section provide a better understanding of the impact of policies on local livelihoods. They focus on how a policy proposal might impact different →*stakeholders* and how they might respond. The frameworks are particularly useful for assessing distributional impacts of different policy options (step 6 above).

Sustainable Livelihoods Approach

The Sustainable Livelihoods Approach (SLA) is a way of looking at how an individual, a household or a community secures its well-being over time (Serrat 2008; Carney 2002). 'Livelihood' in the context of the SLA is made up of the capabilities, the assets (stores, resources, claims and access) and activities required for day-to-day living. It not only takes account of monetary income but also the other forms of capital that people have access to, including:

- **Natural capital** (environmental resources such as rights to access a freshwater stream);
- **Economic capital** (cash and economic assets, such as privately-owned pastureland);
- **Human capital** (animal husbandry skills, knowledge of local market conditions, physical ability, traditional knowledge);
- **Social capital** (family, neighborhood or other social networks and associations such as a local micro-finance project).

What makes livelihoods sustainable or not, depends on their vulnerability, i.e. the degree to which an individual or population is affected by a shock or the seasons. The level of resilience is their ability to cope and withstand the shock.

Box 2.5 Shocks versus seasonal trends

Seasonal shifts can mark changes in economic activity, human and livestock health, price of goods, migration patterns and social activities. Shocks can be natural disasters such as tsunamis or locusts, but can also include economic shocks, conflict and other factors. Shocks differ from seasonal trends. Seasonal trends are more predictable and not one-off events. There are year-to-year variations in terms of seasonal trends such as if and when the monsoon rains come to the Indian sub-continent. Shocks are in some senses 'predictable' in that we might have some idea of their frequency, if not exactly when they will occur. For instance, climate change science tells us that there are likely to be more devastating storms in the future but science cannot predict exactly when these events will occur.

Source: Krantz 2001

The key questions are: How probable are shock and seasonality effects? Can they be dealt with? **Do policies have impacts on livelihoods by providing additional income, or by decreasing the influence of seasonality, or by increasing social capital?**

- Instruments to achieve this include Payments for Ecosystem Services (PES).

Table 2.2 Links between Ecosystem Services and the Sustainable Livelihood Approach outcomes

Description	Ecosystem Service	Outcome in terms of livelihood
Food supply: Ecosystems can provide food directly eg from agricultural land, or indirectly, eg mushrooms or berries from forests or fodder for livestock.	Food	Food security
Health: Intact ecosystems with high biodiversity can reduce the incidence of diseases.	Biological control	Well-being, resilience
Clean drinking water: In many parts of the world rural people depend directly on freshwater lakes and indirectly on soil structure and quality which, in turn, regulates this supply of freshwater.	Freshwater	Well-being, resilience
Clean air: Some ecosystems can mitigate the effects of air pollution which can, in turn, impact on crop productivity.	Air quality regulation	Well-being, food security
Fuelwood: Many people, especially the poor, rely on fuelwood for cooking and keeping warm.	Raw material	Well-being

The majority of the poor directly depend on natural resources and ecosystem services for their livelihoods. They do not have the ability to use technology to create these services or import them from elsewhere. The SLA framework allows local policy decision makers to define policy options in terms of how they affect local livelihoods. The evaluation of ecosystem services may initially seem somewhat detached from the framework, but in fact, it is inherently inter-linked. Some of these linkages are outlined in Table 2.2 and describe what ecosystems provide.

Identifying who depends on the provision of ecosystem services can help to prevent unintended impacts of development. **This analysis can also potentially identify** additional income streams.

Entitlement Approach

The entitlement approach focuses on **individuals' entitlements to goods and services** that affect their livelihoods. Entitlements are determined not only by stocks of capital, as illustrated by the SLA approach - natural, economic, human and social - but also by market conditions. →*Poverty* is determined not just by productive capacity, but also by what the outputs are worth in terms of what they can be exchanged for.

In his analysis of the Bengal famine of 1943, Amartya Sen found that the devastating effects on livelihoods were caused not by a lack of available food but by market conditions. In the Bengalese case, Sen argues that the opportunism and profiteering of speculators in the commodity markets meant that market conditions created the famine as the poor were unable to pay for food. Those who relied on earning wages to buy food on the open market found that the purchasing power of their wages was reduced catastrophically over a very short period of time (Sen 1981).

There is a clear link to the →*'provisioning' service* in the MA framework but the Entitlement Approach and its link to sustainable livelihoods goes further, although there are also critical reflections on the approach (Devereux 2001).

Property Rights

A further concept useful to analyze who derives what benefits from ecosystem services and thus to analyze different policy options for local development affecting ecosystems and biodiversity are →*property rights*. It is important to distinguish that there is **a bundle of different rights** meaning that someone may have the

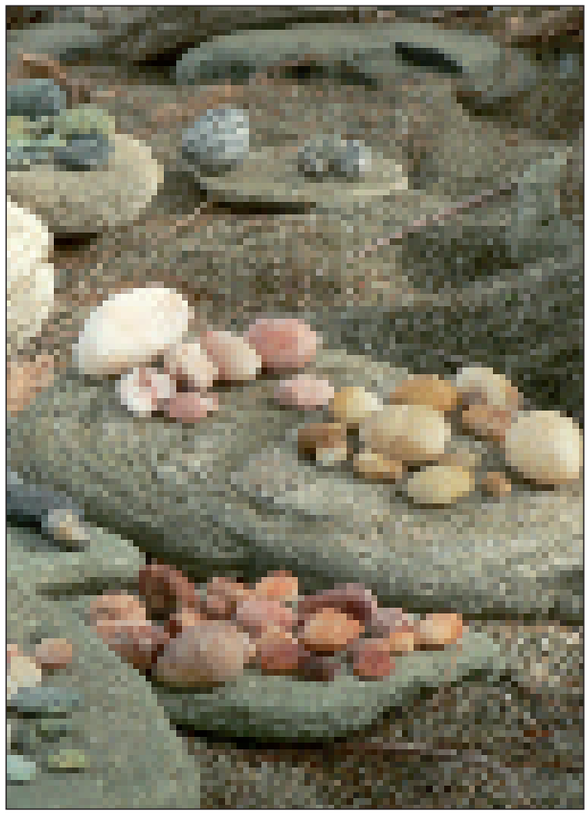
right to the benefit, for example be allowed to collect wild products from a forest while not having the right to manage the same forest or legally own the forest. When assessing different policy options it is therefore useful to carefully analyse who hold what rights to ecosystem services and how these individuals or groups might be affected. (For more detail on property rights, see Apte 2006 or TEEB in National Policy 2011, Chapter 2).

2.3 ACTION POINTS

This chapter has focussed on the complementary frameworks that local decision makers can use to manage changes in ecosystems. Each of the frameworks applies a slightly different perspective but there is a consistent thread: ecosystems and biodiversity provide benefits to humans; many of these benefits impact at the local level; many are highly tangible even if the market fails to place a price on them. Unless we consider a systematic framework for reviewing these benefits, some categories of benefits will not be accounted for and the 'wrong' decisions will be made.

We suggest the following actions:

- The ecological frameworks represent the ecologist's priorities and perspectives; TEV the economist's; SLA the development planner's; whilst the MA is a generalist approach. **Which one suits your decision-making scenario?**
- One course of action is to **begin by using the MA ecosystem service categories**. Then consider whether developmental, ecological and economic issues are covered adequately in your analysis and supplement the MA framework accordingly.
- All local policy decisions are carried out under some form of resource constraints. **What constraints do you face?** Can you apply the stepwise approach to the policy issue as outlined in section 2.2? Even if the analysis is less detailed than it might be under ideal non-resource-constrained conditions, is it worth carrying out some form of assessment?



The concept of Ecosystem Services helps to break down and sort the complexity of Nature in a way relevant to your policy decisions.

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FOR FURTHER INFORMATION

How to consider ecosystems in development

World Resource Institut (2008) Ecosystem Services: A guide for Decision Makers. The succinct user-friendly report uses non-technical language to describe how to integrate ecosystem services in decision making along the 'story' of a hypothetical decision in 'Rio Grande'. http://pdf.wri.org/ecosystem_services_guide_for_decisionmakers.pdf

Millennium Ecosystem Assessment (MA) (2003) Ecosystems and Human Well-being: A Framework for Assessment. Chapter 7: Analytical Approaches. This part of the MA – more academic in nature and tone – deals (very thoroughly) with frameworks for assessment.http://www.millenniumassessment.org/documents/document.305.aspx.pdf

Understanding what the ecosystem services are and how they fit together

Millennium Ecosystem Assessment (MA) (2003) Ecosystems and Human Well-being: A Framework for Assessment. Chapter 2. Ecosystems and Their Services. This brief introduction (22 pages) provides basic information on the ecosystem services approach. http://www.millenniumassessment.org/documents/document.300.aspx.pdf

Millennium Ecosystem Assessment (MA) (2010) Ecosystems and Human Well-Being: A Manual for Assessment Practitioners. This 'how to' guide assists practitioners with first experiences from the 2005 MA.

An introduction to ecosystem services, further publications and case studies are available at the Defra-funded (UK government) portal www.ecosystemservices.org.uk

Understanding the conventional economic perspective – Total Economic Value

Pearce and Moran (1994) The economic value of biodiversity. IUCN. An academic – but nonetheless accessible – book on the value of nature. http://www.cbd.int/doc/external/iucn/iucn-biodiversity-value-1994-en.pdf

Secretary of Conventional on Biological Diversity (2007) An exploration of tools and methodologies for valuation of biodiversity and biodiversity resources and functions Technical Series No 28. The comprehensive report on valuation methods and decision making includes 13 case studies. http://www.cbd.int/doc/publications/cbd-ts-28.pdf

IIED (2006) Pastoralism: drylands' invisible asset? Issue paper no. 142. This easy accessible report illustrates the development of an assessment framework and presents the Total Economic Valuation method using the example of pastoralism in Kenya. http://www.iied.org/pubs/pdfs/12534IIED.pdf

Understanding developmental perspectives

Information on the Sustainable Livelihoods Approach (SLA) as well as related case studies and a toolkit can be found at IFAD website www.ifad.org/sla/index.htm.

Krantz, L. (2001) The Sustainable Livelihood Approach to Poverty Reduction. Along the issue of poverty reduction the various approaches to the SLA are presented and strengths and weaknesses are pointed out. www.catie.ac.cr/CatieSE4/htm/Pagina%20web%20curso/readings/krantz.pdf

3 TOOLS FOR VALUATION AND APPRAISAL OF ECOSYSTEM SERVICES IN POLICY MAKING

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Content of this chapter

Key Messages

- **It's time to acknowledge what we do.** We commonly make decisions that implicitly involve trading off nature protection against the production or consumption of marketed goods.
- **Nature often does not have a market price but 'priceless' isn't the same as 'worthless'.** Financial appraisal often implicitly assumes that ecosystem services are 'free', making nature's benefits invisible. Monetary valuation explicitly values ecosystems and biodiversity so that their services (and the loss of them) can be taken into account by decision makers.
- **It's worth it.** Ecosystems are complicated. Fortunately, however, many tools have already been developed, and the rationale for using them is simple: a considered (and comprehensive) valuation of ecosystem services benefits everyone – from industry, to fisher, to farmer, to citizen.
- **Use the right tool for the job.** There are a variety of environmental valuation tools available. They vary in terms of their complexity, underlying assumptions and reliance on resources. Cost Benefit Analysis (CBA) is a widely-used performance yard stick that uses valuation estimates. Multi-criteria analysis (MCA) and Participatory Appraisal (PA) do not require monetary valuation. They are designed to help decision makers integrate complex actions and multiple opinions into a single framework.
- **If nature is valuable, input in invaluable:** There is a diversity of experts – from village leaders to scientists to analysts. Every participant has something to offer. The frameworks presented in this chapter offer tools for listening – tools for translating complicated and divergent expertise into success at grass-roots level.

"A cynic is a man who knows the price of everything and the value of nothing."

Oscar Wilde

This chapter's aim is to present several methodological tools for balancing the ambitions of development and conservation. It begins with an overview and rationale for placing monetary values on ecosystem services and biodiversity (sections 3.1 and 3.2). It presents an overview of different analytical frameworks such as Cost-Benefit Analysis (CBA) and Cost-Effectiveness Analysis (CEA) to which non-market values can be applied (3.3). Finally, the chapter discusses tools and frameworks for decision making that do not rely primarily on monetized values; we focus on participatory approaches to project evaluation as well as multi-criteria analysis (3.4).

The intention of this chapter is to present options; it is not a 'how to' manual. Many aspects are complicated and controversial. The aim is to present a snapshot of the key framework features, not to assess the controversy or explain the finer details. For greater detail and strategies for implementation, an annotated bibliography is included at the end of the chapter.

3.1 THE RATIONALE FOR VALUING ECO-SYSTEM SERVICES AND BIODIVERSITY

This section presents valuation methods. In essence, it describes methods for putting a 'price-tag' on services that nature provides. The underlying premise of non-market valuation is that, despite a lack of market, the flow of ecosystem services affects our well-being in many ways. The main reason for applying valuation is that if we fail to value these services, the economic systems we rely on will remain biased toward ecosystem degradation and over-exploitation.

Of course, pricing such commodities is often challenging. For this reason, there are many different methods – accompanied by debate over their effectiveness and applicability. While the inherent value of ecosystems services is uncontested, placing a monetary value on ecosystems and biodiversity may be controversial for three broad reasons:

1. It is deemed **unethical**;
2. **Less biodiversity** may be conserved;
3. **There is no price** – for a good reason.

These concerns are valid. The monetary valuation of nature takes place for pragmatic reasons: it is necessary to avoid placing an implicit value of $0 on ecosystem services that are essential to our well-being. Since transactions in the market generally take place in a monetized domain, a decision not to value nature in monetary terms for **ethical** reasons can imply that it has no value – rather than being 'priceless', it is 'worthless.' Furthermore, we often make decisions that involve trading the benefits of nature for the benefits of production and consumption. Marketed goods have a monetary value and can be traded. We may even trade more valuable ecosystem services for less valuable marketed goods; for instance, deforestation creates a marketed income from timber sales but might reduce flood protection.

Another concern is that placing a value on a particular site may imply that the site is 'for sale.' As a consequence **less biodiversity may be preserved**. If a conservation site has a monetary value, a developer can buy it. Putting a price on ecosystem services makes them marketable. While this is a valid point, this scenario is likely to occur much less frequently than the alternative, that is, an essential ecosystem service is traded for nothing, with an implicit price of $0. Typically, placing a monetary value on ecosystem services supports conservation and avoids destructive extraction, which eventually incurs economic costs.

Concerns raised over **whether or not it is possible to arrive at a Dollar figure** for nature's services have some validity. If we're just estimating the value, how can we know that our estimate is right? Most ecosystem services are not directly traded and thus do not have a 'true' price. Further, when a service is traded, we don't have foolproof mechanisms for evaluating whether it was traded at the 'right' price.

Non-market valuation responds to these concerns by 'mimicking' what would happen if there were a market. These methods are outlined in the following section.

3.2 VALUATION METHODS

Environmental valuation methodologies have developed markedly in the last two decades. While there are detractors, **valuation may play an increasing role in policy making**. Valuation methodologies are typically presented in typologies (groups). Some methods work better for some services. This chapter broadly appraises whether a given method requires statistical analysis (including software and trained people). In some cases, the best option may not be feasible: resource constraints may limit the choice of valuation methods. Another constraint, considered throughout, is the appropriateness and limitations of certain methods for given ecosystem services. This section presents and discusses the pros and cons of each method. Valuation methods can broadly be split into 6 categories, as in Table 3.1.

MARKET PRICES

Certain ecosystem goods and services have a market. Timber and fish, for example, have economic values that can be calculated with little statistical analysis. Markets for less tangible ecosystem services are also emerging, such as mitigation of greenhouse gas emissions.

Most ecosystem goods and services, however, do not have readily observable market prices. When they are available, they may be either undervalued or distorted. Distortions in the market (subsidies, price regulations, taxes) may produce incorrect values which must be accounted for in an effective valuation analysis.

Table 3.1 Comparison of valuation methods

Group	Methods	Summary	Statistical analysis?	Which services valued?
1. Direct market prices	Market prices	Observe market prices	Simple	Provisioning services
2. Market alternative	i. Replacement costs	Finding a man-made solution as an alternative to the ecosystem service	Simple	Pollination, water purification
	ii. Damage cost avoided	How much spending was avoided because of the ecosystem service provided?	Simple	Damage mitigation, carbon sequestration
	iii. Production function	How much is the value-added by the ecosystem service based on its input to production processes?	Complex	Water purification, freshwater availability, provisioning services
3. Surrogate markets	i. Hedonic Price Method	Consider housing market and the extra amount paid for higher environmental quality	Very complex	Use values only, recreation and leisure, air quality
	ii. Travel Cost Method	Cost of visiting a site: travel costs (fares, car use etc.) and also value of leisure time expended	Complex	Use values only, recreation and leisure
4. Stated preference	i. Contingent valuation method	How much is the survey respondent willing-to-pay to have more of a particular ecosystem service?	Complex	All services
	ii. Choice experiments	Given a 'menu' of options with differing levels of ecosystem services and differing costs, which is preferred?	Very complex	All services
5. Participatory	Participatory environmental valuation	Asking members of a community to determine the importance of a non-marketed ecosystem service relative to goods or services that are marketed	Simple	All services
6. Benefits transfer	Benefits transfer (mean value, adjusted mean value, benefit function)	'Borrowing' or transferring a value from an existing study to provide a ballpark estimate for current decision	Can be simple, can be complex	Whatever services were valued in the original study

Source: own representation

While in many ways this method is the most appealing, alternate valuation techniques usually need to be used. Often, market prices are not available.

MARKET ALTERNATIVES

When direct market prices are not available, indirect market prices may be. Valuation based on market alternatives can take three forms:

1. **Replacement cost:** What does the alternative cost? (The value of fish habitat can be determined by measuring the cost of artificial fish breeding and stocking programs);
2. **Damage costs avoided:** What protection is being provided by ecosystems, and what is this protection worth? (A healthy mangrove forest protects against storm damage. What would be the costs of damages if the mangrove didn't exist?);
3. **Production function:** If nature is providing inputs to production, what are the monetary implications of changing the quantity or quality of these inputs? (Changes in land-use practices may alter the flow of ecosystem services).

The underlying premise of the **replacement cost** method is that replacement costs can be used as a proxy for the value of ecosystem services. Services provided by healthy ecosystems 'for free' might be replaced by human-engineered alternatives. The value of ecosystem services is estimated based on the cost of replacing them. This method is particularly useful for valuing services that have direct manufactured or artificial equivalents, such as coastal protection or water storage and purification.

This method is relatively easy to apply and does not require complicated data analysis. Its limitation is that it is often **difficult to find human-made equivalents** for 'natural' services. Because this method is based on hypothetical choices (or preferences), it may result in an overestimation of value (see TEEB Foundations Chapter 5).

Ecosystems protect economically valuable assets. The **damage costs avoided** method uses quantifiable costs and scales of damages to price ecosystem benefits. This approach identifies the extent to which an ecosystem's protective services would change due to a proposed or business-as-usual scenario.

Box 3.1 Replacement costs in Fynbos biome wetlands, Western Cape, South Africa

Wetlands purify wastewater and retain nutrients. Wetlands buffer much of Western Cape province's industrial and domestic waste. Waste passes through the wetlands before being discharged into water bodies. A replacement cost approach was used to estimate the value of the wetlands' services. This involved quantifying the removal of pollutants by the wetlands and estimating the equivalent cost of performing this service with treatment plants.

The results of a valuation estimated the average value of the wetlands' water treatment service to be US$ 12,385/ha annually. The values are high enough to compete with alternative land uses.

Source: Wastewater treatment by wetland, South Africa, TEEBcase based on Turpie et al. (see TEEBweb.org)

If mangroves protect shores from erosion, shore protection benefits may be measured by calculating the monetary value of damages avoided. This method applies to situations where it is possible to avoid damage costs. It has the advantage of using tangible data – and the cost of damages are often more apparent to the public than benefits.

Production functions outlines how a marginal change in the management of an ecosystem, for instance changing a land use, will alter the provision of ecosystem functions and ecosystem services that can then be valued. This alteration is measured in order to value the services. For instance, blasting a coral reef alters coastal protection services. To arrive at a monetary value, this method requires identifying a link between a change in ecosystem management and ecosystem function. This method is complicated. In the above case, evaluation requires an understanding of hydrology and ecology – not just economics.

SURROGATE MARKETS

In the absence of clearly defined markets for ecosystems services, surrogate markets can be used to ascertain value. People's preferences and actions in related (surrogate) markets are measured to determine

Box 3.2 Mangrove rehabilitation: Damage costs avoided in Vietnam

Every year, an average of four typhoons and many more storms wreak havoc on Vietnam's coastline. A system of sea dykes has been established behind mangroves. Rehabilitation of the mangroves protects the sea dyke and helps avoid sea dyke maintenance expenses. Generally, the larger the mangroves stand, the more damage costs are avoided. Mangrove stands provide a physical barrier that dissipates wave energy. They also stabilize the sea floor and trap sediment.

In financial terms, the planning and protection of 12,000 hectares of mangroves cost Vietnam around US$ 1.1 million. The cost of dyke maintenance, however, has been reduced by US$ 7.3 million annually. In addition, a typhoon (Wukong) in October of 2000 damaged three northern provinces but did not damage the dykes behind regenerated mangroves. For this reason, there were no deaths inland.

Source: Mangrove rehabilitation for coastal protection, Vietnam, TEEBcase based on World Disaster Report (see TEEBweb.org)

the value of the ecosystem service in question. Two common valuation methods are:

1. **Hedonic price method:** The price of a marketed good relates to its services and characteristics;
2. **Travel cost method:** How much people are willing to spend to travel to and use a given ecosystem service (such as a park) reflects how much the service is worth.

The **hedonic price method** commonly uses the real estate market as a surrogate market. The price of a house with a view of the ocean is likely to cost more than the same house with a view to a landfill site. In theory, the hedonic price method **identifies how much of a price differential is due to a specific environmental attribute**. Once this price differential is determined, it is used to obtain willingness-to-pay for a particular environmental attribute.

This method is useful when there are obvious and direct correlations between the value of a marketed good and its surroundings. The price, however, may also depend on several non environmental factors (for example, crime rates, amenities). Hedonic valuation tends to require significant data collection, data handling and statistical analysis. Generally, it requires a large sample and complex analysis to isolate and analyze the economic effect of a single ecological service.

The **travel cost method** (TCM) uses data from visitors to determine the value of an area's ecosystem services. The underlying principle is that there is a direct **correlation between travel expenses and a site's value**. This method uses questionnaires to determine who visitors are (how old they are, where they come from); how much they spend (to get to the site, to get into the site, while they're there); what their motivations for visiting are; and how often they visit. This information is used to estimate the demand curve. The quantity demanded is expected to decrease as price increases.

Estimating the 'true' cost of travel can be difficult (should the calculation include wear and tear on cars? What costs do people actually report?) and the method places a numerical value on leisure time. While most people would agree that leisure time is inherently valuable, measuring it in terms of foregone income is controversial. This method has limited use beyond valuing recreational sites. It is dependent on a relatively large data set and requires both time and complex statistical modeling.

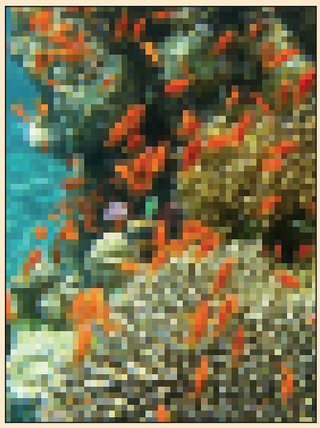
STATED PREFERENCE

This method can capture cultural and spiritual values. Stated preference methods evaluate people's preferences and choices to determine 'willingness-to-pay' for services that are difficult to place a monetary value on. Why people choose or prefer what they do is complicated. Stated preference valuation, as a consequence, is also complex. There are two broad categories:

1. **Contingent valuation** method (CVM): Respondents place values on hypothetical environmental

Box 3.3 The recreational value of coral reefs in Hawaii

Some 200,000 divers and more than 3 million snorkelers enjoy the Hawaiian reefs every year. They pay a substantial amount to admire the state's unique marine life, supporting a large aquatic tourist industry which benefits the rest of the economy.



A TCM valuation study revealed that the total benefit associated with the reef was estimated at around US$ 97 million every year.

Approximately 450 people were surveyed (face-to-face, on-line) using a questionnaire that first outlined the causes of the current decline in the health of the reef and how it could be improved.

Tourists were categorized into 14 different zones based on travel distance from the Hawaiian coral reefs. Travel costs were estimated, considering the costs of transportation, local expenditures, and costs related to travel time. Respondents filled in travel and local spending amounts in the survey. To estimate the value of costs related to travel time, a value of 1/3 of respondents' wage was used.

Source: Recreational value of coral reefs, Hawaii, TEEBcase based on Cesar and Beukering (see TEEBweb.org)

changes. For example, they are asked what they would be willing to pay to maintain a forested area or what they would be willing to accept as compensation for its loss.

2. **Choice Modeling:** Respondents choose preferences. Instead of determining willingness-to-pay, people chose between different situations. Given a 'menu' of options with differing levels of ecosystem services and differing costs, which is preferred?

In **contingent valuation**, a detailed description of an environmental change is presented to a group of respondents who answer a series of questions. The valuation attempts to ensure that the group is 'representative' (i.e. the characteristics of the sample – gender, income, education levels etc. – is representative of the wider population) and that certain known biases are avoided. Biases arise because what happens in the 'real' and 'hypothetical' world may be quite different. **What a person would hypothetically pay** to preserve a national park might be very different from what a person would actually pay. The challenge for CVM is to ensure that respondents give realistic willingness-to-pay (or willingness-to-accept) estimates.

Another challenge is making sure that respondents understand what is at stake. A respondent may be asked to choose between a 'nature reserve' and 'grazing land,' without knowing what the ecological differences between these choices are. Being clear and avoiding jargon means that surveys are accessible.

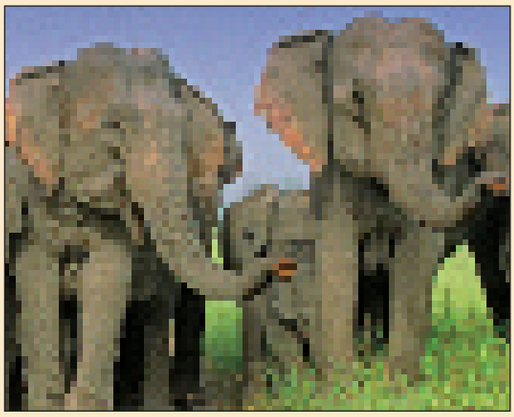
Some issues to bear in mind when evaluating data are:

1. **Zero Bids:** If a respondent says they are willing to pay $0, this could mean many things. It could mean they don't think the change is valuable. It could mean they think it's valuable, but that they shouldn't be the one to pay for it (the state should pay). It could even mean that they think it's so valuable that it is priceless.
2. **Exaggerated willingness-to-pay and yea-saying:** Respondents may want to please the surveyor or appear charitable. Since CVM is hypothetical in nature, people may agree with questions regardless of content. They are, after all, only stating what they would hypothetically pay.
3. **Bidding format:** The way the question is posed can influence the results, for example a one-off question 'are you willing-to-pay $x?' versus an open-ended question 'How much are you willing-to-pay?'

Box 3.4 Conservation of Asian Elephants in Sri Lanka – A contingent valuation study

Crop-raiding is a source of human-elephant conflict in Sri Lanka. A CVM was conducted with 300 people living in urban areas in Colombo to determine willingness to pay to conserve the Asian elephant.

The survey gave respondents some context (the status of the elephant and limitations to the protected area network). The survey asked what they would be willing to contribute to a trust fund to mitigate conflict between humans and elephants.



The proposed fund would compensate farmers for crop damage in exchange for giving elephants some access to crops and refraining from killing them. It would also finance increased protection of existing parks, the relocation of troublesome elephants and the creation of recreation centers and elephant-based eco-tourism.

Based on willingness-to-pay estimates, there is a strong economic case for the trust fund. What people are willing to pay significantly exceeds the economic losses caused by the elephant.

Source: Human-elephant conflict mitigation through insurance scheme, Sri Lanka, TEEBcase based on Bandara and Tisdell (see TEEBweb.org)

Instead of stating willingness-to-pay directly, people choose their favoured option across a 'menu' of options, each with differing levels of ecosystem services and differing costs. Each set has three or more alternatives, one of which has a known monetary value. Some sets may have non-monetary values (social, cultural, spiritual). Respondents **choose between different choice sets**. Implicitly, as they choose, they make **trade-offs** between the attributes of each set. Choice modeling requires complex data analysis and collection.

PARTICIPATORY VALUATION

Participatory valuation is often carried out after a focus group exercise where stakeholders voice concerns and table issues to **infer values indirectly**. For instance, participants may be asked to use counters

Box 3.5 Oku-Aizu Forest Ecosystem Reserve in Japan

There are 29 forest ecosystem reserves in Japan, including world heritage sites designated by the Forestry Agency. The Oku-Aizu forest ecosystem reserve is the largest. However, in comparison with other forest ecosystem reserves in Japan, its buffer zone is larger to allow for the use of forest ecosystem services by locals (mushroom and wild plant harvesting, for example).

Choice experiments were used to estimate the economic value of Oku-Aizu forest ecosystem reserve. A choice set consisted of three profiles (hypothetical protected area) and one status-quo scenario (keeping things as they are). Each profile had four area attributes and one price attribute.

The data were collected through two identical surveys – a regional mail survey and a nationwide internet survey. After analysis, the results showed a higher willingness-to-pay (US$ 89/year) for stricter protection of the ecosystem as compared with maintaining the status quo (US$ 12/year).

Source: Valuing forests for different protection strategies, Japan, TEEBcase based on Kentaro Yoshida (see TEEBweb.org)

Source: Human-elephant conflict mitigation through insurance scheme, Sri Lanka, TEEBcase based on Bandara and Tisdell (see TEEBweb.org)

Box 3.6 Valuation of non-timber forest products in Sekong Province, Laos

As part of a wider study to support conservation of natural forests, a Participatory Environmental Valuation (PEV) technique was used to ascertain the value of non-timber forest products (NFTP). Villagers were asked to express the value of NTFPs in the context of their own perceptions, needs and priorities.

Villagers used rice to rank all the products extracted from the forest by placing counters on each product harvested. The number of counters signified how important a particular product was to them. The value of each product was then expressed relative to the value placed on rice. The wider study (which used other data as well), concluded that NFTP were worth US$ 398 – 525/household annually.

Source: Participatory valuation of forests in subsistence economy, Lao PDR, TEEBcase based on Rosales et al. (see TEEBweb.org)

(pebbles, rice) to represent the significance of certain factors that are important to them. Some of these factors may be difficult to value using market prices alone (security of water supply). Others may have a direct market value (fuel prices, for example).

While determining causation is difficult, this process can elicit the significance of certain factors relative to others. If a respondent uses six grains of rice to describe impediments caused by irregularity of water supply and four to describe obstacles created by fuel prices, something can be inferred about the significance of water security in relation to fuel prices. One important advantage of this methodology is that it can be used with respondents who are illiterate or not used to expressing preferences in monetary terms.

BENEFITS TRANSFER

Benefits transfer (BT) is not a methodology per se and it includes several variations. BT uses primary valuation **studies from other sites to inform decision making**. This method is inexpensive and expedient. It is, however, not as precise as a primary valuation. An in-depth benefits transfer valuation requires significant expertise and statistical analysis (see TEEB Foundations, Chapter 5).

There are different approaches. Perhaps the most accurate approach is to assign 'benefit functions' – screening studies in terms of variables such as habitat types and income levels. Another method, perhaps less accurate, is to look for studies carried out on sites that are similar (ecologically or socio-ecologically). The willingness-to-pay in the studied site is then adjusted to best suit the new site. Adjustments might allow for inflation and exchange rates. The least ideal implementation of a BT would be to use values from a previous study without adjusting them. BT must be used with caution, and only to provide a 'ballpark' estimate of value.

The following are the general steps to be followed when using benefits transfer:

1. **Identify** existing similar studies;
2. **Examine** how transferable they are. To be transferable, the sites should have the same environmental services and service quality. Ideally, they should be comparable in terms of the kind of people who use them and the kinds of institutions that govern them;
3. **Screen** studies to make sure they are theoretically and methodologically robust;
4. **Adjust** existing values to reflect the values of the site under consideration – using relevant, available supplemental information.

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Box 3.7 Economic value of world's wetlands

The total economic value of 63 million hectares of wetland around the world is estimated to be US$ 3.4 billion per year.

A benefits transfer method was used to arrive at this estimate by extrapolating from 89 wetland studies. Studies were screened for methodological robustness. Data were expressed in the same currency with standardized values.

Once the value of certain kinds of wetlands was determined, a benefits transfer method was used to estimate and predict the value of wetlands that had not been valued. The benefit function has been estimated using the following variables: wetland type, size, location, population density and income per capita. Using the estimated function values were transferred to approximately 3,800 wetlands around the world.

	Mangrove	Unvegetated Segment	Salt/Brackish Marsh	Fresh-water Marsh	Freshwater woodland	Total
N. America	30,014	550,980	29,810	1,728	64,315	**676,846**
Latin America	8,445	104,782	3,129	531	6,125	**123,012**
Europe	0	268,333	12,051	253	19,503	**300,141**
Asia	27,519	1,617,518	23,806	29	149,597	**1,818,534**
Africa	84,994	159,118	2,466	334	9,775	**256,687**
Australasia	34,696	147,779	2,120	960	83,907	**269,462**
Total	**185,667**	**2,848,575**	**73,382**	**3,836**	**333,223**	**3,444,682**

Amounts in US$ 1,000s.

Source: The economic value of the World's wetlands, TEEBcase based on WWF (see TEEBweb.org)

3.3 DECISION-SUPPORT FRAMEWORKS: COST-BENEFIT ANALYSIS

Contrasting benefits and costs is an important input to systematically consider the consequences of different options in decision making. In theory, cost-benefit analysis (CBA) is simple. All the benefits and costs of a proposed policy or project are valued, added and compared. When the benefits outweigh the costs (the 'net benefit' is positive), the proposed change is considered to be economically efficient.

CBA arguably **dominates economic decision making** because it allows decision makers to justify expenditures (important in an atmosphere where resources are constrained); appears uncontroversial (mirrors the way people today make consumption choices) and is often either legislated or given preference at powerful levels of government.

A CBA follows six stages:

1. **Project definition:** What is the project's scope and who are the stakeholders?
2. **Classification of impacts:** What are the expected incremental costs and benefits of the project (such as administration and implementation) and when are they likely to occur?
3. **Conversion of physical impacts into monetary values:** How can non-monetized services be described in monetary terms?
4. **Discounting:** A process that puts more weight on costs and benefits that arise earlier in the project.
5. **Net Present Value assessment:** Given the information gathered, is this project economically advantageous?
6. **Sensitivity analysis:** How reliable are the numbers used in the study?

PROJECT DEFINITION

The project's time frame, scope and key stakeholders need to be identified. A local biodiversity preservation project may affect local, national and international communities, but stakeholders that do not directly contribute (financially, legally) to the project, often fall outside the project's boundary. Typically, only costs and benefits for agents directly involved in the project are considered.

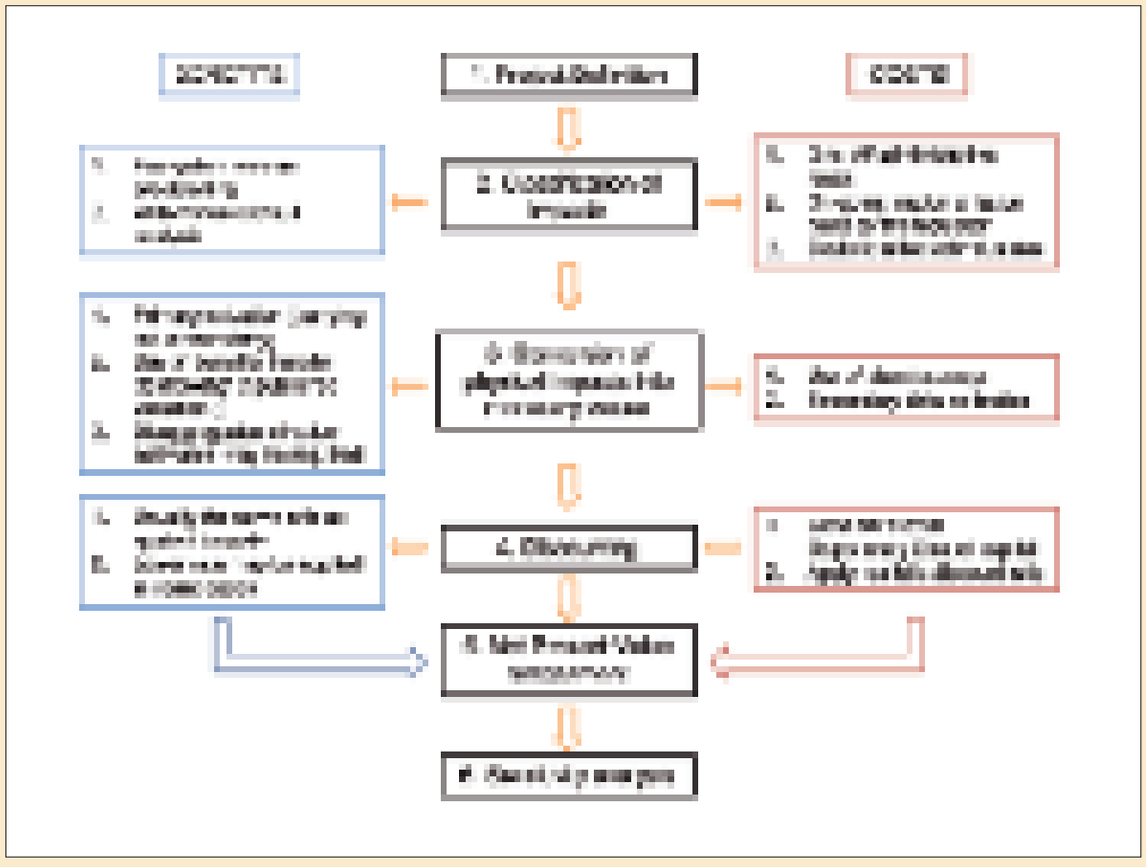
Analysts ask 'What will happen with or without the project or policy?' In other words, what's the outcome 'with' the project, and what's the outcome 'without' it? This is called the **'with-minus-without' principle**. Analysts need to know which costs and benefits stem from the project, and which ones would have occurred anyway. If the proposed project addresses freshwater supply, analysts determine if freshwater supply, under current conditions, is expected to decline, increase or stay the same. Once this has been determined, they evaluate the expected outcomes with the project.

If future water demand rises due to population growth, a project to 'merely' maintain water availability at current levels is beneficial. Similarly, if a project proposes to extend the boundaries of a national park, it is important to determine whether certain infrastructures (such as warden's offices and toilet facilities) are sufficient. Some costs may already be covered by other budgets. Only additional costs should be inputted into a CBA.

CLASSIFICATION OF IMPACTS

The next stage identifies the incremental costs and benefits that are expected to occur and when they are likely to occur.

Figure 3.1 Cost-Benefit Analysis methodology as applied to ecosystem services



source: own representation

In an example for implementing a biodiversity conservation policy, the probable economic costs are:

1. **One-off administrative costs** to the state regulator (constructing a building for the policy administration) or to other stakeholders (industry hiring consultants for guidance on adapting business practices);
2. **On-going implementation costs** for monitoring, enforcement and stakeholder consultation, as well as compensation to affected stakeholders such as industries, landowners and farmers (for lost production or cost burdens in meeting imposed regulations).

Biases at this stage can lead to inflated cost projections. Regulated costs may overstate the cost of compliance because these are privately borne (by firms, industry) while social benefits are publicly borne. Industry also has little incentive to report under-estimation of incurred costs or reduced overhead from improved technologies.

Benefits can also be measured in terms of **'avoided costs.'** A key benefit of installing solar power cells is avoiding greenhouse gas emissions. Benefits might be measured in terms of the avoidance of biodiversity loss, or maintaining access to clean water. Costs and benefits also include non-environmental factors; re-establishing a wetland for flood protection involves paying laborers, and buying raw materials.

CONVERSION OF PHYSICAL IMPACTS INTO MONETARY VALUES

This can be the most time-consuming and resource-intense task for conservation projects, depending on which valuation method is used.

A host of costs and benefits need to be monetized – from ecosystem services to far more **abstract benefits** (such as improved quality of life). In many cases, market prices are used to account for price distortions. For example, an oil subsidy would make the market price for oil lower than its 'actual' price.

While hotly debated, morbidity and mortality may be included at this stage. Certain projects and policies directly impact human lives and rate of injury. Conversion of a wilderness space for a mining operation, for example, may create a risk of injury or death to miners. The mine itself may pose health risks for nearby communities if the mine disperses toxins directly or indirectly.

DISCOUNTING

Discounting describes the practice of placing more value on **immediate costs or benefits** as compared with those that occur in the future. People tend to value future costs and benefits less than immediate ones; when stakeholders are asked why they choose overexploitation (harvesting timber at a rate higher

Box 3.8 Considerations for choosing an appropriate discount rate

- The choice of discount rate affects how future costs and benefits are valued in terms of present values ('today's money').
- In some cases, interest rates are used. The opportunity cost of capital, as measured by the interest rate needed to fund the project or policy, is used to determine the discount rate.
- The Stern Review of Climate Change argues for a differential rate to be applied for climate change. This may be an appropriate benchmark for the conservation of ecosystems and biodiversity if such conservation has a long-term impact.
- There are good reasons to use lower discount rates (1-4%) for projects affecting natural capital as we can not assume we will have more of this resource available in the future.
- If people are very poor, immediate needs may be so pressing that higher discount rates may be appropriate.
- Primary extractive industries (agriculture, forestry and fisheries) might have low rates of return compared to other industries, causing them to fail a CBA test if a high discount rate is applied.

(see TEEB 2008; TEEB Foundations 2010, Chapter 6)

than the growth rate), they respond that they do so in order to meet immediate needs.

A CBA attempts to find an appropriate, consistently applied, **discount rate** – a means of converting costs and benefits that occur at different times in the study period into 'present value-equivalents', i.e. what they are 'worth' to us were they to occur today. Discounting is routinely applied but has a big impact. For example, a US$ 1000 cost or benefit incurred in 20 years time is equivalent to around US$ 150 today, if we apply a 10% discount rate. In purely mechanical terms, discounting is the inverse of compound interest: If I place US$ 150 in a bank today and earn 10% interest per year then I will have around US$ 1000 in 20 years time.

OVERALL POLICY OR PROJECT APPRAISAL

There are two standard ways in which a project or policy might be evaluated using CBA: **Net Present Value** (NPV) and the **Internal Rate of Return** (IRR).

Net present value expresses all costs and benefits in terms of 'today's money.' In mathematical terms, this is the sum of the discounted benefits minus the sum of the discounted costs. The theory is that if the NPV is positive, the project or policy is expected to improve social welfare.

The **internal rate of return** tells us the 'return on investment.' In situations where funding is limited, this can be a useful complementary performance indicator alongside NPV. (IRR is the discount rate that brings the NPV to 0.) IRR and NPV can both be calculated in Excel or equivalent spreadsheet programs. Neither measure, however, tells us anything about the distribution of beneficiaries and losers. For this reason, it is possible to apply a further step in the CBA to capture the **distribution of winners and losers**. This is called a **social CBA**. A social CBA can help to plot who benefits most and who benefits least.

Supposing that two projects A and B have different benefits and costs to the rich and the poor. Using social CBA one could choose between the projects by using various distributional weights to the rich and the poor.

SENSITIVITY ANALYSIS

Estimations, and thus uncertainties, pervade CBA frameworks. Some would argue that the potential for error is increased when non-market goods are monetized. Assuming that a policy maker has opted to monetize ecosystem services, the key question for the policy maker is: how do I ensure my numbers are as accurate as possible? Certain steps must be built into the analysis to test the extent to which the outcome depends on the figures used. This is called sensitivity analysis.

Essentially, at this stage, analysts assess the **robustness of the analysis**. They make changes to key variables to see the effect of these changes. For example, if a strong NPV outcome depends on an estimate that is imprecise or uncertain, the CBA is more sensitive to error. This observation triggers caution, highlighting a potential need for further research. If the CBA relies on data collected through a less robust method, the conclusions are also sensitive to error. While uncertainty always exists in the realm of hypothesis and estimation, the greatest amount of certainty is optimal.

CRITICISMS OF COST-BENEFIT ANALYSIS

While there is a strong rationale for applying CBA in an environmental context, there are criticisms. These are valid but we would argue that they do not constitute a reason to not apply the framework. They should prompt caution, transparency and analytical rigor. Criticism reminds analysts to document assumptions, rationales and known limitations meticulously. Below is a list of common criticisms:

1. There is uncertainty and inaccuracy in estimation, especially with benefits such as →*'resilience.'*
2. CBA does not generally consider the distribution of winners and losers.
3. Discounting presumes that we value costs and benefits that occur today more than those that occur in the future.
4. It is difficult (or impossible) to apply CBA in situations where there is an irreversible change, such as species extinction.
5. CBA is only as transparent and objective as its practitioners make it. Since the methodology is

Box 3.9 Cost-Benefit Analysis, UK Marine Protected Areas

Marine ecosystems contribute to approximately two-thirds of global ecosystem services (Costanza et al. 1997). Recent studies report that the cumulative impact of widespread human activity on these ecosystems is likely to cause a decline in many of the ecosystem provisions that human beings rely on (Halpern et al. 2008).

In response, a number of national marine conservation agendas are emerging. In the UK, legislation (the UK Marine and Coastal Access Bill, 2009) has designated a network of marine protected areas. The government used a CBA to test which sites would be designated as Marine Conservation Zones (MCZ). It also used previously published studies (benefits transfer) to make estimates.

Two separate studies were commissioned, one to assess the benefits of implementation, and one to address the costs (www.defra.gov.uk/environment/marine/legislation/mcaa/research.htm).

Defining the project boundaries

In order to define the project boundaries, the study looked at three different MCZ network scenarios. They considered what kind of restrictions they would impose on the areas (who would be allowed access, which resources could still be exploited). They made projections with a scope of 20 years, deciding that beyond that (2027), uncertainty about the provision of ecosystem service benefits was too great.

The analysis made predications about the impact of humans on marine ecosystems over time and considered measures already in place to mitigate these impacts (the with-minus-without condition). They evaluated the expected impacts of these measures in order to make sure that the proposed measures would not duplicate protection measures already underway.

Current measures were 3 statutory marine nature reserves, 76 Special Areas of Conservation (for marine habitats and species) and 72 Special Protection Areas (marine habitats for birds).

Classifying the impacts

In order to classify the impacts, analysts used ecosystem services as defined by the Millennium Ecosystem Assessment (see section 2.3). They highlighted 11 ecosystem services and determined for each combination of marine habitat-type/ecosystem service what the impact of a protected area designation would be. The authors considered, for example, the impact of reef protection in terms of gas and climate regulation. Each combination was scored or coded by marine ecologists, who classified the impacts in terms of significance and the amount of time it would take for the impact to occur.

Converting impacts into monetary values

In order to describe ecosystem services in monetary terms, a benefit estimate was carried out using the benefits transfer method, ensuring that the studies used were applicable – ecosystems similar to the UK's temperate marine ecosystems.

Application of discounting

A standard discount rate of 3.5% was applied to both cost and benefit estimates. Choosing the same discount rate is a requirement of the UK Impact Assessment guidelines, and a common procedure for many OECD countries.

The net present value of the assessment

The present value (PV) of **benefits** ranged between US$ 16.4 to US$ 36.1 billion.

The **cost** estimate relied on secondary data and interviews with affected stakeholders. Six industrial sectors were considered: marine aggregates extraction; cables (telecommunications and power); renewable energy (offshore wind, wave, tidal); oil and gas; fisheries; and recreation. Estimates were also made for administration costs to the voluntary and non-profit sector. While costs are voluntarily borne by such institutions, the argument for placing a monetary value on voluntary services is that, without these sectors, the government (in effect, society) would bear these costs. The PV of costs ranged between US$ 0.6 to US$ 1.9 billion. The net present value (NPV) is thus at least US$ 14.5 billion.

Testing the values using the sensitivity analysis

A sensitivity analysis reduced the range of the present value of benefits to between US$ 10.2 to US$ 24.0 billion. Hence, even in the worst case NPV is US$ 8.3 billion.

Conclusions

A cost-benefit analysis was a significant factor in creating legislation (the formation of the UK Marine and Coastal Access Bill). Using the ecosystem perspective was useful in terms of justifying conservation on economic grounds. It also demonstrated that the cost-benefit ratio of marine conservation in this case was 10:1.

For further information see Hussain et al. 2010

presented as being objective, the outcomes are perhaps less likely to be challenged than 'softer,' more qualitative evaluations.

6. Estimating the monetary worth of a human being (in disaster mitigation, for example) is controversial.

COST-EFFECTIVENESS ANALYSIS (CEA)

CEA is linked to CBA. It is a decision-support tool for policy appraisal. Unlike CBA, this analysis does not evaluate benefits. It evaluates the costs of implementing a given plan. CEA is useful in circumstances where a policy decision has been made but several implementation options exist.

CEA is especially useful when decision makers are legally obliged to meet a broad policy objective. For example, following the Rio Earth Summit (1992), local policy makers in the UK were required to implement Agenda 21, a sustainable development agenda (see Chapter 4). Using CEA helped them determine the most **economical ways to implement changes to meet new legislation**. It is possible, in the future, that as climate change concerns are translated into law, more policy makers will make use of CEA. Rather than having to decide whether biodiversity or conservation agendas should be considered, the main concern may shift to determining which options most cost-effectively meet biodiversity and conservation targets.

3.4 ALTERNATIVE DECISION-SUPPORT FRAMEWORKS AND TOOLS

There are situations where the quantification of costs and benefits of ecosystem services is perceived to be inappropriate or not possible. Policy makers may choose to avoid monetized valuation for a number of reasons. They may feel it is unethical or not the will of the community they are accountable to.

In such cases, an appropriate alternative can **integrate monetary values without monetizing** a certain set of benefits (such as the value of a sacred site). Alternative decision-support tools and frameworks tend to be stakeholder-focused, and ideally generate scenarios that address the particularities of certain community contexts and conflicts. There are a number of appraisal techniques to collect qualitative information. Table 3.3 gives an overview and uses an example from Kenya to illustrate different appraisal techniques.

Table 3.3 Consultative appraisal techniques

The dilemma: The Maasai people, who have had access to Lake Naivasha (Kenya) for centuries, are now unable to access it due to the development of agriculture around the lake's border. The Maasai argue that their cattle should be able to use the water for spiritual reasons and that they are entitled to lake access for fresh water. While providing bore holes might solve the issue of freshwater availability, this would not address the spiritual concerns of the Maasai. There are a range of consultative appraisal approaches a policy maker might choose to employ to understand different stakeholder concerns and explore solutions.

Individual stakeholder viewpoints

Questionnaires are often the main survey instrument for both monetary and non-monetary techniques. A well-designed questionnaire paints a clear picture of the local context for proposed changes. They glean both quantitative and qualitative information from people. Structured questionnaires record respondents' perceptions, attitudes, experiences or expectations. They can be filled out on the phone, by post, using the internet or face to face.

Semi structured, narrative or in-depth interviews are typically carried out face-to-face. This method is flexible, allowing the interviewer to pursue lines of questioning in response to the answers they receive. This method of determining different stakeholder viewpoints is especially useful in contexts where there are conflicts created by a diversity of views and the interviewer needs to establish the source of the disagreement.

Farmers organized in the Lake Naivasha Riparian Association and the Maasai community could be given questionnaires designed to ascertain key governance issues, identify water access changes that both groups might agree to, identify costs, compensation opportunities and usage patterns. Semi-structured interviews could provide a platform for industry and Maasai representatives to voice concerns and make comments.

Group stakeholder viewpoints

Focus groups aim to elicit the positions of participants regarding a pre-defined issue or idea. Focus groups are useful for gaining insight about institutional linkages and relationships as well as identifying spiritual and cultural values.

In some cases it may help to have separate focus group sessions with opposing parties, in this case industry and Maasai, so that differences of opinion within each party can be discussed. Once internal differences have been clarified, parties are in a better position to negotiate with each other (perhaps facilitated or mediated by an outside person).

Citizen's juries are a means to obtain carefully deliberated and informed opinions of the public regarding an issue or alternative proposals. Experts and stakeholders present evidence and answer questions – the jury (usually composed of citizens) then deliberates and come to a view.

A citizen's juries could be formed to hear the position of the Maasai presented by NGO and advocacy groups, along with views from hydrologists, industry bodies and local government and national government. Document findings and reasons for decision taken by the jury.

Participatory appraisal creates a platform for local and indigenous knowledge and circumstances to play a role in decision making, facilitating the involvement of stakeholders from an early stage, ideally making it possible for stakeholders to perform appraisal, analysis and develop plans that are relevant to their community or jurisdiction. It offers a large array of tools explained below.

Participatory appraisal could involve asking Maasai representatives to map the lake, identifying key areas of spiritual or community significance.

Group stakeholder viewpoints (requiring in-depth statistical analysis)

Q-methodology aims to determine the nature of individual relationships to and **perceptions of environmental problems and solutions**. In the first step, large sets of statements regarding specific issues are identified. Secondly, a smaller number of statements are selected from the larger set (usually 20-50). They are sorted according to what participants identify as least and most important. The data is then statistically analyzed.

Both stakeholder groups could be asked to clarify their concerns. Agribusiness may raise concerns that changes in land access might lead to job-loss, inefficiency and crop damage. The Maasai might assert that they have ownership rights to the water. Analysts could ask each group to rank their views. These views could be sorted for significance. This method may unveil unanticipated 'clusters' of both problems and solutions.

Multi-Criteria Analysis (MCA) can help structure decisions characterized by trade-offs between conflicting objectives, interests, and values. MCA is particularly useful when stakeholders identify non-negotiable outcome (explained below)

Individual expert views

Delphi surveys do not directly appraise stakeholder views. A set of **experts** is selected to make group judgments. This is particularly useful when existing knowledge is limited. This is an iterative process, involving a series of deliberations.

Hydrologists, engineers and advocacy groups may be asked to provide expertise. This expertise can be used to reach a solution or compromise that is technically and socially feasible.

Adapted from Christie 2008

PARTICIPATORY APPRAISAL

Participatory Appraisal is an umbrella term that describes a variety of techniques that incorporate data relating to the **interrelationships between people's livelihoods and socioeconomic and ecological factors**. Participatory frameworks attempt to account for the fact that different policy and community-contexts require different approaches. There are a number of slightly different approaches. Participatory Rural Appraisal (PRA) focuses on the concerns of rural stakeholders. Participatory Learning and Action (PLA) is more ambitious in scope. Its aim is to enhance the participation of ordinary people in local, regional, national and international decision making. Rather than an 'approach' it may even be argued that it is a 'position.'

Participatory Appraisals **usually involve a facilitator** who provides an 'entry point,' for stakeholders to get together and discuss relevant opportunities and dilemmas. To prepare, a facilitator seeks out primary and secondary information to establish the best way to facilitate a process to elicit people's ideas and concerns and get them involved.

Reviewing and familiarizing with the context: Having a sense of the socio-economic, cultural and demographic background of the land and people affected by a current political, economic and ecological landscape is necessary. The facilitator can familiarize him/herself by reading reports, emailing or talking to people and reading relevant books.

Initial stakeholder meetings: The issue is articulated and stakeholders are enabled to take ownership of both the issues and their subsequent analysis. There are a number of ways for the facilitator to try to 'cover all the bases,' from using formal to semi-structured interviews.

Once both the context and relationships have been established, the participatory appraisal method selects from a host of techniques for gleaning the information needed for a robust analysis. Some techniques, relevant to appraising ecosystems services, are presented below.

Participatory mapping and transect walking

Participatory maps differ from conventional maps. Stakeholders are requested to indicate resource availability, boundaries around services (education, resources, health), or opportunities and conflicts that are relevant to their circumstances. These maps help to illustrate many things: where cultural activities take place; where resources are and who manages or uses them; how availabilities have changed over time, and a host of data around people's perceptions regarding their geography.

Differences between maps drawn by people sharing the same community and resources can help clarify key sources of conflict. The facilitator may ask participants to debate differences as well as help determine what needs to be included and excluded in the maps. Several participatory maps can be converged/superimposed on one another to get a sense of how different issues and boundaries overlap and interrelate.

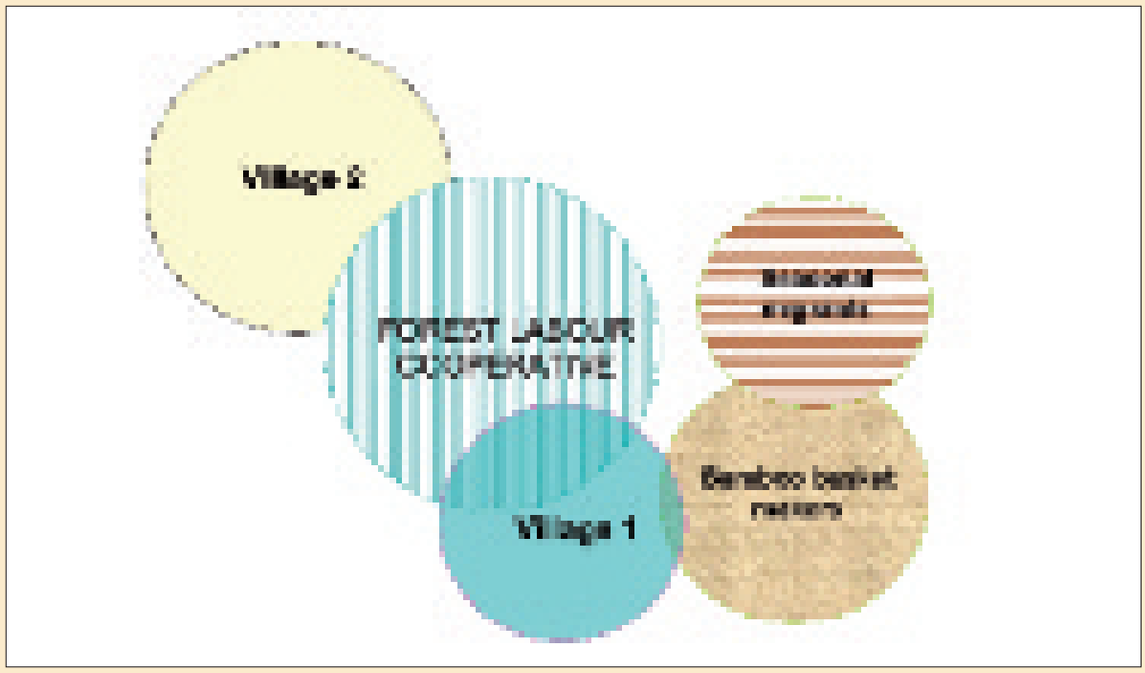
Transect walks can aid in the process of knowledge exchange and engagement. Villagers guide a facilitator or a decision maker through a study area identifying (for example) natural resources, soil-types and vegetation, farming practices, ecological patterns. Transect walks can help cross-reference and verify information on participatory maps. They can also highlight services not indicated on the maps and how resource availability has changed over time (indicating previous forest cover or river flow). Transect walks also create a social space – while walking, stakeholders may bring up new discussion points and ideas that may be useful in further policy related discussion.

Venn Diagrams

The concept behind Venn diagrams is that **issues and services are interconnected**. A Venn diagram attempts to draw-up a holistic view on a given situation – linking sequences, causes and effects. In theory, seeing the relationships between issues can help elicit solutions.

The diagram below illustrates that both seasonal migrants and permanent villagers make bamboo baskets. People from both Village 1 and 2 participate in forest labor cooperatives while the migrant workers

Figure 3.2 Venn diagram



Source: adapted from Participatory Rural Appraisal for Community Forest Management. Tools and Techniques. Asia Forest Network (www.asiaforestnetwork.org/pub/pub20.pdf).

do not. In terms of ecosystem services provision, the Venn diagram may identify sources of resource conflict. If the seasonal migrants extract resources for basket-making without participating in the cooperative, tension may arise between the migrants and the people in both Village 1 and Village 2. This diagram could also be expanded to encompass governance and property rights, effects of services on livelihoods, and how ecosystem services are shared.

Temporal analysis: seasonal calendars and trend analysis

Ecosystems and the services they deliver change seasonally and over time. Seasonal changes take place over the course of a year. Trends may take place over a much longer period of time.

Seasonal calendars show annual schedules of activity and variation. This calendar may provide an overview of harvesting activity and the availability of certain resources at certain times of year. Seasonal calendars allow for the inclusion of many cultural and socio-economic factors in an analysis of the interrelationship between people and their environment. They can highlight certain activities that take place at certain times of year. Overharvesting of fish, irrigation, the dependence on wild food and human-wildlife conflicts often take place at a predictable moment in the passage of the seasons.

Trend analysis aims to ascertain how services have changed (such as water availability) in a community over the years. Participants identify and prioritize (perhaps using counters) the most significant changes that have affected their community. Both tools are particularly useful in analyzing the importance of ecosystem services for livelihoods (see Chapter 2).

Ranking

This technique gives stakeholders an opportunity to prioritize their preferences. Possible changes are identified, quantified and compared to alternatives. Options for ranking are:

Pair-wise: Two items or attributes are compared. The participant identifies which service (or combination of services) is of greater significance.

Direct matrix: A list of services or priorities is given to a participant who gives each item a numerical value (out of ten, out of 100 etc.).

Splitting a total: Participants are given a fixed number of tokens (10, 100 etc.) that they can assign to a variety of choices. A person may choose to assign all tokens to a given attribute or divide their tokens. The participant assigns as much or as little value to the items as he or she deems appropriate.

Strengths and limitations of Participatory Appraisal

The **strengths** of Participatory Appraisal are that it is flexible, adaptable and can capture (quantitatively and qualitatively) a range of data types and levels of information from individuals, households, communities and industry. This approach can assist with sketching out issues related to or underlying conflict and resource use in a relative short period of time (usually between 3-21 days). Significantly, the **knowledge and skills of local people** are used to understand situations and systems in a local context. Not only can this 'shed light' on why things work they way they do, but it can also serve to give people autonomy over their own resources. This has significant implications for improved local governance and project and resource management.

In addition, while Participatory Appraisal need not involve the monetization of environmental values, certain proposed changes may have direct or indirect market value. It can be used as a source of information for other valuation analyses.

Like any framework, Participatory Appraisal also has **limitations**. It is location and context-specific. In effect, this means that results are not easily transferable to other settings. In addition, while many government bodies welcome participation and for some decisions it is even mandatory, some governments may limit the ability for their constituents to voice their perspectives. The robustness of the results depends on the selection of the participants. Typical biases include: who is in the room? Who is allowed to/dares to make a statement? Inhabitants of remote areas, minority groups, young people or women might not be in a position to voice their concerns. This method of appraisal also comes with high expectations on the part of the community.

For this reason, it is generally important that the goals and the objectives of the appraisal are made clear from the outset in order to avoid the risk of disappointment regarding unmet expectations.

MULTI-CRITERIA ANALYSIS

Our final focus in this chapter is on MCA. This method requires the application of statistical expertise and often complements a CBA, particularly in situations where a decision involves implications that are difficult to monetize or even quantify. MCA is a decision-making tool that allows decision makers to **include a full range of social, environmental, technical, economic and financial criteria** in their decision making. While CBA focuses on economic efficiency, an MCA can evaluate a project based on values expressed in different terms.

MCA may differ from CBA in terms of appraising the same agro-forestry venture, for example. Such a venture would affect (either positively or negatively) the flow of ecosystem services to local people. This, in turn, could affect livelihoods. An analysis of costs and benefits would assign all services a monetary value to capture the services' value. Under MCA, the decision maker (or consulted stakeholders) would determine how important each service is relative to other services. Central to the framework of MCA is the concept of 'trade-offs.' The applications of MCA are vast in both scope and type.

MCA, like CBA, is useful for establishing scope, context and options appraisal. Completed analyses also translate human assumptions and values into a readable format, indicating which alternatives carry the most weight (socially, economically etc).

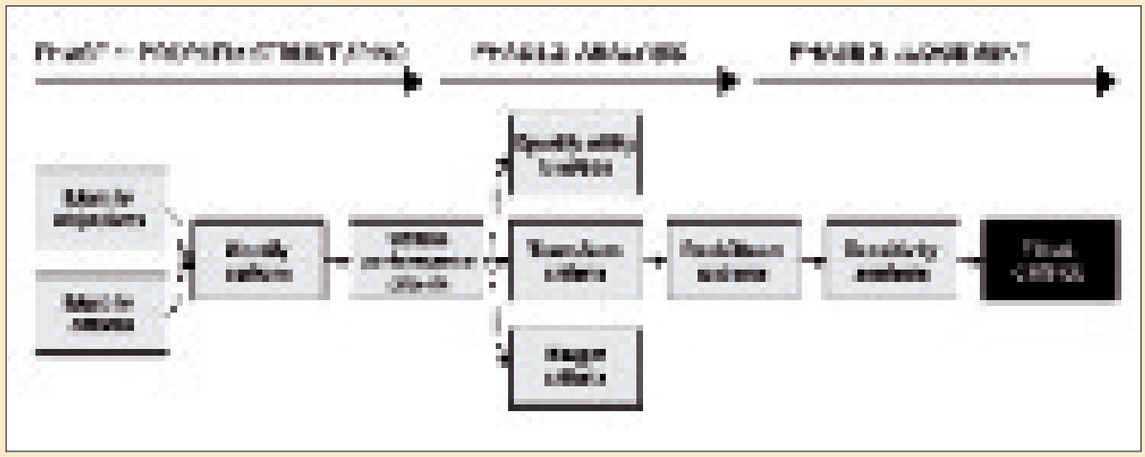
MCA has three (broad) phases with subsections:

1. **Problem structuring:** Identifying the objectives, criteria and options for a project. Who and what is involved – and how?
2. **Analysis:** Analysts look at all the data gathered in the first stage and organize it. What are the most important issues? What are the different options and solutions? What are the ramifications of different actions?
3. **Judgment:** All of the solutions are evaluated, checked for sensitivity and a choice is made about the best plan or policy.

This section will go through each phase of an MCA, using a case study to guide the reader through the process.

The Nairobi River Basin in **Kenya** faces high levels of degradation and it provides a number of ecosystem services to a wide range of people – farmers, residential property owners, large scale industry and smaller enterprises. The diverse group of people that benefit from it often have different and conflicting objectives concerning its management. The catchment areas of the main rivers are wetlands (Ondiri swamp)

Figure 3.3 Steps involved in MCA



Source: adapted from Hajkowicz, 2008

or forest (the Dagoretti forest). While the stakeholders have a diversity of objectives, all of them, in one way or another, benefit from the catchment areas. An MCA was used to find a compromise and create a land-use policy that harmonized a diversity of interests – land tenure, legalities, administration, institutional and other land use needs (TEEBcase Multi-Criteria-Analysis for resolving conflicting river basin uses, based on Makathimo and Guthiga).

Phase 1 Problem structuring

The first stage involves **establishing the decision context**. Analysts identify governance issues, ascertain who the affected stakeholders are and identify various appraisal options. Stakeholders might include policy makers, planners, local administrators, organizations, and both commercial and subsistence users of a natural resources.

In the case of the Nairobi River Basin, the goal of the program was to improve the management of the basin. In order to do this, **management options appraisal were identified**:

1. Strict protection of land close to water (riparian zone and catchment areas);
2. Regulating land use (introducing extraction permits);
3. Not making any changes (open access).

Under the first option, strict **protection**, a riparian reserve would be created. Individuals would not be allowed to extract resources from the river. In the second, **regulated** use would entail establishing regulations and fees for extracting river resources. Direct extractive uses would be enhanced, while uses that reduced water quality would be prohibited or minimized. The third and final option would value all methods of extraction equally. Each stakeholder would be free to extract from the river **without regulations, restrictions or fees**.

After all of the options are defined, the relevant **criteria for decision making are identified**. This can include costs, benefits as well as qualitative criteria. Criteria can be grouped into economic, social and environmental categories or arranged hierarchically. In the case of the Nairobi River Basin, analysts chose to focus on economic viability, social acceptability and ecological health.

Identifying criteria is followed by an **analysis of the impacts** of various actions. These estimates can be made quantitatively or qualitatively (using 'performance' and 'effects' matrices). Rows in a matrix represent options and columns represent each option's performance under the proposed criterion. Impacts can be presented in various ways – numerically, in bulleted lists or with color coded charts.

In the Nairobi River Basin, all criteria were measured using the same set of indicators. The criteria were as follows: domestic water supply; water for irrigation; water for livestock; commercial water supply; recreational services; and waste disposal (dumping).

Phase 2 Analysis

Ranking involves learning more from experts and stakeholders about the relative importance of each criterion. The views, priorities and expertise of stakeholders are given weight. Experts may be asked to rank various criteria on a scale of 1 to 10 (cardinal ranking), or in terms of importance (ordinal ranking).

In the Nairobi River Basin, the performance matrix was calculated based on responses from stakeholder interviews. 141 people (53% farmers, 30% commercial users, 17% residential users) ranked the river's attributes in perceived order of importance.

After the importance of the criteria has been established, it is necessary to **transform the criteria into common measurable units**. There are various approaches. This is a technical, statistical issue which we do not pursue further here. Further details can be found below in 'for further information'.

Once all of the criteria have been weighted and given a common measurable unit, the overall performance of **each option is assessed and scored**. Analysts are interested in finding out how well the options perform relative to one another. There are many ways to do this such as creating a weighted average, an analytical hierarchy and compromise programming. Again, we do not present further details here as most of these processes are statistically complicated. There is also the option of not aggregating, called multi-criteria mapping. This allows the options to be illustrated

Table 3.2 Comparing water management options

	Management option		
Criteria	Total protection	Regulated Use	Open access
Domestic water supply	0.166	0.25	0.10
Water for irrigation	0.166	0.25	0.10
Water for livestock	0.166	0.25	0.10
Commercial water supply	0.166	0.10	0.05
Recreational services	0.166	0.10	0.60
Waste Disposal (dumping)	0.166	0.05	0.05

Please note that in scenario 'total protection' all values are weighted equal.
Source: TEEBcase Multi criteria analysis for resolving conflicting river basin uses, Kenya. (see TEEBweb.org)

and leaves it to the stakeholders or policy makers to decide on ranking.

Judgment and overall appraisal is the final step. The best option is selected based on scores and a sensitivity analysis.

In the Nairobi River Basin, the option for regulated use emerged as the most preferred type of river management. 75% of respondents preferred this option. The MCA made it possible for the conflicting preferences of a variety of stakeholders to enter the same analysis. Importantly, a solution that satisfied the majority of interests was reached.

As the case in Kenya demonstrates, an MCA allows for the **combination of divergent interests and methods**. It can be a very useful decision-support tool in complex situations. It does not require that every value receives a monetary weight, and can thus in-corporate social issues, cultural and spiritual values. It can more easily incorporate different aspects in the analysis than CBA. Yet, MCA also has **limitations**. It relies on the judgment of stakeholders and experts; results may therefore not be representative. CBA, if price distortions are adjusted, is more appropriate to determine cost-effectiveness.

3.5 CONCLUSIONS AND ACTION POINTS

Valuation illustrates the importance of ecosystem services. Because many governments use cost-benefit analysis to make important decisions, valuation is an appropriate tool for including the value of ecosystem services in decision making and action. A careful application of valuation does not only seek out the 'right numbers' to input; it is also sensitive to peoples' cultural and spiritual values. A robust ecosystem valuation is likely one that reconciles economic and non-economic values.

Ecosystem valuation is often instrumental as a decision-support tool. The Republic of Maldives is the second nation to have announced blanket protection for sharks, using valuation to choose dramatic protection measures. Their valuation determined that protection was in the country's economic interest. Single gray reef sharks were valued at US$ 3,300/year to the tourism industry in contrast to US$ 32 for a single catch. (TEEBcase Tourism more valuable than fishing, Maldives)

Ecosystem services valuation can be applied in natural resource management, urban and spatial planning, the development of appropriate certification schemes and standards and the creation of well-managed,

economically-feasible protected areas. Take the following aspects into account:

- Consider whether valuation might be used as an input to your decision at local level, even if it is partial and does not cover all ecosystem services.
- Use the section on valuation to filter your options and find how-to manuals in 'for further information' below.
- Valuation fits into both the conventional economic decision-making framework of Cost-Benefit Analysis and also in alternatives such as Multi-Criteria approaches.
- The purpose of valuation determines which method is most appropriate. Consider the options based on who the end-users of the analysis will be, who the affected stakeholders are, and what resources are available.
- Apply as much rigor to estimating qualitative changes as quantitative ones – they should be well-researched and 'grounded'.
- Be aware of subjectivity in your analysis and be transparent in setting out the assumptions made.
- Always carry out a sensitivity analysis to determine how sensitive your results are to changes in certain variables.

FOR FURTHER INFORMATION

General Valuation

Pearce et al. (2002) Handbook of Biodiversity Valuation: A Guide for Policy Makers. This OECD handbook for practitioners provides guidance on biodiversity valuation, points out tradeoffs and contrasts economic and non-economic valuation.

World Bank; IUCN; TNC (2004) How much is an ecosystem worth? Assessing the economic value of conservation. This brochure introduces the approach of ecosystem services and compares different valuation methods in an easily accessible format. http://biodiversityeconomics.org/document.rm?id=710

A easily understandable introduction on ecosystem service valuation, along with essentials, 'the bigger picture' and an overview of existing valuation methods is available at www.ecosystemvaluation.org

Valuation at different scales

IUCN (1998) Economic Values of Protected Areas: Guidelines for Protected Area Managers. No. 2. Using the example of 16 case studies from around the globe, this report compares existing valuation methods. www.iucn.org/dbtw-wpd/edocs/PAG-002.pdf

SCBD (2001) The Value of Forest Ecosystems (CBD Technical Series, no. 4). This report highlights the multiple values of forest and points out causes of forest loss. www.biodiv.org/doc/publications/cbd-ts-04.pdf

Barbier et al. (1997) Economic Valuation of Wetlands, a guide for policy makers and planners. The handbook provides an introduction to wetland valuation, presents 6 case studies and illustrates – step-by-step – how to conduct a valuation. http://liveassets.iucn.getunik.net/downloads/03e_economic_valuation_of_wetlands.pdf

Bann (2003) The Economic Valuation of Mangroves: A Manual for Researchers. This academic how-to guide points out how to conduct a Cost-Benefit-Analysis of mangroves and presents possible management options. http://network.idrc.ca/uploads/user-S/10305674900acf30c.html

van Beukering et al. (2007) Valuing the Environment in Small Islands: An Environmental Economics Toolkit. This easily accessible report addresses the issues of stakeholders engagement, economic valuation, data collection, and supporting and influencing decision making. www.jncc.gov.uk/page-4065

Multi-Criteria-Analysis

Mendoza et al. (1999) Guidelines for Applying Multi-Criteria Analysis to the Assessment of Criteria and Indicators. As part of the 'toolbox series' this report gives a first introduction (incl. a case study) of the Multi-Criteria-Analysis, an approach for highly unstructured decision contexts. www.cifor.cgiar.org/acm/download/toolbox9.zip

DTLR (2001) Multi Criteria Analysis: A Manual. This comprehensive and detailed manual presents Multi-Criteria-Analysis techniques and approaches for integration in decision making. http://iatools.jrc.ec.europa.eu/public/IQTool/MCA/DTLR_MCA_manual.pdf

On his website Andy Stirling introduces his interactive appraisal technique of multi-criteria mapping. General Information and software tools are available at www.multicriteriamapping.org

Participatory Rural Appraisal

The Participatory Learning and Action website provides extensive resources on participatory rural appraisal. www.planotes.org

Partners for Development (2000) Field Manual for Participatory Rural Appraisal. This manual provides a chronological introduction to Participatory Rural Appraisal and explains the PRA toolkit more detailed. www.foodsecurity.gov.kh/docs/ALL/FullDoc-PRA%20Field%20Manual-ENG.pdf

PART III THE PRACTICE: OPTIONS FOR CREATING POLICIES THAT INTEGRATE ECOSYSTEM SERVICES

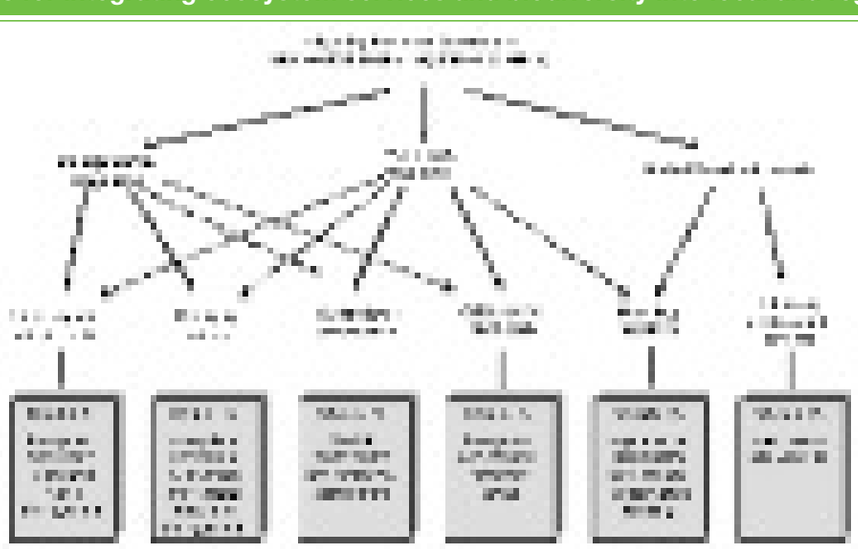
How do we translate what we've learned about the value of ecosystem services into effective policy action? There are many options for doing this – in nearly every field of policy making. TEEB discusses in two reports these options and shows examples of successful policies that incorporate the value of nature: the TEEB Report for National and International Policy Makers and this one, TEEB for Local and Regional Policy Makers. What might be the responsibility of the national government in one country may be managed regionally in another. For this reason, regional level policy makers may wish to refer to both TEEB volumes to address the particularities of their situation. (available at www.teebweb.org)

The TEEB Report for **National and International Policy Makers** focuses on several themes for policy action: In the first place, governments can reform accounting systems to better reflect nature's benefits through adequate indicators in national accounts. The obvious way to capture the value of ecosystem services is for government to regulate. Government can forbid, restrict and reward certain actions. Polluters can be made liable for damages caused. In addition, fiscal policy can be adjusted, with taxes levied on undesirable actions and tax breaks given to companies whose practices are more ecologically sustainable. Other options include legal frameworks for payments for ecosystem services schemes and the reform of harmful subsidies. Finally, governments can directly invest in maintaining and restoring natural capital.

TEEB for Local and Regional Policy Makers: The following six chapters in this volume (see Figure 2) explore options that are typically the responsibility of decision makers at sub-national levels. We present, as outlined in the diagram below.

Chapter 4 examines public management and includes a look at the provision of municipal services and public procurement. Chapter 5 focuses on sector policies that concern natural resources (agriculture, forestry, fisheries, tourism) and disaster management. Chapter 6 covers planning, from spatial planning to the planning of projects and policies. Chapter 7 directs attention to the relevance of protected areas for local authorities, outlining both their role and management options. Chapters 8 and 9 present options for using market-based instruments at the local level.

Opportunities for integrating ecosystem services and biodiversity into local and regional policy



4 ECOSYSTEM SERVICES IN CITIES AND PUBLIC MANAGEMENT

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Content of this chapter

Key Messages

- **Cities depend on nature.** Many essential services provided by local governments depend on and impact the ecosystems around them, either nearby or further afield.
- **Nature is good for your budget.** Local authorities oversee many crucial public management processes. Using an ecosystem services approach can provide cost-effective solutions to municipal service provisioning, such as land use, water and waste management.
- **Take less, get more.** Increasing urbanization puts pressure on ecosystems and biodiversity. City managers have the potential to shift to a resource-efficient and low-carbon future by influencing modes of production, procurement and incentive policies, and consumption patterns.
- **There are many ways to make a difference.** Local government can act as a role model. It can promote and set incentives and it can improve regulation. They can take initiative in many key areas – urban greening, housing, land-use, urban sprawl, solid waste and waste-water treatment, water supply, energy supply and transport.
- **Integration is key.** Using an integrated management approach to deliver ecosystem-dependent services is likely to be most effective. The *eco*BUDGET tool has been designed to enable the integration of ecosystem services into decision-making.

> "For too long, we have been of the opinion that there were only two types of capital for development – financial and human capital, the latter being knowledge, skills, creativity and education. We have been living in the illusion that there is nothing like environmental or natural capital, and that we could use the environment, the environmental capital free of charge. Only now, we can clearly see that this idea is no longer carrying and not allowing for development processes, too. We have overspent more than 60 percent of the ecosystem services available, as we luxuriously live based on economic growth without reinvesting in the natural capital stock."
>
> Klaus Töpfer, Immediate past Executive Director UNEP, cited in UN-HABITAT et al. 2008

→*Public management* is defined as the processes and procedures used to ensure that public and governmental institutions providing public services fulfill all their goals and obligations to promote citizens' well-being and to manage the →*resources* available (UNEP et al. 2001).

For the purpose of this chapter, focus will be put on local governments, although in many countries, a higher level of government (province or state) has more influence on certain areas of public management. Political parties may differ in the way they address local governance, with some mandates resting at Ministry level, but overall, there is a clear trend towards growing decentralization and local capacity building ('localization' of mandates).

This chapter provides an overview of how local governments can improve their performance, service delivery and citizens' well-being by taking into account →*ecosystem services* in public management. It highlights the **benefits of the ecosystem services approach** (4.1); describes the increasing **pressures on ecosystems** in a rapidly urbanizing world whilst exploring the **potential of urban areas to more efficiently manage resources** (4.2). **Local governments' options** to act as linked to ecosystem services are discussed (4.3) and tools for integrating ecosystem services into public management through an **integrated management approach** using ***eco*BUDGET** as an example are presented (4.4).

4.1 BENEFITS OF INCLUDING ECOSYSTEM SERVICES IN PUBLIC MANAGEMENT

Local government leaders and city managers all around the world are constantly working to **improve their citizens' quality of life**. In so doing, they face the ongoing challenge of how to provide municipal services with increasingly scarce resources (human, financial and natural) and to address issues of →*poverty*, unemployment, and inadequate living conditions.

Whether nearby or further afield, the **natural capital from →*ecosystems* contributes to delivering municipal services**. A new road requires raw materials and land; a new well provides drinking water; and new housing uses natural resources in construction. There are also costs to the ecosystem: →*biodiversity* and natural habitats are separated or lost; additional inhabitants convert more fresh water into sewage and increase air pollution. Clearly, municipal action always has implications both on ecosystems and their services. Policy makers often neglect that implementation of their decisions not only requires skilled human and financial resources, but also natural resources and ecosystem services (UN-HABITAT et al. 2008). Particularly during economic and financial crises, local governments try to reduce costs of their service

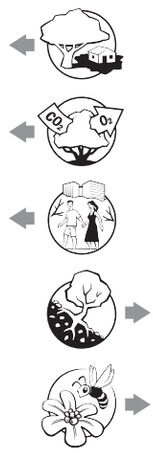
delivery, and foster economic prosperity in the area – often without reinvesting in nature.

Through public management interventions, local governments can diminish, maintain, or increase the provision of ecosystem services in their administrative area. **Assessing ecosystem services and the benefits they provide in public management is an important step to identify cost-effective management options.** Such assessments can help to identify interventions aiming at (re-)investing, maintaining and restoring natural capital and the ecosystem services it provides that will pay off and help decision makers improve local wellbeing. Ideally, a municipality should base its development and the wellbeing of its citizens' on its own, local resources, hence decreasing its dependence on those further away. Benefits of an ecosystem services based approach to public management include:

- **Enhancing citizens' quality of life in urban areas** – a city with a healthy environment provides a higher quality of life for its citizens. Locally generated ecosystem services, such as air filtration, microclimate regulation, noise reduction, rainwater drainage, sewage treatment, and recreational and cultural services, have a substantial impact on →*human well-being* in urban areas (Bolund and Hunhammar 1999). By developing strategies (in urban planning, housing, transport) for maintaining or enhancing local ecosystems to provide services in urban areas, local governments can also safeguard the environment for future generations, and profile their city as a sustainable one. Examples include the Toronto Green Belt (TEEBcase Economic value of Toronto's Greenbelt, Canada), a whole variety of green planting initiatives (Box 4.5) or Singapore Biodiversity Index (Box 4.7).

- **Reducing public management costs** – local governments work with limited budgets and need to find the most cost effective solutions to provide their municipal services. Some services (see section 4.2), such as water supply and water treatment, are highly dependent on healthy ecosystems. Investment in natural capital and ecosystem-based approaches, for example, green infrastructure, can be cost-effective, when compared with man-made solutions. Water treatment (Box 4.1 and TEEBcase Water fund for catchment management, Ecuador) flood protection, climate regulation are some obvious examples.

- **Fostering economic growth in the area** – by emphasizing local ecosystem services and developing policies to support them, local governments can sustainably enhance these services and foster economic prosperity. A healthy and safe environment is likely to attract business and industry with its commensurate job opportunities and wealth creation. The beverage industry, for example, depends on the supply of freshwater. Agribusiness relies on nature's pollination, pest control, and erosion control services while the tourism industry benefits from this ecosystem's recreational value. →*Ecotourism* is a fast-growing sector which generates significant employment and opportunities for local development (see Chapter 5 Section 4). Building green infrastructure (green roofs, green spaces) will provide jobs as well as improve air filtration, CO_2 sequestration and energy saving. Växjö, Sweden has been successful in sustainably managing its ecosystems and fostering growth (see Box 4.9).



Box 4.1 Natural vs man-made? Wastewater treatment in Uganda

The Nakivubo Swamp in **Uganda** provides not only wastewater purification of Kampala's sewage but also nutrient retention. The results of an economic evaluation comparing this natural effect with manmade solutions showed a high economic value between US$ 1 million and US$ 1.75 million a year, depending on the economic analysis method used. Furthermore, the Wetlands Inspectorate Division and IUCN showed that a sewage treatment plant would cost over US$ 2 million to maintain each year. Not only was the cost of expanding the sewage treatment plant greater than the value of the wetland, there were associated costs to livelihoods.

Source: Protected wetland for securing wastewater treatment, Uganda. TEEBcase based mainly on Lucy Emerton et al. (see TEEBweb.org)

- **Reducing poverty** – there is a clear connection between livelihoods and ecosystems, which in the case of the poor is even more direct. Natural resources are a basic source of their income generation. Enhancing local ecosystem services can help reduce poverty and provide the basic needs of citizens. In rural areas the poor rely directly on ecosystems for food, water and fuel. Though less pronounced, the same holds true for many cities. Moshi in Tanzania, is introducing energy efficient stoves to save the forest on the slopes of Mount Kilimanjaro. Nature in cities can also offer income opportunities: local people in South Africa have been trained to manage Pilanesburg National Park, which, with its unique wild-life, is also a tourist attraction.

- **Protecting against environmental disasters** – a range of ecosystems act as important buffers for natural hazards, mitigating the damage caused by extreme events such as floods, droughts and landslides. These events are increasing in intensity, as well as frequency, due to climate change (see Chapter 5.5 and Box 6.5). There is an increasing number of examples. Kumamoto City, Japan, for instance, has established a payment scheme for returning 'used' groundwater by flooding agricultural land between crop cultivation periods (TEEBcase Payments for ground water recharge, Japan). Another interesting example of ecosystem based climate adaptation comes from Mumbai, India (Box 4.2).

Box 4.2 Flood mitigation in Mumbai, India

During an unprecedented monsoon rainstorm in July 2005, almost a meter of rain fell on Mumbai, India, a city with a population of 19.8 million. Severe flooding resulted, and over a thousand people lost their lives. But loss of life and property damage could have been much greater had it not been for 104 km^2 Sanjay Gandhi National Park, which lies entirely within the city limits. The heavily forested park absorbed much of the rainfall.

Source: Trzyna 2007

- **Alleviation of pressures on the resource base** of other regions, ensuring the future provision of services from areas beyond city administrative areas. Examples exist from the timber industry and forest management in Brazil: in order to deal with its ecological footprint, the city of Sao Paulo has adopted a policy about using certified timber which is having an immediate positive impact on the Amazonas. Aichi Prefecture, Japan, has established a tap water fee in order to pay for sustainable forest management practices (TEEBcase Water fee for forest management, Japan).

- **Becoming a political frontrunner** – local government pioneers get recognition. Cities that have been proactive in protecting their ecosystems and halting biodiversity loss are internationally renowned (Boxes 4.3 and 4.6).

Box 4.3 Cities taking part in Local Action for Biodiversity (LAB) initiative

With the aim of strengthening biodiversity management 21 pioneering local governments from around the world piloted LAB. Between 2006 and 2009, they took part in a coordinated process of biodiversity assessment, planning and implementation. This was underpinned by political commitment through the signing of the internationally-recognized Durban Commitment. The LAB initiative represents a partnership between ICLEI – Local Governments for Sustainability and IUCN – the International Union for Conservation of Nature.

Source: Local Action for Biodiversity, www.iclei.org/lab

4.2 PRESSURE AND POTENTIAL OF URBAN AREAS

> "The global effort for sustainability will be won, or lost, in the world's cities, where urban design may influence over 70 percent of people's Ecological Footprint. High-Footprint cities can reduce this demand on ecosystem services and natural capital greatly with existing technology. Many of these savings also cut costs and make cities more liveable."
>
> Wackernagel et al. 2006

Cities are growing in size, population and economic power. **More than half of humanity lives in cities, which occupy only 2% of the world's land surface, yet are responsible for 75% of the world's natural resources consumed, and waste produced** (Klein Goldewijk and Van Drecht 2006 in OECD 2008). This trend of global urbanization is increasing and within the next two decades, 60% of the world's population will reside in urban areas (UN-DESA 2007; UN-DESA 2008).

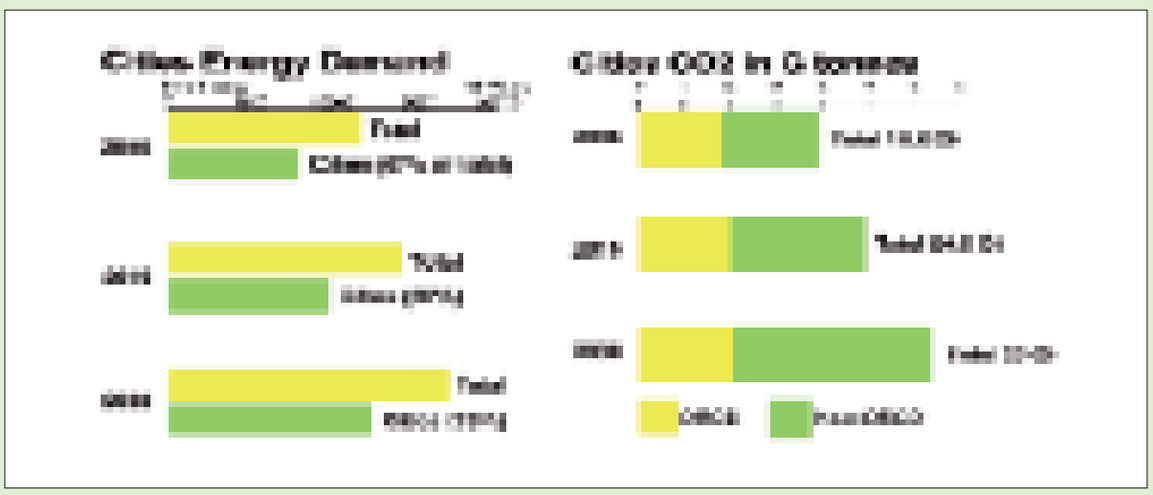
In this scenario, decision makers in developing countries may play an even more critical role than their counterparts in developed ones, when it comes to sustainable use of ecosystem services and biodiversity for development. There are two reasons for this: a) 93% of urbanization is expected to occur in developing countries (UNFPA 2007) and b) although often aware of biodiversity issues, municipalities in the South may be more constrained than their Northern counterparts to manage biodiversity and ecosystem issues, both in terms of their capacity and support from their national authorities. This is highly relevant considering that the majority of the world's biodiversity is controlled by developing countries.

At the same time, urban development and the urban environment cannot be seen in isolation from each other. Growing cities and changing lifestyles require an increasing quantity of natural resources for their production and consumption needs, which are supplied from rural and remote areas. The **'Ecological Footprint'** – an →*indicator* that translates consumption patterns into the surface area needed to sustain the urban consumption, strives to present an indication of this phenomenon. Many cities' Ecological Footprint greatly exceeds their territory. In Greater London, the Ecological Footprint was 49 million ha at the Millennium, which is 42 times its biocapacity and 293 times its geographical area (IWM 2002). Cities in developing countries will increasingly face similar challenges: Lagos, Bangkok, Guayaquil are following this trend already.

Cities deplete natural resources such as forests, agricultural land, water, air to provide for consumption needs of their inhabitants, as well as demands for municipal infrastructure developments, purchasing decisions and service delivery. According to OECD and IEA (2008), cities globally consume 67% of energy and at the same time emit 70% of greenhouse gases (Figure 4.1). Waste, pollution, and emissions produced affect not only city surroundings but are transported to other regions and can cause global impacts.

This concentrated demand makes cities ripe for a global paradigm shift to a resource efficient and low carbon future (Uhel and Georgi 2009). **Cities have the potential to manage resources more efficiently and protect ecosystem services.** They could delink urban development from resource consumption (less living space and less energy for housing and transport per person). For instance, increasing green spaces in cities would increase quality of life, while contributing also to CO_2 sequestration and thus climate change mitigation.

Figure 4.1 – The global impact of cities: energy demand and GHG emissions



Source: OECD and IEA (2008)

Many cities have a high concentration of biodiversity and high rates of urbanization often overlap with critically endangered ecosystems or 'conservation hotspots' (Box 4.4).

In many cases, **the way in which current conservation corridors or major wilderness areas** (such as the Amazon, the Central African forest or the forests of Borneo) **will undergo urbanization will determine whether significant biodiversity will survive or not**. A crucial role in this resides with local governments and their managers and their responsible management of this process. For instance, the Southeastern deforestation border of the Amazon in Brazil is controlled by 16 municipalities (coming together under the denomination 'Portal of the Amazon') whose economy is based on timber extraction and cattle ranching. Arguably, the most strategic investment for sustainability will be in building the capacity of these local governments to manage urban and landscape planning, 'green' public areas, use ecosystem services and biodiversity sustainably, raise citizen awareness as well as to promote and attract sustainable businesses.

The **benefits** that urban areas derive from ecosystems **are directly linked to public management**, through which the municipal activities and services are made accessible. As an example, the correlations between urban green spaces and urban citizens' health are provided in Box 4.5.

Box 4.4 Cities and biodiversity

Rome is one of Europe's largest cities with the highest number of protected areas. The 19 terrestrial and 1 marine reserve totaling 40,000 ha under protection (31% of the total area) are complemented by 5,000 ha of green public areas.

The municipal area of South Africa's **Cape Town**, overlaps with the Cape Floristic Region, one of only three areas in the world ranked as an urban biodiversity hotspot.

Source : Local Action for Biodiversity: www.iclei.org/lab

Sustainable ecosystem-based management is a crucial component of urban and regional spatial planning (see also Table 4.1 and Chapter 6). Other government units can also make use of ecosystem services in their work. To name but a few services, urban ecosystems provide:

- Food through urban agriculture which can be enhanced eg in community gardens, through land-use management, urban planning, or urban greening,
- Healthy green areas or trees which increase mental health and exercise opportunity, reduce stress, as well as air and water pollution, to be taken into account by health services, sports, urban planning, urban greening,

Box 4.5 Urban green spaces contribute to better health and protection

Green spaces:

- provide protection from flooding, air pollution, noise, temperature extremes and – if biodiversity friendly – from negative impacts of alien invasive species.
- promote relaxation and reduce stress. They enable sensory stimulation and time spent in natural light.
- provide inviting areas and encourage individual or group-based physical activity. Accessible, appropriately-sized, and biodiverse green spaces are very likely to be used by neighborhoods for exercise.
- promote social interaction and enhance community because they provide free public access to parks and communal facilities.

Source: Adapted from Greenspace 2008

Out of these considerations, numerous urban greening or tree planting have been established:

- The city of **Curitiba**, Brazil, amongst other greening activities, has managed to increase green space per person from less than 1 m^2/capita to 52 m^2/capita. Local residents planted 1.5 million trees and tax breaks were given to building projects that include green space. New lakes in parks helped to reduce the problem of flooding (ICLEI 2005).
- In **Honduras**, tree-planting and re-vegetation on slopes through schools, housewives' action and community work has been made part of a programme to fight extensive degradation of watersheds and recharge areas around Tegucigalpa. www.gwptoolbox.org/index.php?option=com_case&id=40

Local initiatives have found many occasions for encouraging tree planting:

- More than 10 million trees have been planted throughout Azerbaijan as part of the United Nations **'Plant for the Planet: Billion Tree Campaign'**. www.unep.ch/roe/WED2010/Press/Baku_tree_planting.pdf, www.unep.org/billiontreecampaign/index.asp
- **Nationwide efforts** like the initiative of the Keren Kayemeth LeIsrael-Jewish National Fund (KKL-JNF) to plant 7 million trees in Israel – one for each Israeli citizen. Project partner Zara-Mart offers its customers four different ways of contributing a tree to this initiative. www.kkl.org.il/kkl/kklMain_Eng.aspx, www.a-zara.com/index.asp?mainpage=plant_a_tree
- **Offsetting your vacation CO_2 emissions:** many airlines offer opportunities to offset carbon emission caused by travel by paying an extra contribution to fund, for instance, reforestation projects. The federal state of Mecklenburg-Vorpommern, Germany created a 'climate forest'. Tourists can either buy 'forest shares' or plant trees themselves to offset the emissions caused by holiday-related activities. www.waldaktie.de/en
- **Urban greening:** Many municipalities have programmes offering to plant trees for weddings, births or new immigrants. Montreal, Canada and Villa Carlos Paz, Argentina have introduced a 'One baby, one tree' programme. saintlaurent.ville.montreal.qc.ca/En/Intro/enfantarbre_ang.asp, www.villacarlospaz.gov.ar/amplia_noti.php?id_noticias=5273
- The University of Leipzig, Germany celebrated its 600th anniversary by planting 600 additional trees on its campus. www.600baeume.de
- Memorial trees: A vivid and lasting sign of remembrance are memorial forests. An American Forests campaign planted a tree for each victim of the 9/11 attacks. www.americanforests.org/campaigns/memorial_trees/

Trees and internet:

- **Tree benefits calculator:** This web-based application presents the benefits of specific trees in a visual format highlighting the dollar values of the ecosystem services delivered. www.treebenefits.com/calculator/ (for further examples see Annex)
- **Green search engines** like escosia.org help to save trees. The cooperation of yahoo, Microsoft Bing and WWF Germany re-invests 80% of its revenues in projects to protect the Amazon rain forest. ecosia.org/how.php
- WikiWoods.org: The German Wikipage connects tree planting events across the country and provides background knowledge on trees, their benefits and how to take part in initiatives. www.wikiwoods.org

- Shelter through moderation of extreme natural events. This concerns urban planning, adaptation to climate change, and disaster management (for further examples see Chapter 5.5).

For local governments to make the most efficient, cost-effective and responsible decisions, it is necessary to assess the impacts and dependence on ecosystem services, balance the →*trade-offs* and act accordingly. Often synergies can be achieved through working with nature rather than against it, by developing and using ecosystem-based approaches, which provide multiple benefits. The City of Manila (UN HABITAT 1998) and more recently, the city of Nagoya have successfully managed to reduce waste, lower cost and protect local ecosystems (TEEBcase Waste reduction to conserve tidal flat, Japan).

4.3 OPTIONS FOR LOCAL MANAGERS

Municipal governments have essentially three basic options to act:

1. **acting as role models** in implementing measures to improve performance and processes of administrative departments.
2. **promoting and setting incentives** to stimulate processes of transformation involving all sectors of society.
3. **setting the regulatory framework** and monitoring compliance to enforce sustainable use and management of natural capital.

For example, water supply is one of the most common services provided by local governments. A water saving programme implemented in municipal buildings can show the benefits of technological options available and encourage private companies and citizens to follow the example (role model). Encouraging water saving through pricing schemes or providing other financial support can help citizens reduce their water consumption (promoting). Restricting land-use in ground-water sensitive areas (regulating) minimizes the depletion. Further examples of local governments' activities are given in Table 4.1.

Table 4.1 Local Governments' options to act

Activities	Acting as role model	Promoting and setting incentives	Regulating
Green public places and infrastructure	Create green network with green belts to enhance ecosystems, biodiversity in urban areas and invest in climate change mitigation and adaptation measures	Incentives for citizens to develop private green spaces, green rooftops, community gardens and green walls	Building standards that allows only certified wood for public construction (see WWF 2009)
Low-resource consuming Housing including eg energy, land and water saving construction and technology and supporting climate adaptation and biodiversity measures	Offer low resource consumption public housing options for municipal employees	Partnerships with local housing companies Financial incentives and support for public housing integrating ecosystem services Advice and educational programmes; promotion of citizen construction groups integrating ecosystem services Bonus and off-setting schemes to compensate biodiversity or climate impacts from constructions	City development plan Zoning plan
Land-use / urban sprawl / sustainable urban development	Locate public services and public buildings in inner-city and neighbourhoods Land-saving construction of public buildings	Penalties for land-consumers Promotional campaigns and attractive cultural and social services Properties stock-exchange Extension and improvement of public transport along desired routes Bonus and off-setting schemes to compensate biodiversity or climate impacts from constructions	City development plan, inner-city development, city compaction programme Sustainable city quarters and developments Building code for impacts on land/landscape due to construction
Solid waste treatment	Waste to energy, eg biogas production from waste Reduce municipal waste and recycle	Education programme on how to reduce waste, reuse and recycle Efficient waste management system, incorporating low waste production, appropriate collection and recycling Financial incentives, to reduce waste 'Pay as you throw'	Waste regulation that promotes polluter-pays principle Waste to energy solutions Kerbside collection Penalty scheme

Table 4.1 Local Governments' options to act

Activities	Acting as role model	Promoting and setting incentives	Regulating
Water supply and wastewater treatment	Manage local and regional ecosystems to enhance water supply and treatment Water saving programme in public buildings, utilisation of rainwater	Partner with other levels of government, private sector and citizens in order to find effective water management for the entire catchment Set up payments for ecosystem service schemes for watershed protection Promote water saving devices and rainwater utilisation	Water quality standards Building code on natural rain water sinks Surface sealing codes
Energy supply	Implement energy efficiency and carbon reduction measures in the different public buildings and in management sectors 'Passive house' standard for public buildings	Awareness-raising campaigns to reduce consumption Subsidy programme or tax incentives for promotion of rational energy use Solar roof programme	Building code on 'passive house' standard Mandatory connection to urban district heating and cooling network, urban development plan
Transport	Replace fleet of municipal cars with low-emission vehicles Well performing public transport system Job ticket for municipal employees	Raise awareness of sustainable transport options and their potential impact Improve attractiveness of public transport, cycling and walking Car sharing programme Promotion of biofuels	Limit construction of new roads in favour of investment in public transport and cycle lanes Traffic Development Plan: parking space management, tram

Source: prepared by ICLEI for TEEB

To prepare, implement and evaluate their decisions in any of these options, there is a **vast array of instruments** used by local governments to help manage natural capital and reduce the negative effects on ecosystem services. These include planning, partnering and facilitating, monitoring, reporting. Specific tools which can be used include environmental indicators and targets, baseline inventories (carbon emission inventories, vulnerability assessments), urban planning and building codes, thematic action plans (such as Action Plans for Biodiversity and Climate Change Action Plans), biodiversity and ecosystem services guidebooks.

4.4 INTEGRATED MANAGEMENT FOR RESPONSIBLE PUBLIC MANAGEMENT

"Decision-making needs to reflect and respond to the many interconnections that lie in the fundamental drivers of urban development, yet the reality is that major gaps still need to be filled. (...) Even if overall sustainable development strategies based on an integrative concept are in place, sectoral and vested interests remain dominant where decision-making, administration and budgets are fragmented (lacking institutional integration) and decision-makers are not aware of the benefits of an integrated approach." (EEA 2009)

To deliver ecosystem-dependent municipal services effectively, **local governments need to integrate their public management of →*natural capital*** due to:

- the great interconnectivity between different types of ecosystem services (recreational, climate regulation, pollution reduction, air filtering, spiritual services),
- the connection between cities' activities and regional, national or even global natural capital, eg through emitting or mitigating greenhouse gases,
- the impact of local governments' decisions on a future time or future generations,
- the uncertainty of local governments' decisions in a rapidly changing environment,
- the need to involve a variety of →*stakeholders*, eg when developing and implementing a biodiversity strategy or a climate adaptation strategy.

THE INTEGRATED MANAGEMENT SYSTEM (IMS)

Ecosystem services and biodiversity can be integrated into public management and all local governments' decisions through cyclic, integrated management and planning. Various approaches have been developed – such as Integrated Development Planning (IDP) and City Development Strategies (CDS) methods. Recently, 25 European cities and towns in the framework of the project Managing Urban Europe-25 have been developing an →*integrated management system* (EC 2007). This approach employs experiences from participatory processes, such as Local Agenda 21, and environmental management systems such as the European Environmental Management and Audit Scheme – EMAS, or the international →*standard* ISO 14000 series (Box 4.6).

An Integrated Management System (IMS) follows five major steps that are repeated in regular cycles (EC 2007; UBCCE 2008; see Figure 4.2). An Ecosystems Services Assessment should be carried out as a **baseline review** documenting the current state of sustainability and the administrative situation, legal requirements and political priorities. Through facilitated public participation, a **target setting** exercise will develop goals for various aspects of local development and ecosystem management. Actions and initiatives identified according to current technologies and lifestyles then implement these targets. **Political commitment** is needed throughout the cycle but becomes most crucial to mandate the implementation of targets and to reflect related actions in the municipal budget (UBCCE 2008). The target timeframes provide for future monitoring and evaluation of the process. **Implementation** of actions will be based on political priorities and **monitoring** will gather information on the functionality of the system and progress towards targets. In the last step, **evaluation and reporting** will assess the information collected and analyze the success and draw-backs of the process. This provides the basis for a city council to decide on how to continue in the next cycle. Once the mechanism is established, the process is reiterated in subsequent years.

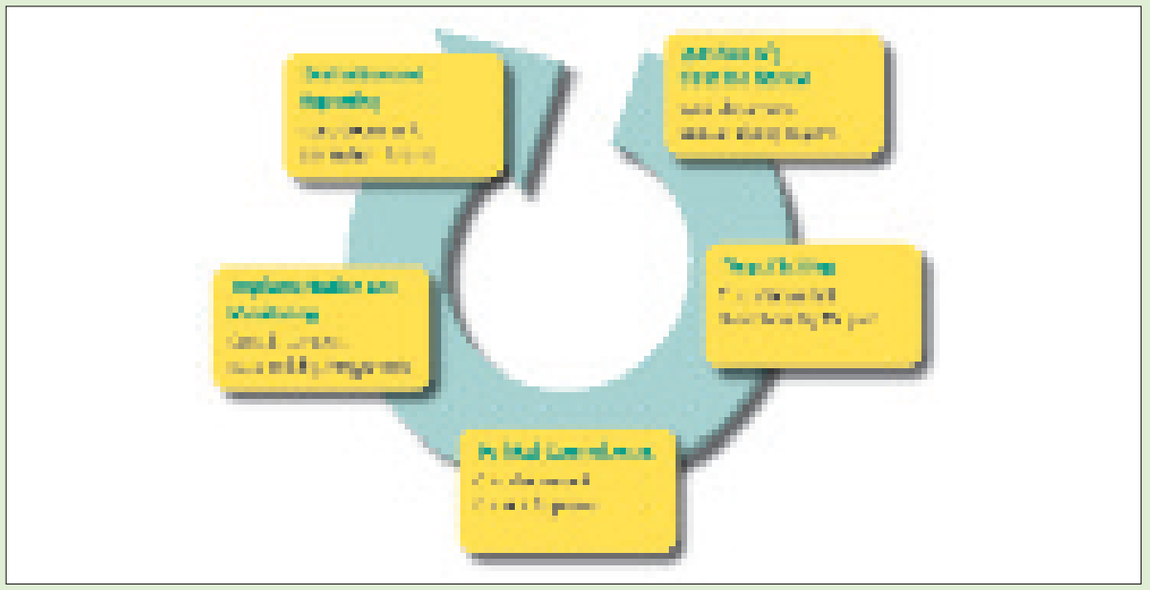
Box 4.6 Local Agenda 21, EMAS and ISO 14001

Local Agenda 21 (LA 21) was introduced with the UN Summit on Environment and Development in Rio, 1992. It called for participatory planning processes coordinated by local authorities to develop action plans for local sustainable development. Since introduction, Local Agenda 21 has been a success story for stakeholder involvement. By 2001 there were 6,500 LA 21 processes world-wide (ICLEI 2002).

The **European Environmental Management and Audit Scheme (EMAS)** is a voluntary management instrument for public and private organizations, in the European Union and the European Economic Area, to evaluate, report and improve their environmental performance. To date, this is being applied by more than 140 public authorities at all governmental levels including regional, national and European, located in the following Member States: Austria, Belgium, Germany, Denmark, Spain, France, Italy, Sweden and the United Kingdom. (ec.europa.eu/environment/emas)

ISO 14001 was developed and maintained by the International Organisation for Standardisation (ISO). ISO 14001 specifies requirements for an environmental management system to enable an organization to develop and implement policy objectives and targets which includes significant environmental aspects. (www.iso.org/iso/iso_14000_essentials).

Figure 4.2 Sustainability Cycle



Source: ICLEI 2007

The integrated management approach is based on **appropriate information, consultation and involvement of citizens and stakeholders at all steps of the cycle**. It has been successfully established in a variety of local governments: Ludwigsburg, Germany; Province of Siena, Italy; Lahti, Finland; Kaunas, Lithuania. With IMS, the effort lost in running several parallel management systems can be turned into sustainable and multiple benefits. Integrated, cyclic management is highly adaptive and robust, and thus is responsive in addressing uncertainties.

There are various instruments that can be used to feed into an IMS, for example, those of environmental accounting or the City Biodiversity Index proposed by Singapore (Box 4.7).

Box 4.7: Singapore City Biodiversity Index (CBI) /Singapore Index (SI)

The CBI is referred to as the Singapore Index (SI) on Cities Biodiversity. It has been developed as a self-assessment tool which allows local authorities to measure their performance not only on biodiversity itself, but also on ecosystem services and governance of natural resources. The Singapore City Biodiversity Index measures performance and assigns scores based on three categories:

The Index comprises 3 components:

1. Native Biodiversity in the City (including the percent of natural areas in the city, number of native plant, bird and butterfly species in the city, etc.);
2. the Ecosystem Services Provided by Biodiversity in the City (including carbon sequestration, recreation and educational services, etc.); and
3. Governance and Management of Native Biodiversity in the City (including budget commitment to biodiversity conservation efforts by cities, biodiversity conservation project and programmer carried out by city authorities, private sectors, non-governmental organisations, academic institutions, etc.).

Emphasis has been placed on selecting indicators that would more accurately measure positive actions taken by the cities rather than dwell on consequences that result from adverse activities beyond the control of the present generation. Twenty-five indicators were selected as this number optimised the comprehensiveness and robustness of the index without it being onerous. The CBI is currently being tested in 15 cities. The User's Manual for the Singapore Index on Cities' Biodiversity will be updated regularly on the website of the CBD, www.cbd.int.

Source: Singapore city biodiversity index, TEEBcase by Lena Chan

The following section will provide a concrete example of how an integrated system could look using the tool *eco*BUDGET.

*eco*BUDGET

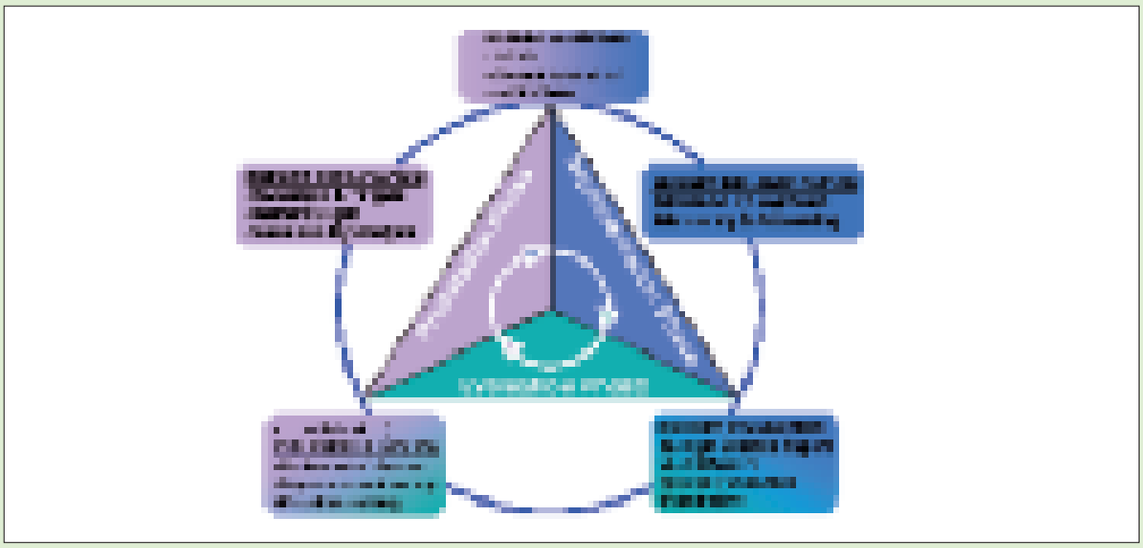
*eco*BUDGET has been developed based on natural capital management, and political and community involvement. It is a particular instrument that has been designed to explicitly address the integration of ecosystem services in decision-making based on the IMS principles described above. It provides a method to plan, control, monitor, report on and evaluate the consumption of natural resources (land, water, materials) including service functions (such as climate stability, air quality including noise and state of biodiversity). Box 4.8 and Box 4.9 provide experiences from the Philippines and Sweden.

*eco*BUDGET follows the **cyclical approach of local financial budgeting**, familiar to local decision makers, and has been developed for, and tested by, local authorities (Figure 4.3). The traditional budgeting accounting system is complemented by an environmental budget, in which ecosystem services or natural resources are measured in physical units instead of monetary value (ICLEI 2004). Due to its participatory character, *eco*BUDGET offers the potential for applying the participatory budgeting approach.

The aim is to **keep environmental spending within limits of an environmental 'Master Budget'**. The Master Budget identifies environmental targets oriented to the sustainable management of natural capital. Once approved by the Council, the targets become politically binding. At year-end a Budget Balance indicates the city's achievement against its targets.

Being a political instrument, a key feature in the *eco*BUDGET cycle is **systematic involvement of political decision makers and urban managers**, allowing political steering in the use of environmental resources. *eco*BUDGET embraces all environmental resources, not only the impact of delivering municipal services, but environmental spending by the entire community including industries, households, education and health institutions and transport companies.

Figure 4.3 – The *eco*BUDGET Cycle



Source: ICLEI 2007

Box 4.8 Using *eco*BUDGET in the Phillipines

The municipality of Tubigon in the province of Bohol, Philippines, has 44,434 inhabitants and an economy based on agriculture, fishery and tourism. The viability of the municipality's (and the province's) economy clearly depends on the health of its ecosystems: fertile soil, clean water, high biodiversity, adequate forest cover, and healthy mangroves, seagrass, and coral reefs. In 2005, with a high level of involvement from the private and non-government sector, the municipality began implementing *eco*BUDGET in order to tackle major threats to its environmental resources and to evaluate the impact of its existing environmental initiatives.

After a process of consultation, the first step in June 2005 was the production of a shortlist of environmental priorities by the 48-member Municipal Development Council. Over the next few months, several dissemination events took place to keep the public informed and involved in the development of the draft Master Budget. By December, the Budget was enacted by the Council based on six environmental resources: Drinking Water, Forest Cover (Upland Forestry and Mangrove Cover), Timber/Fruit Trees, Coral Reefs and Seagrass Beds, Quarry Materials and Good Built Environment.

A local implementing team (LIT) of nine municipal staff from different departments, coordinated by the municipal planning and development department, together with a team from Bohol provincial government, prepared an annual workplan for each municipal sector. During 2006, a variety of initiatives implemented included reforestation of timber, fruit trees and mangroves, establishment of a new marine protected area and the implementation of an ecological solid waste management program.

After one year, Tubigon had met most of its short-term targets and had realised *eco*BUDGET's potential as a platform for linking its municipal vision, plans, strategy, resource allocation and performance measures in order to promote sustainable development. The city is successfully addressing the aspects of sustainable tourism and strengthening local fishery by protecting coastal zones, mangrove areas and coral reefs through their *eco*-BUDGET. Tubigon has also learned that successful *eco*BUDGET implementation requires a long-term vision, well-defined targets, appropriate indicators, high level of political commitment and community involvement.

Source: EcoBUDGET Guide for Asian Local Authorities. ICLEI 2008. www.ecobudget.com/fileadmin/template/projects/ecoBudget_ASIA/files/ecobudget_final.pdf

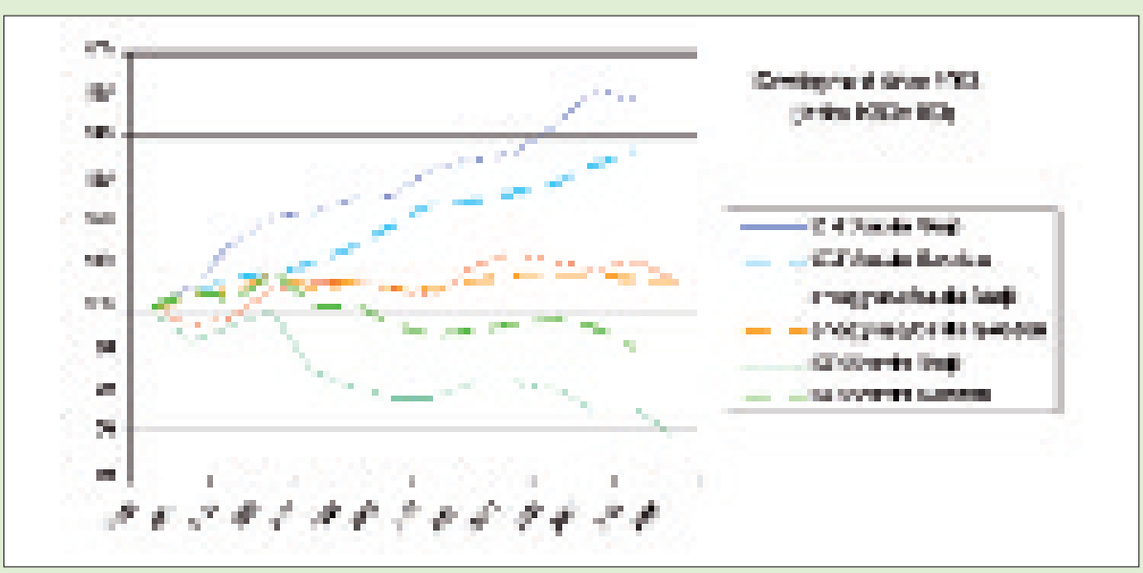
Box 4.9 Using *eco*BUDGET in Sweden

In Sweden, **Växjö's** biggest industries are forestry and wood production, with forests covering 60% of its geographical area. It is a pioneer of using wood biomass for fuel and has been using *eco*BUDGET as a management tool to meet its environmental target to become Fossil Fuel Free.

Using forest waste collected from within 100 km of the city, more than 90% of the energy for heating is renewable. Between 1993 and 2008 the emissions of carbon dioxide from Växjö have decreased by 35% per capita and the city was able to increase its GDP/capita by 50%. Collective environmental thinking over the last few decades has resulted in economic profits as well as cleaner air and water. Växjö officials are proud that the municipality is well on its way to further achievements.

Source: www.vaxjo.se/VaxjoTemplates/Public/Pages/Page.aspx?id=1664

Figure 4.4 Energy consumption, GDP and CO_2 emissions of Växjö, Sweden



Source: Figure provided by the City of Växjo, Sweden

4.5 ACTION POINTS FOR LOCAL GOVERNMENTS

Local governments depend on natural resources and their ecosystems when delivering services – drinking water, clean air, a healthy environment and treatment of waste and sewage. Explicitly **assess the ecosystem services used** for and impacted in municipal service provisioning.

This can help to **identify cost effective options** for investing in natural capital through sound ecosystem management. This will also lead to a healthier environment for citizens, thus attracting business and industry, and can help to reduce poverty for those who depend most on natural resources for their livelihoods.

An **integrated management system** provides good grounds for local governments to internally organize themselves and externally influence and regulate the management of ecosystem services, biodiversity and at the same time **address community needs**. This integration will help to systematically incorporate natural capital in decision making and ensure that environmental management is not seen as a 'stand alone' with no connection to the council's core activities.

FOR FURTHER INFORMATION

Quality of Life in Cities and Towns and Impacts on Ecosystems
European Environmental Agency (EEA), 2009 'Ensuring quality of life in Europe's cities and towns' Report No 5/2009. This comprehensive report aims to raise awareness of the potential of cities to deliver quality of life under conditions of global change. It provides ideas and good practice examples of integrated action, policy responses and governance. www.eea.europa.eu/publications/quality-of-life-in-Europes-cities-and-towns

World Resources Institute (WRI), 2008 www.pdf.wri.org/corporate_ecosystem_services_review.pdf This report points out business risks and opportunities arising from ecosystem change.

Guidelines on Integrated Management
European Commission (EC), 2007 'Integrated Environmental Management, Guidance in relation to the Thematic Strategy on the Urban Environment'. This EC guidance is available in all EU languages and lays out its principles. ec.europa.eu/environment/urban/home_en.htm

Union of the Baltic Cities Commission on the Environment (UBCCE), 2008 'Managing Urban Europe-25 project. Integrated Management –Towards local and regional sustainability'. This handbook, along with practical guidance including case studies and checklists, is available at www.localmanagement.eu/index.php/mue25:downloads

Elaborated baseline reviews and strategic programmes are collected at www.aalborgplus10.dk/

An overview of policy, management and planning instruments along with 12 case studies from around the globe is presented in 'Liveable Cities. The Benefits of Urban Environmental Planning', The Cities Alliance, Washington, 2007. www.cities-alliance.org/ca/node/720

Guidelines on ecoBUDGET
A brief and easy-to-read introduction for local decision makers is provided by UN-HABITAT, UNEP & ICLEI (2008); 'ecoBUDGET Introduction for Mayors and Municipal Councilors'. www.ecobudget.org/fileadmin/template/projects/ecoBudget_webcentre/files/publications/ecobudget_introduction_to_mayors.pdf

More in-depth guidance for planners and managers in cities is provided at www.ecobudget.org. The website contains further guidebooks – for both developed and developing countries, introductions and case studies and on the ecoBUDGET instrument.

Tools, methodologies and case studies on good governance and poverty reduction can be found in 'Participatory Budgeting in Africa – A Training Companion', UN-HABITAT, 2008; www.unhabitat.org/pmss/getPage.asp?page=bookView&book=2460

Guidelines on Biodiversity inclusive Management
ICLEI – 'Local Governments for Sustainability, Local Government Biodiversity Management Guidebook', (publication autumn 2010). The Local Action for Biodiversity (LAB) Guidebook provides advice for planning and managing local biodiversity drawing on the experiences of 21 local authorities. It covers the topics biodiversity and climate change, mainstreaming and managing biodiversity as well as legislative frameworks and implementation mechanisms. (further information and update will be available on www.iclei.org/lab).

The Secretariat of the Convention on Biological Diversity (CBD) is preparing a complementary guidebook which will include best practices, lessons learned, guidelines and recommendations on how to support local governments to effectively implement the Plan of Action.

Information and case studies on urban agriculture are available on the Climate Institute website: www.climate.org/topics/international-action/urban-agriculture.htm

UNEP, FIDIC & ICLEI (2001) 'Urban Environmental Management: Environmental Management Training Resources Kit'. Earthprint

United Nations (2010) 'Avances en la sostenibilidad ambiental del desarrollo en America Latina y el Caribe', Chile, 2010

5 ECOSYSTEM SERVICES IN RURAL AREAS AND NATURAL RESOURCE MANAGEMENT

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Content of this chapter

Key Messages

- **Desire for change is not enough.** People and institutions may want to practice sustainable resource use but are impeded by poverty, ineffective governance and poorly designed incentive schemes.
- **It's easier to act if you can see what you're doing.** Valuation makes the impacts of changes in the flow of ecosystem services visible. This is useful in negotiations around the distribution of costs and benefits.
- **Integration is effective.** Placing value (monetary and otherwise) on ecosystem services can help make the case for integrated ecosystem management. Integrated approaches have already been developed and applied around the world.
- **Local officials play a key role** in implementing sustainable practices in forestry, fisheries, water management, agriculture and tourism. They can initiate capacity building, balance the needs of various sectors, promote locally-produced sustainable produce, run incentive schemes, and establish regulations and management-use zoning. They can also promote and explain the economic benefits of protected resources to their constituents.
- **Local governments can make disasters easier to manage** by maintaining and restoring ecosystems. The role of ecosystem services in disaster mitigation is gaining increasing attention. Healthy forests, mangroves, wetlands, floodplains, and reefs protect communities from natural disasters.

> "We need to start looking at having a way of managing the whole ecosystem, because you can't pick away at it piece by piece, you have to truly start being coordinated and managing our resources as a system. We haven't gotten to that point yet."
>
> Ted Danson

In this chapter we illustrate the relevance of an →*ecosystem service* perspective in increasing the potential for effective natural →*resource* management. We argue that such an approach is not only ecologically sound, but also holds economic benefits both for those directly dependent on them and for the national economy in terms of medium and long-term cost and benefits. **Well-managed natural →*ecosystems* provide citizens with vitally important goods and services**, including clear and plentiful supplies of water, high quality farm soils, genetic material for medicines and crop breeding, wild foods including fish, and buffering against extreme weather events and climate change. These, along with a range of cultural, spiritual and aesthetic →*values* that we derive from nature, are called ecosystem services.

An **ecosystem service perspective** can make a **substantial contribution to the effective management of natural resources** for improved agriculture (5.1), fisheries (5.2), forestry (5.3), tourism (5.4) and disaster mitigation (5.5). Many decisions on the use of natural resources are typically made by the individuals, families and companies engaged in these sectors, such as farmers, fishermen, logging companies and tourism operators. Local governments and other local actors (NGOs, local sector agencies) can play an essential role in realizing the economic potential of managing natural resources in a way that values the ecosystem services, by providing advice, creating economic incentives and playing a regulatory role.

Under conditions of climate change, good management of natural resources becomes even more important as **healthy ecosystems can significantly contribute to both mitigating climate change and providing good adaptation opportunities locally**. For example, natural disaster management particularly preventing damage from storms, avalanches or flooding, is a policy field where ecosystems can often provide very cost-effective protection.

Maintaining and managing ecosystem services can be challenging, either because benefits are far removed from the local ecosystem or because some problems only become visible after a certain time-lag, in both cases collective action may be necessary to address management. Carefully designed policies can ensure that the costs and benefits of ecosystem services are fairly distributed across space and time, but only if these are properly understood. Whilst the legal framework for such interactions is often worked out at a national level, the day-to-day negotiations – and some of the most innovative approaches to solving resource conflicts – usually take place at the local level. The final section of this chapter summarizes options for local policy to effectively enhance ecosystem services in natural resource management.

5.1 AGRICULTURE

Almost half of the world's population live in rural areas, with their livelihoods and security depending directly on the productivity of land and water resources (Engelman 2010). At the same time, rural areas provide resources for urban populations, ranging from food and fibre to water, minerals and energy. **Agriculture is the single most important sector in providing the basic necessities for human existence.** It accounts for about 37% of the world's labor force or about 1.2 billion people, even though this is well under 10% in most developed countries (CIA 2010).

For agriculture to be able to provide the service it does, it must rely on a set of complex interdependent and functional relationships between soil, crop production, animal husbandry, and often forestry and wetlands.

The most essential components of a farming enterprise are the soil, crops, livestock, pasture, and household, but pollinators and natural predators are also important (Figure 5.1). The crops draw the nutrients from the soil to produce a harvest for subsistence and/or markets. By-products of the agricultural harvest enter the livestock system as fodder or bedding for animals which in turn produce meat, milk, eggs and fur, and in some cases, draught power. Animal waste may either be used to manure the soil, thus closing the nutrient cycle, or as fuel for cooking (dung cakes and biogas). Careful management, based on understanding local ecological conditions, can maintain or enhance productivity whilst reducing some harmful effects of intensive agriculture. In Japan, for example, rice farmers keep the Aigamo duck, which removes weeds and pests from the rice fields. The duck also fertilizes the rice, producing mulch around the rice plants (TEEBcase Fertilizing the fields with ducks, Japan).

Maintaining an agro-ecosystem in a productive state is a challenge. If a hill farm replaces all its trees with a monoculture crop, the subsequent rains will wash down substantial amounts of soil into the neighbor's low-lying fields and affect the soil fertility, for better or worse. Use of harmful pesticides on one farm may affect the neighboring farm through spray drift in the atmosphere or being transported in waterways or may facilitate migration of chemical resistant varieties of pest. Thus, explicitly **considering ecosystem services** and maintaining or restoring the system to a healthy state, is a valuable strategy **for securing or improving agricultural yields**. Hiware Bazaar (Box 5.1) has achieved this through improved water management.

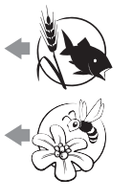
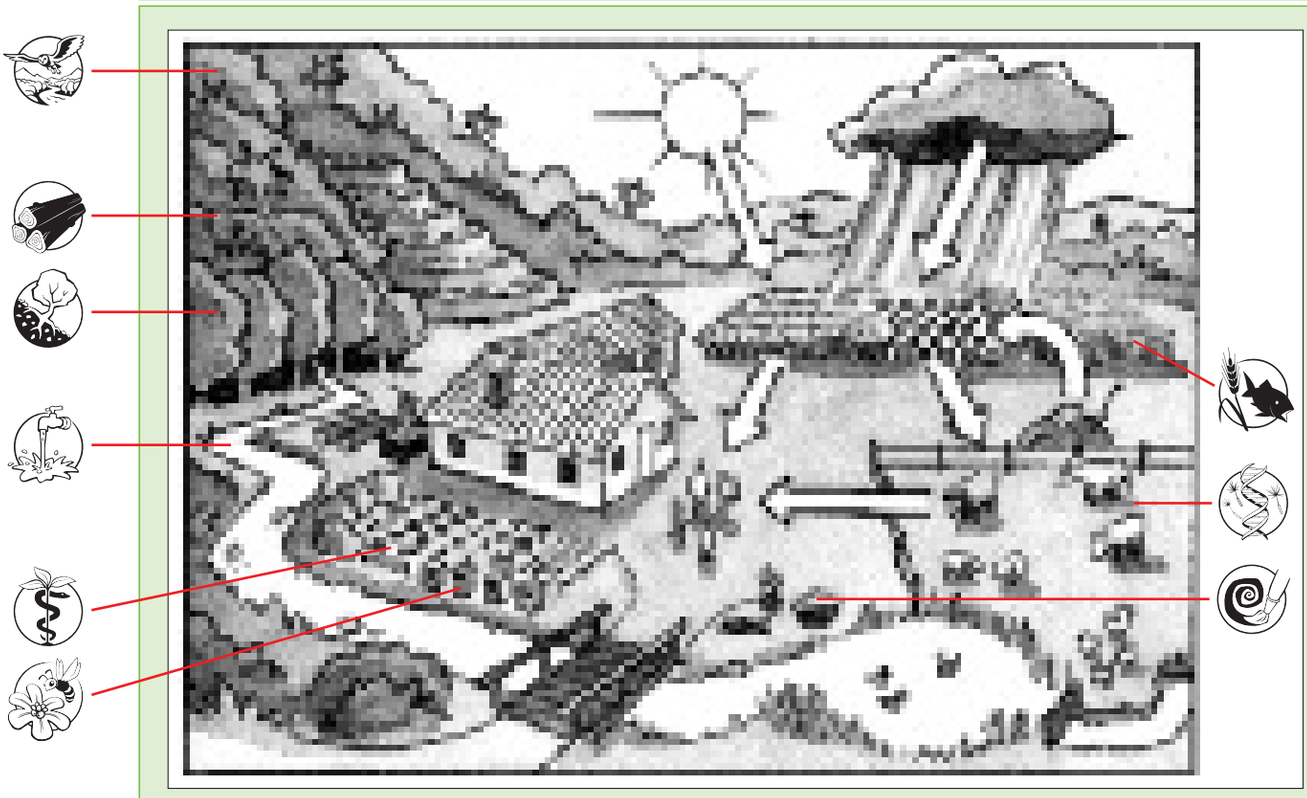


Figure 5.1 Agriculture interacts with the wider ecosystem and its services



Box 5.1 A village with 54 millionaires: Agricultural revolution in an Indian village

Hiware Bazaar, an agrarian village in an arid district in the state of Maharashtra, has turned from abject →*poverty* to become home to more than 50 millionaires (in Rupees) and boasts one of the highest average rural incomes in India. In the 1970s, problems from low rainfall (400 mm annually) were exacerbated by increasing run-off during monsoons, leading to a decline in water levels and acute water shortages. The cause was deforestation and vegetation loss in the surrounding catchment. By 1989 barely 12% of the arable land could be farmed and this crisis had already triggered a trend of out-migration.

Village elders and leaders realised that the way out of this vicious poverty cycle was better management of water and forests. They drew up and implemented an integrated natural resource management plan which was helped by the emergence of the Indian government's Employment Guarantee Scheme (EGS) in the mid-1990s. With additional resources, and good coordination between government departments supporting the EGS, the village members regenerated 70 ha of degraded forests and built 40,000 contour bunds around the hills to conserve rainwater and recharge groundwater.

The number of active wells doubled, the area under irrigation expanded from 120 to 260 ha between 1999 and 2006, while grass production went up from 100 to 6,000 tonnes. Consequently, livestock increased dramatically, as did milk production from 150 litres to 4,000 litres per day. Income from agriculture alone amounted to 25 million Rupees (US$ 550,000) in 2005. In less than a decade, poverty reduced by 73% and there was an overall increase in the quality of life with people returning to the village. Hiware Bazaar is a striking example of an integrated approach to natural resource management.

Source: Enhancing agriculture by ecosystem management, India. TEEBcase mainly based on Neha Sakhuja (see TEEBweb.org)

THE IMPACTS OF AGRICULTURE ON ECOSYSTEMS

The demand for agricultural products is constantly increasing due to population growth, new food preferences and an increase in purchasing power with economic growth (Pretty et al. 2006). Although crop and livestock production systems have been vastly enhanced over the last 50 years, **both the intensity of production and the growth in area cultivated are increasingly affecting ecosystem services** (MA 2005).

A major **side-effect of agricultural intensification is soil degradation and deterioration in water quality**. Animal effluent and run-off from agricultural fields that includes fertilizers, pesticides, hormones, and high levels of nitrates may pollute ground water and nearby aquatic systems. Emissions from livestock stables and feedlots can additionally affect air quality. The negative impact of intensive agricultural production systems not only affects human →*well-being* directly, but also reduces populations of bees and other beneficial insects that pollinate food crops or provide biological control of pests. Agricultural intensification is one of the main threats to →*biodiversity* (EEA 2006). Agro-bio-diversity, the variety of different plants cultivated and animals produced, typically also declines in intensive agricultural systems.

The most **common →*externalities*** with respect to the expansion of agricultural area **are changes in land-use at the expense of forests and other ecosystems, land degradation and nutrient depletion**. At the same time this accelerates climate change, especially deforestation of tropical forests, which is a significant source of green house gas emissions.

The **challenge today** is therefore **to secure and increase yields while** at the same time **maintaining or enhancing other vital ecosystem services** including water quality and quantity, maintaining soil fertility and biological control. Fortunately, many successful examples of sustainable approaches to agriculture already exist around the world.

THE ROLE OF BIODIVERSITY FOR AGRICULTURE

Many wild animal and plant species play a role in agriculture; some damage crops and livestock (see Box 5.8); others control pests through predation and competition or provide essential services such as pollination. Such agro-ecosystems build populations of valuable soil microorganisms and use natural vegetation in field margins and on slopes to stabilize soil and retain moisture.

In addition, **crop genetic diversity** – both cultivated plants and the wild plants from which our crops originate, are important resources **for food security and economic stability**. This diversity provides crops well-adapted to local ecological and climatic conditions and contributes valuable source material for crop breeding. Estimates of the global value associated with the use of plant genetic resources for crop breeding vary from hundreds of millions to tens of billions of US dollars per year (Stolton et al. 2006). Wild coffee, for example, with its associated potential genetic resources for agriculture, is only maintained in the understorey of Ethiopian highland forests, which are rapidly disappearing (Gatzweiler 2007). Hein and Gatzweiler (2006) estimated the economic value (net present value) of these genetic resources at US$ 1,458 million (over 30 years, 5% →*discount rate*).

Whilst seed collections are useful and necessary, it is also important to maintain healthy wild populations in the field – whether in protected areas or otherwise conserved. Yet many of the places that are richest in economically important crop wild relatives have low protected area coverage and many important species and varieties remain at risk of extinction (Stolton et al. 2008a). Conserving local crop varieties, and supporting farmers in improving them, can help secure local livelihoods in the short-term and provide important options for the future (Box 5.2).

TAKING ECOSYSTEM SERVICES INTO ACCOUNT IN AGRICULTURE

Agriculture goes beyond the provisioning of essentials such as food and fibre; it also incorporates biodiversity and genetic resources, biological control mechanisms, soil microorganisms and habitats that

Box 5.2 Benefits of genetic diversity for rice farmers in the Philippines

A SEARICE-led initiative aims to empower local farmers and decision makers to conserve genetic diversity. The project started with efforts to conserve different local varieties jointly with Philippine farmers. Rather than just conserving varieties in their present state, farmers wanted to improve them further, in order to increase food security and yields. Provided with the necessary know-how they were able to develop locally well-adapted traditional varieties at a cost of ~US$ 1,200 per site for an annual breeding program; considerably lower than those of formal crop breeding (~US$ 6,000 per year per site). Rice farmers benefit from the genetic diversity conserved as the availability of good quality seeds increases, input and production costs decrease and dependence on conventional plant breeding companies is reduced. Hence, decision makers and farmers with knowledge about their regional genetic diversity gain immediate benefit (SEARICE 2007).

provide a range of other ecosystem services. Policy makers have the power and capacity to bring an integrated ecosystems perspective to agriculture. For example, if looking to enhance productivity through technology, it is important to avoid deterioration of other ecosystem services in the process.

Agricultural development requires a whole **system approach** and needs to be tailored to the particular opportunities and requirements of the ecosystem. In Muraviovka Park in Russia organic agriculture was introduced at a local level, along with a wetland conservation strategy. The use of traditional varieties, and a strategy of crop rotations with fallow, has allowed the elimination of agrochemicals. Yields obtained with these practices exceed those of the local conventional methods with only half of the production costs. Many farmers around the park followed the example (TEEBcase Organic farming in private protected area, Russia). With the resulting increase in wetlands and water quality, the biodiversity of the region improved with the number of cranes and storks increasing threefold. In Ecuador, for example, the Quichua community has successfully shown that reintroducing traditional crops and medicinal plants led to a dramatic increase in agricultural productivity, food security and income levels (Equator Intitiative Award 2008).

Box 5.3 Traditional water management delivers multiple benefits, Sri Lanka

The early Sri Lankan society developed a system of irrigation tanks that retain river runoff mainly for the purpose of irrigation agriculture. Besides the production of rice, the tanks provide goods such as fish, lotus flowers and roots that diversify household income.

Since the 1970's the demand for water in upstream areas for modern, large-scale agriculture and hydropower has risen and traditional management practices have been lost. This led to increased sediment load and siltation with negative consequences for the livelihood of downstream users. Recently, local authorities took over management of the tanks and raised the spill in order to rapidly restore their capacity for water storage. This, however, did not solve the problem of siltation.

IUCN together with the local authorities conducted an →*economic valuation* of the goods and services that the traditional tank system is providing for the livelihood of local communities in the Kala Oya river basin. The analysis considers four different scenarios and shows two things: First, the ecosystem services perspective revealed that only 16% of households obtain benefits from paddy rice cultivation, the most prominent purpose of the tank, while 93% benefit from access to domestic water. Secondly, the analysis suggests that rehabilitating tanks and continue 'traditional management' is the scenario with the highest economic return for local communities with a net present value (NPV) of US$ 57,900 per tank (over 30 years, 6% discount rate) as a broad range of services can be secured. Since the communities would directly benefit from the rehabilitation of the tank system, they were positive about participating and taking over the restoration work.

Source: Water tank rehabilitation benefits rural development, Sri Lanka. TEEBcase based on Vidanage et al. (see TEEBweb.org)

In many areas of the world people have developed and maintained sustainable production systems over a long time. These **traditional landscapes** often fare well from an ecosystem perspective as they **provide multiple benefits**. These systems are now increasingly threatened, due to urbanization, new technologies, or population migration. While not all traditional systems are more productive or more equitable, analyzing them from an ecosystem perspective can help to uncover benefits that often go unrecognized, as the example of traditional water management system in Box 5.3 illustrates. Measures are urgently needed to recover the sustainable practices and knowledge involved to improve agricultural technologies. The Ministry of the Environment of Japan and the United Nations University Institute of Advanced Studies jointly initiated the Satoyama Initiative to conserve these sustainable types of human-influenced natural environments, and the many species that depend on them. (TEEBcase Conserving cultural landscapes, Satoyama Initiative, Japan). Practical experience with sustainable practices is increasing rapidly (Box 5.4).

HOW CAN LOCAL POLICY SUPPORT SUSTAINABLE AGRICULTURE?

Local governments, local sector agencies, non-governmental organizations, and other actors at the local level have many opportunities to encourage sustainable practices by:

Providing advisory services: Farmers may not be aware of land-use alternatives even if they make economic sense. This is often the case for enhancing services through improved soil fertility, water retention, pollination and biological control. Agricultural extension services can help create awareness and access to alternatives.

Supporting long-term investments: The deterioration of ecosystem services becomes visible only after a certain time lag. Equally the benefits from investing in improvements such as agro-forestry or contour trenches to combat erosion are slow to be seen. Therefore, even though the benefits often outweigh the costs, poor farmers are usually unable to make significant investments upfront so that credit schemes or subsidies on investments can be decisive.

Creating incentives for maintaining ecosystem services across scales: This is particularly important where benefits are mostly public or accrue to others. Examples include water supply, which may be dependent on a watershed system hundreds of miles away; carbon sequestration, which is not only locally significant but serves to regulate the global climate, and maintaining habitat for species that are valued globally. Where public benefits are local, as for local climate regulation, recreation and health, there is a rationale for local governments to invest in providing these services. Where the benefits occur elsewhere, local policy makers have a role to play as intermediaries by

Box 5.4 Sustainable agricultural methods and technology raises yields and improves ecosystem services

A study of 286 interventions in 57 developing countries assessed the impact of various sustainability-enhancing agricultural practices: integrated pest management; integrated nutrient management; use of conservation tillage; agroforestry; aquaculture; water harvesting and integration of livestock in farming systems. A net crop productivity increase of 79% and an improvement in critical environmental services was found over the 12.6 million farms that were studied.

Projects dealing with adequate use of pesticides reported a 71% decline in their use, while increasing yields by 42%. The overall water use efficiency increased considerably by enhancing soil fertility and reducing evaporation, using low-tillage techniques, improved varieties and inducing microclimatic changes to reduce crop water requirements. Annual gains of 0.35t C per hectare in carbon sequestration potential offered new opportunities for households to generate income from carbon trading schemes. Within a period of four years, there was a dramatic increase in the number of farms (56%) and area (45%) that adopted sustainable technologies and methods, with poor households benefiting substantially.

Source: Pretty et al. (2006)

supporting farmers in negotiations with distant beneficiaries. Integrating payment for ecosystem service schemes across levels are an instrument to do this (see Chapter 8 for examples).

Enhancing coordination: Improving ecosystem services often requires collective action. For example, habitat conservation for biodiversity in intensely used landscapes requires careful coordination between land users. Farmers can support biodiversity conservation by limiting agricultural land use or providing wildlife corridors. Europe has implemented payment schemes based on keeping land in 'good agricultural and environmental condition' (EEA 2006). Similar schemes exist in Canada (Robinson 2006), USA (Lenihan and Brasier 2010), New Zealand (Rosin 2008) and Japan (Hiroki 2005). State and district authorities can define local desirable practices in agri-environmental schemes.

5.2 FISHERIES AND WETLANDS

Marine and freshwater wetlands supply many values (Box 5.5) including fish, but attitudes to wetlands remain ambiguous and management is patchy. Some fisheries are relatively well managed and management techniques are understood; here the challenge is to extend techniques to other areas. Wetlands, however, particularly freshwaters and estuarine habitats, are still quite neglected and there is a major challenge in changing perceptions and practices.

According to the Food and Agricultural Organisation, 250 million people in developing countries are dependent on small-scale fisheries for food and income (Béné et al. 2007). In 2004 the annual value of global marine catch was US$ 85 billion. However, **due to overfishing 75 percent of fish stocks were underperforming**. This is causing an annual loss of US$ 50 billion compared to the catch that would be possible if fish stocks were managed sustainably and not overfished (World Bank and FAO 2009). There are similar findings at the national level (Box 5.6).

Fisheries are declining globally (Pauly et al. 2005) due to damaging fishing practices and climate change will make this situation even worse. Coastal and nearshore fisheries are further impacted by agricultural run-off, deforestation, coastal tourism and destruction of mangroves and salt marshes. Many coastal communities are at risk because large-scale fishing operations have over-fished their traditional stocks, creating a social problem alongside the ecological losses. Aquaculture operations, while promoted as being more sustainable, often rely on wild caught fish for feed (Naylor et al. 2000). In some countries aquaculture has replaced mangroves where wild fish spawn, thus further reducing populations. The Millennium Ecosystem Assessment highlights the problem, **"The use of two ecosystem services – capture fisheries and freshwater – is now well beyond levels that can be sustained even at current demands"** (MA 2005:6). While the problems usually require national or even international regulation and management, local and regional policy makers can often influence coastal and inland fisheries as well as local aquaculture.

There is now ample evidence that **protected areas can rapidly rebuild fish numbers** and act as reservoirs for replenishing stocks beyond their borders. Thus local ecosystem management can quickly repay investment, particularly through the use of both temporary and permanent no-fishing areas (Box 5.7).

A review of 112 studies in 80 marine protected areas (MPAs) found that fish population densities were on average 91% higher, biomass 192% higher and organism size and diversity 20–30% higher than in surrounding waters, usually after just 1-3 years and even in small reserves (Halpern 2003). As fish increase in MPAs they 'spill-over' to surrounding waters, increasing catch; the net gain usually outweighs the lost fishing area (Pérez Ruzafa et al. 2008). Promoting and demonstrating the value of no-take zones can be a key role for local governments or NGOs interested in stabilising both marine environment and food supplies.

Box 5.5 Wetlands supply multiple values to society

Wetlands are under-valued, misunderstood and often viewed as unproductive waste areas that spread disease and serve as rubbish dumps. But the Millennium Ecosystem Assessment estimated that wetlands provided services worth US$ 15 trillion worldwide (MA 2005a), including:

Food: protein from fish and animals; plants used as food and fertiliser; mangroves are also important as fish nurseries. Cambodia's inland fisheries alone are worth up to US$ 500 million/year with 60% coming from Tonle Sap Lake (ICEM 2003).

Water: for irrigation, industry and domestic use. Wetlands can be highly effective in reducing pollution (Jeng and Hong 2005); the East Kolkata wetlands clean at least a third of the sewage from Kolkata in India (Ramsar 2008, Raychaudhuri et al. 2008). Some water plants concentrate toxic materials in their tissues, thus purifying surrounding water. In Florida's cypress swamps, 98% nitrogen and 97% phosphorus from waste water entering wetlands were removed before the water entered groundwater reservoirs (Abtew et al. 1995).

Protection: by allowing space for floods and sea surges to dissipate their energy, including in river flood-plains and coastal marshes. Wetlands have been shown to be very cost-effective ways to provide storm protection services (see section on Disasters). Conversely, loss of protection from coastal marshes was estimated to have been a major contributory factor in the US$ 75 billion damage caused by Hurricane Katrina in the southern US (Stolton et al. 2008b).

Stabilisation: of climate change by storing and capturing carbon, particularly in peat, which although it only covers 3% of the world's land surface is estimated to be the largest carbon store, storing 550 gigatonnes of carbon worldwide (Parish et al. 2008; Sabine et al. 2004). In 2008, however, emissions from degraded peat were estimated at 1,298 Mt, with over 400 Mt from peat fires, increasing the need for sound management (Joosten 2009).

Cultural values and recreation: for many people, particular wetlands also have important cultural values as places with high aesthetic quality, for sports and recreation, and also as sacred sites. These values often have direct economic benefits. Economic valuation by the World Resources Institute estimated the value of reef-related tourism and fisheries from just one area, Glover's Reef Marine Reserve, contributed around US$ 4.9-7.3 million a year to the national economy of Belize (Cooper et al. 2009).

Box 5.6 Underperforming fish stocks in Argentina

In Argentina continued overfishing of the Argentinean Hake (Merluccius Hubbsi) is threatening the long term ecologic and economic viability of the fish stock mainly because total allowable catch is ignored and exceeded by up to 90%. At the same time discards increase due to the increased catch of juvenile fish representing an annual loss of US$ 11-77 million. Ecological models project that if existing quota were met, the already created no-fishing zones in the nursery grounds around the Isla Escondida were respected, and the current 120% overcapacity of fishing vessels were reduced by 25-50%, the stock of hake would recover leading to significant economic gains: compared to a continued →*overexploitation* the compliance with the existing policies for the protection of the fish stocks would increase the Net Present Value (NPV) from US$ 65.7 million to 118.5 million for the fresh fish fleet, and from US$ 263 to more than US$ 460 million for the freezer fleet, over the period 2010 to 2030 (Villasante et al. 2009).

Source: Better fishery management could significantly increase catch, Argentina. TEEBcase based on Villasante et al. (see TEEBweb.org).

Box 5.7 The benefits of protecting critical habitat in Bangladesh

The wetland of Hail Haor, in north-east Bangladesh, provides fish and aquatic plants that are essential sources of food and income for local communities. Severe over-exploitation put the annual benefits of US$ 8 million at risk. This motivated local and regional efforts to improve wetland management and install protection zones. Protecting just 100 ha of wetland, by restoring some critical habitats and establishing closed seasons for fishing, contributed to increased fish catches across the 13,000 ha of the entire Hail Hoar wetland by over 80% and local fish consumption by 45%.

Source: Wetland protection and restoration increases yields, Bangladesh. TEEBcase by Paul Thompson (see TEEBweb.org)

OPTIONS FOR LOCAL ACTION

Local responses to declining fish populations can include, for instance, pollution control, restoration of coastal habitats such as salt-marshes and mangroves, anti-poaching patrols and changes to fishing practices in addition to protection. Many national and local governments have regulated fishing, with varying success. **Co-management regimes**, where local fishing communities manage fishing practices jointly with the government, as well as management by local fishing communities themselves, have also proved successful in managing fish stocks. Research in Lao PDR found that co-management can be particularly successful for protecting fish (Baird 2000). Policy makers can help local fishing communities to learn from such cases. **Successful management practices** include: changes in mesh size (to reduce by-catch of young fish); better sorting; bans or restriction on bottom trawling; and protection of fish breeding sites. These can all help maintain a rich and stable marine environment, thus securing the livelihoods of subsistence or commercial fishing communities. In some parts of the world such practices have been known for centuries; in places where these ideas are still new, their introduction often takes careful negotiation, trials and →*trade-offs*, which usually need to be undertaken at a very local scale.

Water resources are under pressure in many parts of the world and are proportionately far less protected than terrestrial ecosystems (Abell et al. 2007). Decisions about wetlands are usually made on a local scale and need to be based on wide ranging assessments that **take all values into account**. Recognising the multiple values of wetlands is critical to their maintenance and sustainable management.

Box 5.8 Collaborative management of wetlands in Kenya

The Kipsaina Crane and Wetlands Conservation Group formed in 1990 as a partnership of local communities to conserve and restore the Saiwa Swamp National Park in Kenya. As a result of the group's efforts, neighboring communities have a reliable and clean water source all year round, and community members are now engaged in new types of business such as beekeeping, eco-tourism, and agro-forestry. There has also been a fivefold increase in the grey crowned crane population as well as increased income from fish and produce sales.

Source: Equator Initiative Prize 2006 (www.equatorinitiative.org)

5.3 FORESTS AND WATERSHED MANAGEMENT

Throughout history, forests have been a source of subsistence, not only for hunters and gatherers, but also as part of farming systems, providing construction timber, cooking fuel, animal fodder, wild game, medicinal herbs and other products for subsistence and market (Box 5.9). Furthermore, forests not only prevent soil erosion but also contribute to the formation of topsoil, which serves as an important sink for carbon (more details below).

Box 5.9 Wild products and wild animals from natural and semi-natural ecosystems

Wild products are often dismissed as being of minor importance but they remain a critical resource for many poor people, who have no safety net if these resources become unavailable. All countries have significant wild forest products markets and recent immigrants are also revitalising collection in some countries. It is important to **check if, and for whom wild products are important and how their availability is altered by policy decisions and lack of good governance**.

Foods: particularly wild fruits, nuts, and fodder for livestock. FAO estimates that 18,000-25,000 tropical wild plant species are used as food (Heywood 1999), supplying hundreds of millions of people. Collecting wild food also provides income; international trade in wildlife products like medicinal plants, live animals and animal products including game meat and fur (excluding fisheries and timber trade) have been estimated at US$ 15 billion a year (Roe et al. 2002).

Bushmeat is a source of protein and makes up more than a fifth of animal protein in rural diets in over 60 countries (Bennett and Robinson 2000). It is an important food and income source for 150 million people with a global value of US$ 7 billion (Elliott et al. 2002). However, over-collection is now creating a conservation crisis in many countries (Redmond et al. 2006). Managing wildlife allowing a sustainable off take, often combined with tourism, offers important income potential; options include game conservancies (Jones et al. 2005), private farms or hunting reserves. The most famous example is Campfire, where local communities obtain significant income from fees for trophy hunting (Frost and Bond, 2008).

Benefits from wildlife need to be balanced against costs; **human wildlife conflict** is a growing problem in many countries as rising human populations are forced into close proximity with wild animals. Wildlife managers need to design and implement increasingly sophisticated methods for conflict management through compensation payments for crops and livestock damage. An innovative idea is currently being considered in Sri Lanka (TEEBcase Human-elephant conflict mitigation through insurance scheme, Sri Lanka) and Pakistan (TEEBcase Insurance scheme to protect Snow Leopards, Pakistan).

Medicines: Medicines from wild plants play a key role in many pharmaceuticals (ten Kate and Laird 1999) and in traditional herbal medicines, which are still the primary medicines for 80% of the world's people (*WHO* 2002). Global sales of pharmaceuticals based on materials of natural origin are worth US$ 75 billion a year (Kaimowitz 2005). Collection of wild medicines can be an important income source for rural women (Steele et al. 2006).

Materials: Non-timber forest products (NTFPs) such as rubber, latex, rattan, and plant oils remain important for subsistence and trade. Annual trade in NTFPs globally is estimated at US$ 11 billion (Roe et al. 2002). A meta-study of 54 cases of income generation amongst people living near or in forests found that forests provided important resources at every income level and on every continent, providing an average of 22% of total income (Vedeld et al. 2004).

Fuel: More than a third of the world's population (2.4 billion people) relies on wood or other plant-based fuels for cooking and heating (IEA 2002).

At present, forests occupy 31% of the world's land area, of which one-third are primary and relatively undisturbed forests. Forest cover is being rapidly lost; 13 million hectares of forests (equal to the size of Greece) are being cut down each year to make way for agriculture and human settlements (FAO 2010). Deforestation is a major cause of land degradation and destabilization of natural ecosystems and contributes significantly to climate change.

One response to this pressure has been to increase the area of protected forests. Currently, 13.5% of the world's forests are in protected areas (IUCN categories I-VI) (Schmitt et al. 2009). In the last decade, efforts have also been made to increase reforestation through plantations as well as landscape restoration. Notwithstanding these efforts, the net loss was still 5.2 million hectares per year (an area the size of Costa Rica) between 2000 and 2010 (FAO 2010). Furthermore, the ecosystem services provided by plantations are not equivalent to primary forests. There are important benefits for local policy makers in reducing the loss of primary forests and ensuring good management of secondary forests and plantations. Since the benefits are not only local but also accrue globally, this opens possibilities for gaining technical and financial support for these activities at national or international level (Box 5.10). Carbon sequestration and watershed protection are two highly relevant ecosystem services of global significance provided by forests.

CARBON SEQUESTRATION

Industrial societies have recently started to recognize the **critical role of forests in regulating the global carbon cycle** and thus the earth's climate. Carbon dioxide is one of the gases that, in excess, can lead to higher global temperatures due to the greenhouse effect and the potential to 'capture' carbon dioxide in vegetation is one important component of a strategy to address the problems of climate change. Most well-functioning natural ecosystems sequester carbon: forests and also peatlands; grass; seagrass beds; kelp; mangroves; marine algae; coastal marshes and soil are all important. The threat of losing these critical climate change mitigation functions through land conversion leads to the risk that many ecosystems could soon switch from being net sinks of carbon, to net sources if they continue to degrade. Most predictions of rapidly accelerating climate change are based on this scenario.

Box 5.10 Reduced Emissions from Deforestation and Forest Degradation – REDD and REDD-Plus

Keeping carbon stored in ecosystems is increasingly a major business opportunity. Voluntary carbon offset schemes are already operating and plans for official REDD (Reduced Emissions from Deforestation and Forest Degradation) schemes are advancing. REDD-Plus goes beyond deforestation and forest degradation, and includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks. Countries receive 'carbon credits' for maintaining carbon stored in ecosystems and for improving this storage (for example through vegetation restoration activities). REDD and REDD-Plus schemes are being explored in managed forests and in protected areas.

There are still many practical problems to be solved; for example, how to reduce 'leakage' – conservation in one place leading to people simply clearing more forest elsewhere; how to avoid perverse incentives by rewarding countries with a high deforestation risk; and even how to measure accurately carbon stored or sequestered (see TEEB in National Policy 2011, Chapters 3 and 5; TEEB Climate Issues Update 2009)

Locally, this could be a direct source of raising revenue and will become an argument for particular management choices regarding land within local planning decisions. Local governments will have a role ensuring that local communities are represented in discussions about REDD and carbon offsets, to avoid all decisions being made by powerful players at national level. The political and economic contexts and the debates arising will change over time – currently there are opposing views amongst NGOs concerning social rights versus the economic benefits arising (Dudley et al. 2009).

Box 5.11 Water funds

Water users have an incentive to find the lowest cost option for maintaining access to a clean, regular water supply. In the Andean region, natural ecosystems provide these ecosystem services at low cost, so investing in nature conservation makes economic sense. Downstream users participate in 'Water Funds' to compensate upstream land users for managing forests and grasslands that provide clean water. They are long-term trust funds that involve a public-private partnership of water users who determine how to invest in priority areas. The tool InVEST (Chapter 6 Box 6.7) was used in the East Cauca Valley Water Fund in Colombia to help direct the fund's conservation investments towards areas with the highest potential for reducing sedimentation and maintaining water yield.

Source: Water Funds for conservation of ecosystem services in watersheds, Colombia. TEEBcase by Rebecca Goldman et al.(see TEEBweb.org)

Scientists have estimated that the world's forest ecosystems presently stock between 335 – 365 gigatons of carbon (MA 2005b), and an additional 787 billion tons in the top one metre layer of soils (IPCC 2001). Deforestation and forest fires not only release this carbon into the atmosphere, but also reduce the earth's capacity to sequester carbon emissions from industrial activity. Forests and peatlands have the ability to offset part of the carbon balance in the atmosphere and help mitigate climate change, thus giving fresh impetus to their conservation. (See TEEBcase Peatland restoration for carbon sequestration, Germany)

Natural forests are known to keep accumulating carbon at a higher rate than we had previously understood (Baker et al. 2004; Luyssaert et al. 2008; TEEB 2009; Lewis et al. 2009). Although planted forests can also sequester carbon, sometimes very quickly, their establishment can also result in a huge release of carbon from the soil. From a carbon perspective, draining peat to plant fuel crops makes no sense. It has been calculated that it would take 420 years of biofuel production to replace the carbon lost in establishment (Fargione et al. 2008).

Conserving forests and increasing their area is becoming a priority not only for governments but is now recognized as a business opportunity in terms of carbon credits (Box 5.10; Chapter 8; TEEB in Business 2011 Chapter 5). **Payments for carbon sequestration**, when embedded in careful overall management strategies, **can help increase market income from forests** while allowing them continually to provide the other services local development relies upon. Many local authorities are currently looking at options for using the carbon sequestration role of forests in their region to enhance forest value and benefit local communities.

WATERSHED MANAGEMENT

Many countries are already facing severe water shortages and these are likely to get more serious; by 2025 around three billion people could be experiencing water stress (Human Development Report 2006). Hydrologists are turning to natural ecosystems for key water services. **Well-managed natural forests almost always provide higher quality water**, with less sediment and pollutants than water from other catchments. Other natural habitats, including wetlands and grassland, also play a key role in reducing pollution levels. These values are recognized and used by many local governments. Research has shown that around a third (33 out of 105) of the world's largest cities by population obtain a significant proportion of their drinking water directly from protected areas or from forests that are managed in a way that gives priority to maintaining their hydrological system functions (Dudley and Stolton 2003).

About 80% of Quito's 1.5 million population receive drinking water from two protected areas; Antisana (120,000 ha) and Cayambe-Coca Ecological Reserve (403,103 ha). To ensure that the reserves remain in good enough condition to secure high quality water, the city authority is working with NGOs to protect the watersheds. Following initial investments from The Nature Conservancy, a trust fund was set up in 2000 in which water users helped to support conservation

Box 5.12 Forest Conservation for Environment and Health in Nepal

The government has transferred the management of the Khata Corridor to local communities after together developing strategies for sustainable forest management. Groups of forest users charge membership fees, sell non-timber forest products and levy fines. The income has been used to purchase biogas systems for the production of gas from manure. By using gas for cooking, less fuel wood is needed. This has reduced forest degradation and reduced exposure by women and children to indoor smoke pollution and the consequent acute respiratory infections. The new fuel also saves women time and effort, allowing them to increase their income from trading non-timber forest products.

Source: Community forestry for public health, Nepal. TEEBcase based on D'Agnes et al. (see TEEBweb.org)

projects in the watershed; revenue is now in excess of US$ 1 million a year. (TEEBcase Water Fund for catchment management, Ecuador).

Some natural forests, particularly tropical montane cloud forests (forests often surrounded by mist), play an economically and socially important role in **increasing total water supply**, by 'scavenging' droplets from humid air onto leaves, which then run down into the watershed (Hamilton et al. 1995). Water gains from cloud forest can be 15-100% or more than from ordinary rainfall. This function is lost if forests are cleared. Local authorities in a number of cloud forest countries, particularly in Central America, have collaborated with landowners to maintain forest cover and thus water flow, for example, around Tegucigalpa in Honduras. Cloud forests, and some other vegetation types such as the paramos of the Andes, also release their water relatively slowly, thus providing an important storage function.

OPTIONS FOR LOCAL POLICY

In addition to the policy options discussed in the agricultural section to inform or provide incentives to private forest owners, many **municipalities own forests** themselves. This offers the possibility to assess the entire range of ecosystem services and adapt management practices to take all relevant services into account. Local authorities can help with negotiation of **Payment for Ecosystem Services schemes** or can even be direct contributors to such schemes, for example, in the case of paying forest owners to maintain high quality water supplies. A further interesting option is the support of **community forestry**. While not always a success, in many regions of the world this management option has enabled secure benefits for local communities while at the same time conserving forests and biodiversity. An analysis of several studies reporting on the social and economic effects of community forestry (McDermott and Schreckenberg 2009) found that access to decision making by poor and marginalised people generally enabled them to gain a bigger share of the benefits. Box 5.12 shows an example where integrated forest management was used to support community health care. Further policy options are discussed in the final section of the chapter.

5.4 MANAGING ECOSYSTEMS FOR TOURISM

Ecosystems not only provide us with a wide range of practical services, but **also contribute to many cultural aspects of our lives**. For most rural and traditional societies, the natural environment often serves a spiritual function. In some societies this is manifested in the creation of sacred groves and in elaborate rites to appease nature, either to protect the community from calamities or to ensure abundance; in others it takes a less formalized recognition of the cultural importance of particular landscapes. For urban dwellers, nature offers a temporary escape from the mayhem of day to day city life. Landscapes are increasingly seen as spaces where nature and culture meet (Svensson 2000) and many believe that humans

need to connect with nature in order to function and flourish (Smith 2010). One consequence of this is a growing desire by people to travel and experience new landscapes and seascapes.

A RAPIDLY GROWING SECTOR

The tourism sector is one of the major employers in the world supporting over 200 million workers (Backes et al. 2002). The rate of growth is enormous. In 2008, 922 million international tourists were recorded compared with 534 million in 1995 (UNWTO 2009; Kester 2010). Remarkably 40% of these journeys were directed towards a developing country (Mitchell and Ashley 2010). In many countries, such as Australia, Belize, Brazil, Costa Rica, Kenya, Madagascar, Mexico, South Africa and Tanzania, biodiversity represents the primary tourism attraction (Christ et al. 2003). According to the UN World Tourism Organization, the earnings from tourism in 2008 touched a record US$ 944 billion (provisional data, UNWTO 2009). Of the total in 2007, US$ 295 billion were spent in developing countries, almost three times the official development assistance (Mitchell and Ashley 2010).

Thus, tourism is the primary source of foreign exchange earnings for the vast majority of Least Developed Countries (UNWTO 2010). In Tanzania in 2007, for example, tourism contributed US$ 1.6 billion (11% of the total economy). Tanzania also secured about half the total value of the global value chain (the total amount tourists spend on a particular holiday) for Mount Kilimanjaro and Northern Safari Circuit, of which 28% (US$ 13 million) and 18% (US$ 100 million) respectively went to the local poor (Mitchell and Faal 2008). Many countries currently under-charge; a survey of willingness to pay amongst visitors to Uganda suggested that revenue at Mabira Forest Reserve could be maximised with a fee of US$ 47 (2001 prices) whereas the charge then was just US$ 5 (Naidoo and Adamowicz 2005). A survey of 18 studies of willingness to pay in marine protected areas found overwhelming support for higher entrance fees amongst tourists (Peters and Hawkins 2009).

Tourists are also visiting new places. In 1950, the top 15 destinations absorbed 98% of all international tourist arrivals; in 1970 the proportion was 75%, falling to 57% in 2007, reflecting the emergence of new destinations, many in developing countries (WTO 2010). At the same time, countries are developing domestic tourism, which may be more stable; in South Korea, 99% of visits to national parks is domestic (KNPS 2009). In Austria, about 40% of all tourism is domestic, with a large number of visitors spending their holidays in the countryside. Farmhouse and rural tourism is highly organized with farmers offering accommodation, food and recreation (Statistics Austria 2010).

AN OPPORTUNITY AND A CHALLENGE FOR LOCAL DEVELOPMENT

Such numbers should not disguise the fact that **tourism comes at a price**. In many tourist destinations, the largest share of tourism-related income goes to non-local service providers whereas the costs are mostly borne locally. Some of the impacts include: rising consumption of water; rising prices for local goods, services and property; increased waste and pollution and rapid changes in local public life. Local policy challenges are to **channel tourism development** in such a way **that a fair share of income is retained locally**, and that **locals remain 'sovereign' owners of their home place**. This takes careful government planning and marketing, as well as local regulation and capacity building. One important tool to help this process is the development of various national and international →*certification* systems to set basic →*standards* for sustainable tourism, such as the European Charter for Sustainable Tourism in Protected Areas, coordinated by the EUROPARC Federation and the Pan Parks certification system (www.europeancharter.org).

Local and national tourism can add value to natural resources, directly through fees paid to park authorities, private companies or in some cases to local communities, and through associated benefits and economic opportunities from having more tourists in the region. In Maldives, which harbours rich biodiversity, the contribution of tourism has been estimated at 67% of GDP, while that of the fishery sector is 8.5% of GDP (TEEBcase Tourism more valuable than fishing, Maldives). But important economic benefits from →*ecotourism* are not confined to poorer countries; it is

Box 5.13 Features of tourism to deliver pro-poor local growth

- Labor-intensive (although less so than agriculture);
- Links well with local industry, especially agriculture and fisheries;
- Provides opportunities for off-farm diversification, particularly in areas that offer few other development opportunities;
- Can create initial demand that can itself develop into a growth sector;
- Can generate demand for natural resources and culture, to which the poor often have access;
- Delivers consumers to the product rather than the other way around;
- Provides essential services for local communities through tourism infrastructure

Source: adapted from Mitchell and Faal 2008

calculated that nesting ospreys (Pandion haliaetus) in Scotland bring an addition US$ 7 million per year into the area as a result of nature tourism (Dickie et al. 2006).

Tourism management often involves some degree of ecosystem management to ensure the provision of the tourism services (recreation, adventure, etc.). This requires maintenance of landscapes and conserving habitats for local and regional biodiversity. Flagship species such as elephants, rhinoceros and tigers may require special attention to attract tourists interested in wildlife safaris. Development of tourism very much depends on the availability of other resources such as water, but also a local population that is receptive and hospitable to visitors. Equitable benefit sharing from tourism supports a culture of tourism, and not only reduces conflicts but provides incentives for people to take care of their natural and cultural heritage. Increased revenues can be generated by local governments in supporting local tourist-related businesses such as accommodation, guiding, adventure, or the sale of local handicrafts or consumer products. The revenue can serve as an incentive to protect and conserve biodiversity and the local ecosystem. Returns from tourism can be quite high. The gross earnings for a small island of Samothraki in Greece, with a population of less than 3,000, is about €19 million annually, most of it attracted by its pristine landscape (Fischer-Kowalski et al. forthcoming).

Box 5.14 Community-based initiatives for tourism

Federation for Ecuadorian Community Tourism (FEPTCE), Ecuador

This partnership of sixty community-based initiatives comprising indigenous peoples, afro-Ecuadorians, and farmers, focuses on encouraging eco-friendly tourism. Since its establishment in 2002, participating communities have experienced improved access to health services and education, and increased employment. It has also generated public interest in biodiversity and agriculture. Reforestation and the protection of native flora and fauna, has improved the environment and biodiversity of 25,000 hectares which has been used to promote the region's tourism. Conserving biodiversity has permitted the FEPTCE communities to diversify their economy, leading to added income and an improved standard of living (www.feptce.org).

Community Tours Sian Ka'an (CTSK), Mexico

Tourism alliance of three Mayan cooperatives in the UNESCO Sian Ka'an Biosphere Reserve (www.siankaantours.org). By regulating the influx of tourists and providing high quality services, they have been able to raise their tour prices by 40% leading to increased community income with the least amount of environmental impact. CTSK's cooperation with Expedia.com lead to an increase rate of tourists of more than 100 percent in 2006/2007. 5% of CTSK's annual income is dedicated to conserve the local ecosystem (Raufflet et al. 2008).

Source: Equator Initiative Prize 2006 (www.equatorinitiative.org)

The NGO Network for Sustainable Tourism Development lists **ten principles and challenges for a sustainable tourism development** in the 21st Century: tourism must help overcome poverty; use sustainable modes of transport; combine with regional development; protect nature and biodiversity; use water sustainably; maintain human dignity and gender →*equity*; ensure local people participate in decision-making processes; promote sustainable consumption and lifestyles; promote sustainable tourism and fair trade in developing countries and show political commitment (Backes et al. 2002).

LOCAL POLICY PLAYS AN IMPORTANT ROLE

Tourism development is a typical case where it is worthwhile to adopt an integrated planning approach based on a careful assessment of the benefits of ecosystems as well as the probable impacts of tourism operations on ecosystems as outlined in Chapter 2. How tourism develops depends on different departments of policy, planning and management as do the implications for local people and local ecosystems:

- **Which type of tourists to attract?** The 'holistic' who follow the classical traveller's tradition of seeking the sublime in an idyllic landscape; the 'fragmented' who are driven by a distinct interest such as in birds, butterflies, or fishing; those that cherish 'a gentle engagement with nature' through activities such as bicycling, canoeing, walking or picking berries; the 'adventurer' with a determination to confront and conquer the perils of nature through activities such as mountain climbing, big game hunting, or rafting and finally the 'eco-tourists' that derive their satisfaction from living green and healthy while benefiting nature and those engaged with it;
- Planning: **what infrastructure to provide** and where? Building and maintaining access roads or nature trails, how to avoid selling off the entire waterfront to hotels and holiday houses;
- **Service provisioning:** water and waste, information? This also affects what rates are charged for municipal services such as water and waste, which in many locations do not cover full costs of these services.

Being aware of the implications for ecosystem services can help to answer these questions so that local population does not lose out. Certification and →*labelling* can help to communicate this to tourism operators as well as tourists (see Chapter 9).

Box 5.15 Tourism instead of logging in Rennell Island, South Pacific

In 1998, permission was granted to a foreign logging company to extract timber from the small island of Rennell, part of the Solomon Islands. Logging has been very destructive on other Melanesian islands, where clear-logging has destroyed unique environments as well as the livelihoods of local populations.

Rennell was a very special case, being one of only 25 raised atoll islands in the Island Pacific, all comprised of porous coral rock. Soils are very shallow, and very vulnerable to being washed into the sea and lake by heavy rain after logging. Rennell also has a very high endemicity index; numerous plants, at least 60 species of insects, 11 species of birds, and snake, land snails and flying fox all endemic to the island. The loss of the Rennell forest would have been a catastrophe for the local Rennellese as well as for science.

Despite time constraints, the people of Rennell with my support developed a proposal for nature tourism to present to parliament. It was calculated that a small guesthouse facility with 20 rooms and an occupancy rate of 60% over 12 years would give a return equal to what the Rennellese had been offered by the loggers. The proposal was accepted and the logging license revoked. Today the forest on Rennell is thriving and there has been no loss of endemic species. There are now 10 small guesthouses on the island, and Rennell has been named a world heritage site by UNESCO – the first in Melanesia.

Source: by Nils Finn Munch-Petersen (Tourism expert and consultant)

5.5 ECOSYSTEM RESILIENCE AND DISASTER MITIGATION

Natural ecosystems can absorb or deflect natural hazards. Today, ecosystem management is seen as a vital component for disaster risk reduction. The Millennium Ecosystem Assessment estimates that 60% of global ecosystem services are degraded, contributing to a significant rise in the number of floods and major wild fires on all continents (MA 2005). The latest report from the Intergovernmental Panel on Climate Change states 'Increased precipitation intensity and variability are projected to increase the risks of flooding and drought in many areas' (Bates et al. 2008:3). If ecosystems are degraded and the effectiveness of ecosystem services reduced, natural hazards are more likely to lead to disasters particularly affecting poor communities which lack the money, effective emergency services and other safeguards to recover from them.

Studies have shown that every dollar invested in risk reduction can save between two and ten dollars in disaster response and recovery cost (IFRC 2007). This approach to disaster risk reduction is now receiving greater attention. The International Strategy for Disaster Reduction notes that protection of vital ecosystem services is fundamental to reducing →*vulnerability* to disasters and strengthening community →*resilience* (Stolton et al. 2008b) and includes ecosystem approaches within its comprehensive guide to risk reduction (ISDR 2005).

FLOODS

Floods cost approximately US$ 1 trillion in damage during the 1990s, notwithstanding the 100,000 lives lost (Laurance 2007). Analysis of flood data from 56 developing countries found a significant link between forest loss and flood risk, 'Unabated loss of forests may increase or exacerbate the number of flood-related disasters, negatively impact millions of poor people and inflict trillions of dollars in damage in disadvantaged economies over the coming decades' (Bradshaw et al. 2007). The UN Task Force on Flood Prevention and Detection has stated, 'Natural wetlands, forested marshlands and retention areas in the river basin should be conserved, and where possible restored or expanded' (Anon 2000).

Protecting and restoring natural water flows and vegetation can be a **cost-effective method of addressing flood-related problems**. This may involve setting aside flood-prone areas as temporary pasture or protected areas, restoring traditional flooding patterns and removing dykes and barriers to provide space for flood waters to escape, reducing downstream impacts. Forest protection or restoration strategies also help to mitigate floods with positive results. Many countries are cooperating in restoring natural ecosystem functioning for flood control and pollution reduction (Nijland 2005).

The city of Vientiane (Lao PDR), for example, has frequent heavy rainfall which results in overflowing drains and urban flooding. Flooding occurs at least 6 times annually, damaging buildings and infrastructure. Several wetlands, however, absorb a proportion of the floodwater, dramatically reducing damages. The value of the ecosystem services of the wetlands has been measured (using annual value of flood damages avoided), calculating the value of the wetlands to be just under US$ 5 million (TEEBcase Wetlands reduce damages to infrastructure, Lao PDR).

Copyrights: André Künzelmann / UFZ

The city of Napa, California has successfully restored floodplains which provide cost-effective protection against floods. Such actions have the added benefit of creating considerable investment opportunities and increased property values (TEEBcase River restoration to avoid flood damage, USA and Box 6.5). In Sri Lanka, two reserves in the Muthurajawella Marsh have a flood attenuation value (2003 values) estimated at US$ 5,033,800 per year.

LANDSLIDES

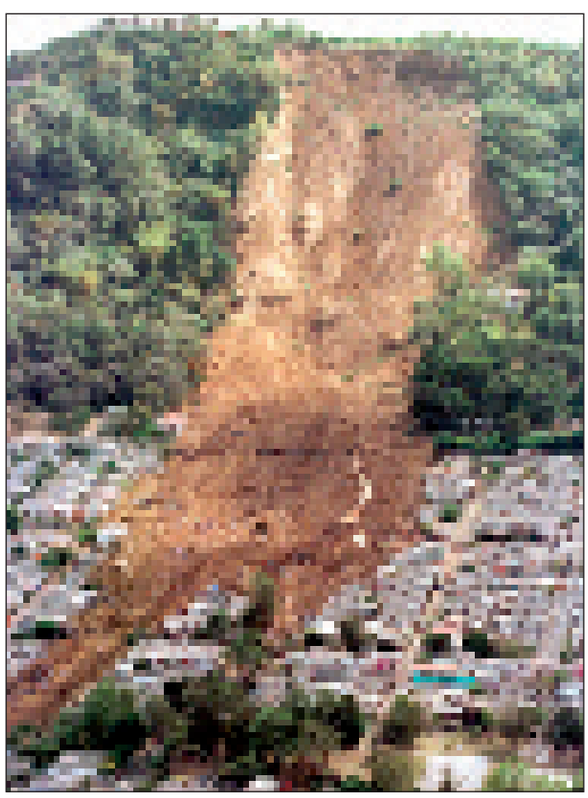
A European Commission review of landslides noted that 'The reforestation of hill slopes can help to reduce the occurrence of shallow but still dangerous landslides (mainly mud flows and debris flows)' and 'excessive deforestation has often resulted in a landslide' (Hervas 2003). The retention of vegetation on steep slopes to control landslides, avalanches and rock falls has been used as a practical management response for hundreds of years (Rice 1977). In China, policies in Sichuan are starting to shift from planting fruit trees on steep slopes to planting natural forests because natural vegetation tends to be denser and therefore more effective in landslide prevention (Stolton et al. 2008b).

In the Swiss Alps, policy recognizes that healthy forests are a major component of disaster prevention: 17% of Swiss forests are managed to protect against avalanches and floods. These services are valued at US$ 2-3.5 billion per year (ISDR 2004). Similar to flood strategies, decisions about which slopes to protect are determined at a local level.

TIDAL SURGES AND STORMS

Blocking the movement of water with coral reefs, barrier islands, mangroves, dunes and marshes can help mitigate the impacts of storm surges and coastal erosion. A study in Sri Lanka following the Indian Ocean Tsunami found that although the tidal wave was six metres high when it reached shore and penetrated up to 1 km inland, mixed landscapes of mangrove, coconut plantation, scrub forest and home gardens, absorbed and dissipated much of the energy (Caldecott and Wickremasinghe 2005).

Investment in natural buffers saves money. An investment of US$ 1.1 million in Vietnam (planting mangrove forests) saves an estimated US$ 7.3 million annually in dyke maintenance. During typhoon restored areas experienced far less harm than neighboring provinces, which suffered significant loss of life and property (TEEBcase Mangrove rehabilitation for coastal protection, Vietnam). Conversely, reef damage in Sri Lanka has led to erosion estimated to be 40 cm a year on south and west coasts. The cost of replacing reefs with artificial forms of protection has been calculated at US$ 246,000-836,000/km (UNEP-WCMC 2006).



Photograph courtesy of the U.S. Geological Survey

Local community involvement can play a key role in developing response strategies. In Honduras, the Ibans Lagoon in the Río Plátano Biosphere Reserve, home to three indigenous groups is threatened by the erosion of a narrow coastal strip between lake and ocean. In 2002, MOPAWI, an NGO, began collaborating with communities to identify strategies for addressing these problems. They developed a community action plan for ecosystem management and protection prioritising the restoration of mangrove and other species to reduce erosion and improve fish habitats (Simms et al. 2004).

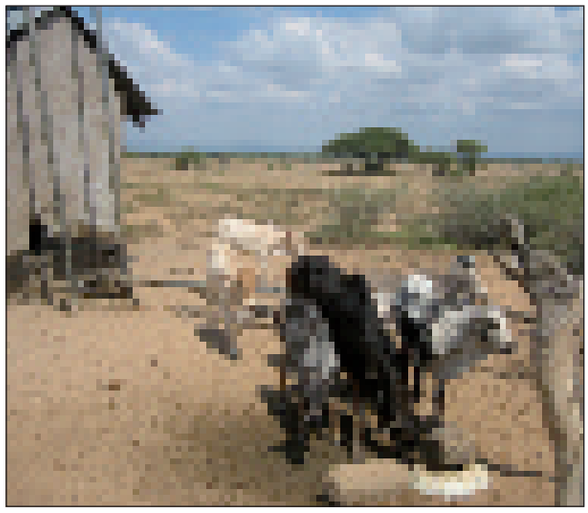
FIRE

Due to warmer climates and human activity, fire incidence is increasing around the world. Ecosystem-scale responses include limiting encroachment into fire-prone areas, maintaining traditional management systems to help control fire and protecting intact natural systems that are better able to withstand fire. In Indonesia, selectively logged forests suffer comparatively more fire damage due to open canopies and logging debris that provides additional dry fuel. More mature protected forests tend to be much less vulnerable to fire, which tends to sweep rapidly through undergrowth (MacKinnon et al. 1997).

DROUGHT AND DESERTIFICATION

An extreme form of soil degradation is desertification, driven mainly by forest destruction, intensive agriculture, overgrazing and excessive ground water extraction. At present, desertification affects over 100 countries, mainly in Asia and Africa, with high population pressure and livestock units. Desertification leads to a drastic decline in an area's biological productive capacity and the economic and social cost is high. China experiences US$ 6.5 billion in damages each year from sandstorms alone (UNCCD 2001).

The combination of **natural vegetation restoration and maintenance**, reduced grazing and trampling pressure and maintenance of drought-resistant plants are seen as key steps in slowing or halting dryland degradation and desertification. Conserving wild food plants can provide critical emergency supplies for people and livestock if crops fail due to drought. Local responses to environmental problems in drylands can include re-introducing traditional management approaches, such as the hima reserves in the Arabian Peninsula (Bagader et al. 1994). The implementation of such approaches is spreading. In Mali, protected areas are seen as reservoirs of drought-resistant species (Berthe 1997). In Djibouti, regeneration and protection projects have been initiated to prevent desert formation (UNCCD 2006). Morocco is also establishing eight new national parks largely to control desertification (Stolton and Dudley 2010).



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EARTHQUAKES

Although ecosystem management clearly has no role in preventing earthquakes, it can help prevent the aftermath – landslides and other environmental hazards. Analysis of several thousand landslides triggered by the 2005 earthquake in Kashmir found that forested slopes suffered less slippage than bare, agricultural and shrub-covered slopes (Kamp et al. 2009). Similarly, analysis of landslides following an earthquake in the Neelum Valley (Pakistan) found landslide risk higher in deforested areas (Sudmeier-Rieux et al. 2008).

ROLE OF POLICY AND MANAGEMENT

Disasters hit at the local level and planning for and response to disasters is predominantly a role for local government. It requires steps that are unlikely to be taken solely by individuals because some wider decisions and trade-offs are often necessary. **Coordinated action** is required for adequate **land use planning** (see Chapter 6), choosing adequate strategies for disaster prevention and management and investment planning. In most localities, disaster prevention is in the domain of engineers who may not be familiar with the potentials of well managed ecosystems in disaster prevention and what management practices are required to achieve this. **Awareness raising and capacity building** are therefore essential if the potential of ecosystems to mitigate disasters is to be used. Options include: maintaining or restoring wetlands capable of

absorbing floods; restoration of flood plains on rivers; protection or restoration of forests on steep slopes (through legislation, purchase, incentives or agreement); protection; good management or if necessary, restoration of natural coastal defences including coastal marshes, coral reefs and mangroves; protective planting against soil erosion and desertification.

Reorganizing disaster prevention can create interesting opportunities to rearrange land management so that different sector needs can be addressed simultaneously. In the Napa Valley example mentioned above, the floodplains restored with appropriate trails and green areas led to revitalization of the inner city. A further case from Belgium (TEEBcase Changed agro-management to prevent floods, Belgium) illustrates this potential for a rural setting: restructuring land use for mudflow management not only reduced soil erosion, but also led to an increase of biodiversity and en-hancement of landscape quality. These new green corridors attracted cyclists and allowed an increase in the recreational potential through bicycle trails and accommodation.

5.6 OPTIONS FOR INTEGRATING ECOSYSTEM SERVICES

Ecosystems provide a range of services. Recognizing and capturing the value of nature's services presents positive opportunities for both local development and the enhancement of quality of life. Because they play a key role in people's lives and livelihoods, it is important to consider them in decision making. The key challenge is balancing the different services – enhancing some at the expense of others. Due to this challenge, assessment tools have been developed to aid decision makers who have to weigh the costs and benefits of many different services.

There are eight key areas for local engagement:

1. **Planning:** Land use and sectoral planning present opportunities to combine agriculture and forest management with other land uses, while maintaining important ecosystem services. Planning can also balance productive industry with maintaining a landscape attractive for tourism. For further details see Chapter 6.
2. **Management:** Where local governments are directly involved in land management they can identify ways to integrate the economic benefits of ecosystems services into management practices. By choosing integrated approaches to municipal forest management, groundwater management and the maintenance of local reserves and tourist destinations such as beaches and parks they can provide exemplary practices for private land users to follow.
3. **Regulation and protection:** Local governments play a critical role in interpreting and implementing regulations that encourage best practices and ecosystem protection. There are opportunities for leaders to encourage sustainable harvesting through regulations. There are many legislative opportunities for ecosystem protection such as harvest laws (timber, caps on fishing seasons, mesh size of nets); supporting efforts to ensure that ecosystem services are protected both for and from tourists (preventing illegal fishing with patrols) and approving innovative infrastructure (stables for animal husbandry). The police force and local courts may also play a role in making sure that laws relating to natural resources are implemented, monitored and enforced.
4. **Coordination and collective action:** Negotiation and coordination between different interest groups inevitably takes place at the local level. Certain areas require collective action. There are many examples of local communities effectively managing common resources such as grazing lands, fisheries or forests (see Library of the Commons dlc.dlib.indiana.edu/dlc). Local governments can support the formation of resource management committees where these do not yet exist; they can integrate formal and informal institutions to ensure effective participation and outcome. Coordination is also useful between different government departments or agencies, here a focus on ecosystem services can help to avoid contradictions in

Box 5.16 A tool to assess and integrate ecosystem services in land-use decision making

A quantitative ecosystem services assessment helped Kamehameha Schools (KS), the largest private landowner in Hawai`i, to design and implement a plan that fulfils its mission to balance environmental, economic, cultural, educational, and community values. With the Natural Capital Project, KS used the InVEST software (see Box 6.7) to evaluate the impacts on ecosystem services of alternative planning scenarios on its iconic 10,500 hectare landholding on the North Shore of O`ahu. The scenarios included biofuel feedstock, diversified agriculture and forestry, and residential development. Carbon storage and water quality were quantified, as well as financial return from the land. Cultural services were also addressed. The results informed KS' decision to rehabilitate irrigation infrastructure and make the other investments required to pursue diversified agriculture and forestry.

Source: Integrating ecosystem services into land-use planning in Hawai'i, USA. TEEBcase by Goldstein et al. (see TEEBweb.org).

sector planning. Furthermore, local actors can play a role as an intermediary between local farmers or forest owners willing to protect watersheds and distant beneficiaries of the enhanced water supply.

5. **Investment:** Local governments can invest in ecosystem services through purchasing policy. They can choose to buy local timber for government buildings or create an atmosphere that supports buying locally-produced food, eg through local labels for local products. Some local governments have invested in ecotourism ventures, thereby supporting an industry that boosts the economy without overexploiting natural resources. Restoring ecosystems and thereby recovering degraded ecosystem services can be a very good investment (TEEB in National Policy 2011, Chapter 9).
6. **Incentives:** Local governments can create positive incentives for improved ecosystem services management. There are opportunities for Payment for Ecosystem Services schemes at private, public and government levels (see Chapter 8). In some cases authorities, sector agencies, regional development banks and other programs have funds to help promote green business ventures or investments that aim to secure the long-term viability of ecosystem services. (see also TEEB in Business 2011).
7. **Extension services and capacity building:** Many environmental problems occur because people do not understand the full implications of their actions or the available alternatives. Farmers may not be aware of alternatives that allow for a more →*sustainable land use*, while at the same time being economic from their perspective. Once the benefits of an ecosystem have been identified, local leaders can share what they have learned, offering advice about disaster mitigation, best fishing practices, water conservation and opportunities for tourism.
8. **Research and promotion:** Local agencies often carry out research (alone or collaboratively with research institutions) in order to assess the role of local ecosystem services. Determining their value is a prerequisite for establishing what the best resource management practices are. Much of the monitoring that forms the basis of such research is coordinated at a local level. The success of monitoring and other measures often depends on collaborating with well-informed local →*stakeholders*. Once benefits are assessed this information can be used to promote local products or services; examples include local labels for agricultural produce or sustainable tourism.

The following table provides an overview of TEEBcases available on teebweb.org that illustrate these areas of intervention in practical applications. The last column refers to further relevant chapters in this report and in TEEB in National Policy, also available on TEEB web.org.

Table 5.1: Options for integrating ecosystem services in selected sectors illustrated by TEEBcases.

Sector	Agriculture	Fisheries, wetlands	Forestry	Tourism	Disaster prevention	Further chapters
Planning	Agro-ecological zoning, Brazil	SEA for including ecosystem services in coastal management, Portugal Wetland restoration incorporates ecosystem service values, Aral Sea, Central Asia	Integrating ecosystem services into spatial planning in Sumatra, Indonesia.		Preventing desertification by establishment of PAs, Morocco (section 5.5)	6,7
Regulation	Salinity Credits Trading Scheme, Australia (Australian Government)	Temporary closures in octopus reserves increase catch, Madagascar	Conservation law benefits communities and biodiversity, Papua New Guinea Benefits of Forest Certification, Solomon Islands	Local tourism within ecological limits (Box 7.4)		TEEB in National Policy, Ch7
Management	Re-introducing traditional practices, Ecuador (Box 5.13) Organic Farming in private protected area, Russia Planting orange orchards to curb soil erosion, China (in prep.)	Guidelines for harvesting crocodile eggs, Papua New Guinea (Equator Initiative) Wetland protection and restoration increases yields, Bangladesh Collaborative management of wetlands increase ecosystem service benefits and biodiversity, Kenya (Equator Initiative)	Community forestry for public health, Nepal (Box 5.12) Discounts on entrance fees for excercising in national park, India (in prep.)	Community restricts tourist numbers, Mexico (Box 5.14)	Changed agromanagement to prevent floods, Belgium Multiple benefits of urban ecosystems: spatial planning in Miami City, USA Adjusted forestry practices (section 5.5)	
Negotiation coordination		Community-based lake restoration increases income from fisheries, Nepal	Industries share sales revenue for watershed protection, China (in prep.) Voluntary user contributions for watershed protection, Mexico (in prep.) Protecting biodiversity through inter-agency cooperation, South Africa (in prep.)	Community networks for eco-tourism, Ecuador (Box 5.14)	Reforestation for flood mitigation, Switzerland (section 5.5, ISDR 2004)	
Incentives	Reducing nutrient loads by providing debt guarantees, Colombia Agri-env schemes (section 5.1) Valuation of pollination spur support for bee keepers, Switzerland	Carbon finance for conservation of native prairie, USA Reverse auctions help farmers to reduce phosphorous content in local waterways, USA (in prep)	Farmers invest in reforestation and conservation, Kenya (in prep.) Insurance scheme to protect Snow Leopards, Pakistan PES scheme funded by collections made from salaries, China (in prep.) Subsidy for traditional rubber production, Brazil (in prep.)	Blue Flag certification for beach quality, South Africa		8, 9
Investment infrastructure, restoration	Enhancing agriculture by ecosystem management, India (Box 5.1) Water tank rehabilitation benefits rural development, Sri Lanka (Box 5.3)		Payments and technical support for reforestation and soil conservation for watershed protection, Brazil		River restoration to avoid flood damage, USA (Box 6.5) Managed realignment for coastal protection, UK (in prep.) Mangrove rehabilitation for coastal protection, Vietnam	TEEB in National Policy, Ch9
Extension, capacity building			Economic value of Toronto's Greenbelt, Canada Carbon offsets for sustainable land use, Mexico			
Research and promotion	Benefits of genetic diversity for rice farmers in the Philippines (Box 5.2)	Wetland valuation changes policy perspectives, Burkina Faso	Watershed services crucial for economic development, Mongolia Participatory valuation of forest in subsistence economy, Lao PDR	Tourism more valuable than fisheries, Maldives Tourism value of San Rock Art, South Africa	Wetlands reduce damages to infrastructure, Lao PDR	4, for monitoring

All examples refer to TEEBcases on TEEBweb.org unless otherwise stated.

FOR FURTHER INFORMATION

Agriculture
FAO (2007) The State of Food and Agriculture 2007: Paying farmers for environmental services. Using the example of Payments for Ecosystem Services (PES) this report presents the link between ecosystems and agriculture in an easily accessible format. ftp://ftp.fao.org/docrep/fao/010/a1200e/a1200e00.pdf

Jarvis et al. (2000). A training guide for In Situ conservation on-farm: Biodiversity International. This handbook offers an introduction in situ conservation and a 'how to'-guide on the implementation of efforts to conserve crop genetic diversity. www.bioversityinternational.org/fileadmin/bioversity/publications/pdfs/611.pdf

World Bank (2008) World Development Report: Agriculture for Development. Especially chapter 8 of this report with many graphs and figures highlights the natural resource implications for the agricultural sector. http://siteresources.worldbank.org/INTWDR2008/Resources/WDR_00_book.pdf

Fisheries
IUCN (1999) Guidelines for Marine Protected Areas. Bests Practice Guidelines number 3. These technical guidelines provide detailed information about the establishment and management of areas to protect both biodiversity and fisheries. http://data.iucn.org/dbtw-wpd/edocs/PAG-003.pdf

MARE (2005) Interactive fisheries governance: a guide to better practice. This easily accessible guide gives advice on best practice governance. www.fishgovnet.org/downloads/documents/bavinck_interactive.pdf

Water management
WANI toolkit: The IUCN Water and Nature Initiative (WANI) together with 80+ partner organizations has developed a toolkit for practitioners to demonstrate best practice water management (incl. case studies) that supports healthy rivers and communities.

The WANI series covers the following topics:
FLOW: the essentials of environmental flows; CHANGE: adaptation of water resources management to climate change; VALUE: counting ecosystems as water infrastructure; PAY: establishing payments for watershed services; SHARE: managing waters across boundaries; RULE: reforming water governance; NEGOTIATE: reaching agreements over water. www.iucn.org/about/work/programmes/water/resources/toolkits

Forestry
Hamilton, L. 2005. Forests and water. Thematic study for the Global Forest. Resources Assessment 2005. FAO Technical paper that outlines issues related to management of forests in light of water requirements. ftp://ftp.fao.org/docrep/fao/011/i0410e/i0410e01.pdf

Step-by-step guidance on community forestry is provided by the multilingual FAO community forestry manuals which are available at www.fao.org/forestry/participatory/26266/en/

Tourism
Honey, M. (2008) Ecotourism and Sustainable Development: Who Owns Paradise? Island Press. The book provides an introduction to Eco-tourism and several case studies from the Americas and Africa.

Information and a multilingual guidance on how to integrate sustainable practices in tour operators' supply chains as well as a set of case studies is compiled on the website of the Tour Operator Initiative www.toinitiative.org

Disaster management
UN/ISDR (2005) Know Risk. The illustrated book provides many best practice examples of ecosystem related disaster risk management. 160 authors compiled examples from marine and coastal to urban and mountainous ecosystems.

Climate change adaptation
The World Bank website on the 'Economics of Climate Change Adaptation' provides reports on the costs of climate adaptation for the forestry and the fisheries sector as well as on implications for disaster management and infrastructure. http://beta.worldbank.org/climatechange/content/economics-adaptation-climate-change-study-homepage

Equator Initiative
The Equator Prize is awarded biennially to recognize outstanding community efforts to reduce poverty through the conservation and sustainable use of biodiversity. Many showcases illustrate best practice examples. www.equatorinitiative.org

6 SPATIAL PLANNING AND ENVIRONMENTAL ASSESSMENTS

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Content of this chapter

This chapter highlights **opportunities for policy makers** to consider ecosystem services and biodiversity **in both spatial planning and environmental assessments**. Section 6.1 outlines challenges to spatial planning and describes the trend towards its redefinition. 6.2 explores its relationship to ecosystem services and →*biodiversity*, advocating the importance of incorporating ecosystem services in spatial planning – as well as identifying the connection between spatial planning and climate change issues. The use of environmental assessments to account for ecosystem service values and biodiversity is presented in 6.5. **Action points** on spatial planning are in 6.4 and lessons from practice on environmental assessments in 6.7.

Key Messages

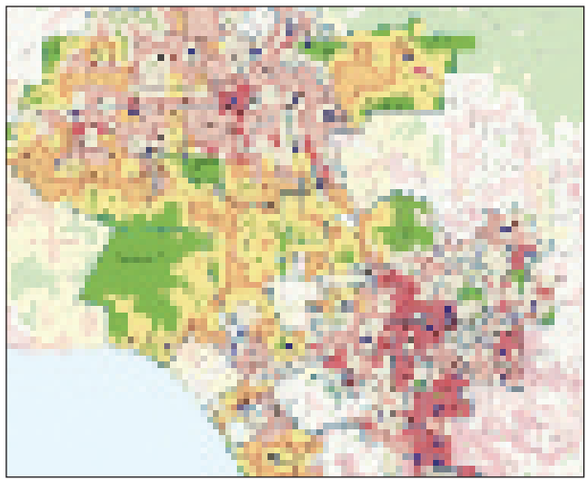
- **Seeing the forest for the trees.** The overriding benefit of spatial planning is that it can encompass the cumulative impacts of incremental decisions on ecosystems and their services. It examines the 'parts' to make decisions that affect the 'whole.'
- **Knowledge really is power.** An effective planning framework can make the policy and planning process transparent and inclusive, assessing who benefits from which ecosystem service, helping to avoid conflicts, especially if different stakeholder groups are part of the planning process.
- **Early thinking enables opportunities and management of changes.** Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA) can contribute to the integration of biodiversity issues and ecosystem services in local and regional planning. This safeguards livelihoods, illuminates impacts on ecosystem services and highlights the risks and opportunities associated with changes.
- **Start locally to think globally.** A good strategy considers both local and global systems and stakeholders. Spatial planning, supported by EIA and SEA, may form a basis for sustainable, economically and socially appropriate responses, for example, to climate change.
- **Getting more than you bargained for can be a good thing.** The proactive inclusion of ecosystem services allows environmental assessment to identify the economic potentials, rather than simply the constraints, associated with development that supports biodiversity.

6.1 CHALLENGES FOR SPATIAL PLANNING

A clear planning framework helps to create sustainable communities, and an →*ecosystem* perspective is increasingly recognized as key to effective spatial planning. Plan-led urbanization and rural development can contribute significantly to more sustainable economic growth and environmental justice. This means that planning authorities should create long-term spatial development plans for specific areas which are used to inform decision making. This can be achieved through a range of approaches to spatial planning (Box 6.1).

IDENTIFYING THE CHALLENGES

Current estimates project that by 2035, 2 billion additional people will be living in urban areas, of whom 1 billion will be slum dwellers. This scale of urbanization is overshadowed by risks associated with climate change and the threat of natural disasters which present extraordinary challenges for spatial planners. Projections for the impacts of climate change involve uncertainties in particular at the local and regional level. Therefore, decisions for long term planning need to be precautionary considering a range of possible scenarios. As ecosystems like forests and wetlands can deliver multiple services relevant for climate change mitigation and adaptation, they are an important component within regional planning. Essentially, the planner's job is to 'map the way' to future economic growth and ecological integrity by resolving conflicting development goals.



Map displaying park access for children of color living in poverty with no access to a car in Los Angeles, USA. Parks in green, areas with more than half-mile-distance to next park in red.

Box 6.1 The nature of spatial planning

Spatial planning can be delivered through development policy or through legally binding plans. Development policy guides planning by formulating objectives and key areas of intervention while legally binding plans define rules of action. In both cases, effective plans are monitored, measured and re-assessed when necessary. Open and collaborative spatial planning helps to make agreement between diverse →*stakeholders* with a variety of agendas, backgrounds and landscapes possible. Spatial planning integrates three perspectives:

Sectoral Planning targets specific 'activities' such as transport, water resources, forestry and mineral extraction. Plans are often prepared by the government department or agency that manages these →*resources*.

Master Planning addresses areas requiring significant changes such as new communities or areas targeted for regeneration. Typically, these plans are prepared by lead agencies in either the public or private sector.

Nested Planning addresses different scales of governance – from local to regional to national. Nested planning increasingly encompasses mega-regions beyond state boundaries. Their shape is as variable as the mechanisms and bodies that implement them, reflecting both their scope and purpose. It can be influenced by broad and specific goals, geography and relevant legislation.

The Millennium Ecosystem Assessment (MA 2005c) recognized that when urban systems are managed more equitably and the loss of →*ecosystem services* is purposefully addressed, the benefits to →*human well-being* can be substantial. However, despite the fact that effective spatial planning can be instrumental in 'greener' urban development, the Global Report on Human Settlements (UN- HABITAT 2009) reports that although the sustainable urban development vision has been embraced by cities all over the world, none are yet able to simultaneously and comprehensively address the different facets of the sustainable urban development challenge: both where ecosystem services can help improve quality of life (green agenda) and where ecosystem services are affected by infrastructure (brown agenda, Table 6.1).

The European Environment Agency report on 'Ensuring quality of life in Europe's cities and towns' (EEA 2009) identifies four common challenges for spatial planners:

1. **The sectoral nature of policies:** The diverse number and range of local strategies (transport, housing, environmental, economic) are often in conflict and are not integrated.

Table 6.1 Green and brown agendas for urban planning

Green Agenda (ecological systems)	Brown Agenda (human systems)
Ecosystems that provide green/ recreation space and biodiversity protection.	Waste systems that recycle and remove (solid, liquid, air) wastes from cities.
Water systems that provide a natural flow for both water supply and waste disposal.	Energy systems that provide power, heating, cooling and lighting for city functions.
Climate and air systems that provide cities with a healthy environment.	Transport systems (including fuel) that enable mobility in the city.
Agricultural and forestry systems (and other ecological services) that provide food and fibre for cities.	Building and materials systems that provide the physical infrastructure of cities.

Source: Adapted from UN-HABITAT (2009).

2. **Poor delivery mechanisms:** Plan making and plan delivery are often managed by separate agencies which are not aligned. Implementation increasingly rests with private corporations, particularly in the case of major new infrastructure such as transit systems.
3. **Lack of professional resources:** A shortage of planners limits the promotion of sustainable development – especially those who have an understanding of the role of the ecosystem services approach in effective planning.
4. **Administrative boundaries:** Administrative boundaries rarely coincide with economic, social or ecological systems. These boundaries may create competition rather than collaboration between municipalities across an ecosystem (eg one municipality may extract headwaters from a river system, affecting downstream areas).

REDEFINING SPATIAL PLANNING

The above challenges require a redefinition of spatial planning, to make it more **value-driven and action-oriented** (The New Vision for Planning, RTPI 2000). This has set an agenda for planning that places greater importance on sustaining habitats that underpin ecosystems and biodiversity (Vancouver Declaration 2006).

Integrated, inclusive and sustainable plans have become the internationally accepted goal. For example, the European Council of Spatial Planning (ECTP) has set out a New Charter of Athens (ECTP 2003) which focuses on the need to recognize social, environmental and economic connectivity. The charter stresses the importance of both the **'Precautionary Principle'** and environmental considerations in all decision-making processes, not only when they are obligatory (see Box 6.10).

Aligning local and regional spatial planning with wider global challenges is also critical to the delivery of the eight **Millennium Development Goals** of the United Nations. Planning has been identified as a key tool for addressing wealth, health and educational challenges. This is because goals pertaining to welfare have a strong spatial dimension.

Local communities can use **benchmark planning** systems with a range of criteria such as those set out in the INTERMETREX Benchmarking System (METREX 2006). In designing or re-designing planning systems to make them effective, decision makers may consider the following: who holds development rights; delivery mechanisms; public participation processes in planning decisions; and how disputes are resolved. Planners can also rank the extent to which public benefits are extracted from private development initiatives.

6.2 THE RELATIONSHIP BETWEEN SPATIAL PLANNING AND AN ECOSYSTEMS SERVICES PERSPECTIVE

Integrating ecosystems into spatial planning positively affects quality of life and provides essential support for ecosystems and habitats (EEA 2009). Effective planning can be instrumental in reducing a city's ecological footprint by increasing housing density, no longer exporting waste to surrounding areas, decreasing flood risk (DCLG 2010) or by providing green space for exercise. The challenge for the planner is to determine how to incorporate an ecosystem perspective into city and resource management. Including →*values* of ecosystem services can significantly change the results of Cost-Benefit Analysis (Box 6.2).

When exploring opportunities for significant land use change or natural resource extraction, taking ecosystem services into account allows for the identification of alternative strategies that limit the impacts on the natural resources that sustain rural livelihoods (Box 6.3).

The overriding benefit of spatial planning is its ability to address and encompass the cumulative impacts of incremental decisions on ecosystems. Spatial planning can effectively assess incremental consequences because it considers the long-term outcomes of different options.

Box 6.2 A Cost-Benefit Analysis of ecosystem services in Brazilian Amazon

Road construction and paving in the Brazilian Amazon has been greatly debated in the last decades due to its 'positive' impact on regional development and 'negative' impact on forest ecosystems.

In 2005 the Brazilian government announced plans to reconstruct a road between the states of Amazonas and Rondônia as part of its Growth Acceleration Plan (PAC). This route, once connecting two capital cities (Porto Velho and Manaus), requires 406 km of extensive paving, bridges and reconstruction. The impact of improved infrastructure, however, is projected to cause extensive deforestation unless effective policy measures can restrain forest clearing.

A pre-feasibility study used a Cost-Benefit Analysis to evaluate the effect of including environmental externalities in both a 'conventional' and an 'integrated' scenario. Interestingly, both feasibility studies indicated that the project was not economically feasible. The 'conventional' scenario focused on local and regional benefits associated with cargo and passenger transportation savings as well as the costs of road construction and maintenance. This study indicated that the project would result in a net loss of about US$ 150 million. The 'integrated' scenario, which accounted for the costs of deforestation, projected a net loss of up to US$ 1.05 billion; this means the expected value of the lost ecosystem services amounts to US$ 855 million (NPV 25 years, 12% →*discount rate*).

The project is stopped at the moment because of several factors, the main one being the fact that the project still does not have an environmental license approved by IBAMA, Brazil's environmental agency, because they considered the environmental impact study to be deficient. The study referred above was used by the Brazilian Senate and the National Public Prosecutor's Office - MPF to question the feasibility of the road.

Source: Costs benefit analysis of road construction considering deforestation, Brazil. TEEBcase based on Fleck 2009 (see TEEBweb.org)

For example, cutting a few hectares of forest for a new road or shopping mall mainly has local effects, however, as a regional trend, urbanization affects the function of natural ecosystems at large and this has relevance for global climate change (DeFries et al. 2010). Equally, the first few farmers converting forests on hill slopes to agricultural production might not have serious implications; however, if the trend continues, cumulative consequences include soil erosion, siltation, reduction of water availability and landslides. **Integrating an ecosystem services perspective into spatial planning helps planners to identify and deal with →*trade-offs* and cumulative effects.**

Box 6.3 Low-impact mining in Chocó, Colombia

The Chocó eco-region is a biologically and culturally rich area. The region's soils contain gold and platinum, making it attractive for mining. Large-scale mining would destroy most of the area's ecosystems and their services. Local communities depend on these services for fishing, wood extraction and subsistence agriculture. For this reason, local communities decided not to rent out land to large-scale mining companies but rather to extract minerals with innovative and traditional low-impact mining practices that do not involve the use of toxic chemicals.

With this type of alternative land use plan, communities can generate income from mining while sustaining biodiversity and ecosystem services. The strategy was implemented with the help of national and local NGOs and foundations. This enabled the communities to get their minerals certified by FAIRMINED and sell it at a premium in the growing market for low-impact mined minerals.

Source: Hidrón 2009 and Alliance for Responsible Mining 2010

Decisions about climate-relevant ecosystem services cannot only be made on a project by project basis – which has often been the case to date. Those that are relevant to climate regulation are both global and local in their extent and are delivered by a wide range of ecosystems, which are at risk to varying degrees (MA 2005). Similarly, water services and regulation of extreme events are complex and vast. Ad hoc and small scale approaches to their management risk the total value of the resource being lost because of the **cumulative effect** of the individual decisions (DEFRA 2007). Without a larger strategic context there is a real danger of 'not seeing the forest for the trees.'

Sustaining ecosystems is therefore no longer just an environmental goal. It is necessary to ensure the conditions for sound economic and social development. Therefore two **key principles** need to be applied if we are to integrate an ecosystem services approach into spatial planning:

- Planning must be undertaken for the **functional spaces** within which people live and work rather than the administrative boundaries of a single municipality or region. Ecosystems and the scales on which they deliver services should therefore be understood as the key building blocks for spatial analysis.
- It is essential to integrate ecosystem services into socio-economic decision making, rather than addressing them separately. For this reason, planners can develop a **multi-scale approach** to decision making that accounts for both 'horizontal' and vertical' collaboration.

The potential of ecosystem services is increasingly taken into account in regional and national land use planning (Box 6.4). At the local scale, the Global Report on Human Settlements (UN-HABITAT 2009) has identified eight potential planning responses for urban zoning. These responses provide opportunities to incorporate the above principles into ecosystem services planning (Table 6.2). Furthermore, assumptions that are based on historical experience no longer hold under climate change. Therefore, new tools and guidance is needed that include sophisticated methods like climate models for local and regional planning, which integrate ecosystem services (Box 6.7).

In order for spatial planning to effectively use an ecosystem service approach, municipalities and other agencies are advised to establish:

1) **Legal Framework:** This provides a statutory basis for local plans to guide both development and the powers that enforce it (UN-HABITAT 2009). Without a legal framework, the adverse impacts of proposals on ecosystem services cannot be fully controlled or remediated. Planning systems can be made more effective if local communities can design (and redesign) regulatory and legal systems to support effective development.
2) **Regional or national planning frameworks:** In most countries, spatial planning takes place only at the local level, making it difficult for municipalities to draw up strategies for entire ecosystems (such as water catchments). Developing a regional or national planning framework helps to implement plans that incorporate entire ecosystems (Box 6.4).
3) **Technical Resources:** Planners need data and tools to draw up effective plans. This is a particular challenge in developing countries, where there is often negligible information, for instance, about slum neighbourhoods and informal settlements.
4) **Processes for engaging local communities:** Participatory planning is at the core of spatial planning. Community support is essential for an effective plan. This depends on the political will and the resources of the community, particularly in areas where civic society does not have a democratic culture or institutions.

Ecosystem services approaches can be operationalized within planning systems using three different perspectives (Haines-Young and Potschin 2008):

1) **Habitat:** A focus on Habitat units is valuable because it has clear relevance to policy. It links the assessment of ecosystem services with biodiversity action plan processes.
2) **Services:** This approach focuses directly on the ecosystem services themselves (such as water supply or flood control) and is particularly effective in assessing regional and national-level services, such as water basin management.
3) **Place-based:** This approach identifies and evaluates the interrelationships between all services in a defined geographical area. This perspective may overcome problems in defining an ecosystem.

Table 6.2 Policy responses integrating ecosystem services

Policy directions	Examples of potential responses
Renewable energy to reduce dependence on non-renewable sources	• Community energy systems in Freiburg (Germany) and travel management in Calgary (Canada)
Carbon-neutral cities to cut and offset carbon emissions	• Zero-carbon housing in Denmark • Urban tree and woodlands in Sacramento (USA)
Small-scale, distributed power and water systems with more energy-efficient service provision	• Water sensitive design that uses the complete water cycle in Hanoi (Vietnam) • Waste water agro-systems in Kolkata (India) • Local power systems and cooperatives in Malmo (Sweden)
Increasing photosynthetic spaces (as part of green infrastructure development) to expand renewable sources of energy and local food	• Local food provision in Devon (UK) • Biomass in Vaxjö (Sweden) • Green roofs and materials in Shanghai (China)
Eco-efficiency to enable the use of waste products to satisfy urban energy and material resource needs	• Industries reduce waste and resource requirements by sharing waste and resources in Kalundborg (Denmark) • Ambitious recycling targets in Cairo (Egypt) • Maximising urban densities in Hammarby Sjöstad (Sweden)
Local strategies that increase 'pride in place' by enhancing the implementation and effectiveness of innovations	• Participatory systems that localize energy, food, materials and local production in Medellin (Columbia) • Planning systems that capture the value of ecosystem services and creating a 'local sustainability currency' in Curitiba (Brazil)
Sustainable transport that reduces the adverse impacts of dependence on fossil fuels	• Urban form and density in Vancouver (Canada) • Transit systems in London (UK) • Street planning and mobility management in Tokyo (Japan)
Development of 'cities without slums' to improve access to safe drinking water, sanitation and reduce environmental degradation	• Respecting community structure in slum resettlement in Kampung (Indonesia) • Planning for the informal economy in Somalia (UN-HABITAT initiative)

Source: Adapted from UN-HABITAT (2009).

Box 6.4 Ecosystem services in regional planning

China: Provincial and county planners in China now consider areas that are critical for the provision of ecosystem services and for biodiversity conservation in order to develop multi-objective and cross-sectoral land use plans. In Boaxing County, for example, InVEST was used to desing zones development zones that help to protect areas with high ecosystem services value for sediment and water retention for erosion control and flood protection as well as carbon storage. These are also key conservation areas for biodiversity.

Source: Mapping conservation areas for ecosystem services in land-use planning, China. TEEBcase by Wang et al. (see TEEBweb.org).

Indonesia: Sumatra's next ecosystem-based spatial plan will guide local and regional decision-making processes and assist planners to determine whether, and where, to award concessions for economic activities, such as oil palm and pulp and paper plantations. Using the InVEST tool, the location and quantity of high-quality habitat, carbon storage and sequestration potential, annual water yield, erosion control, and water purification were analyzed. This will help to locate and determine conservation activities such as payments for carbon or watershed services as well as best management practices for forestry and plantations.

Source: Integrating ecosystem services into spatial planning in Sumatra, Indonesia. TEEBcase by Barano et al. (see TEEBweb.org).

Although both the 'habitat' and 'service' perspectives are useful in assessing ecosystem services, political decision making typically focuses on a particular geographical area. For this reason, a place-based perspective is potentially the most effective. It encourages people to think about **cross-sectoral issues**, appropriate geographical scales for analysis, and the values and priorities of different stakeholder groups (Box 6.5).

A place-based approach to planning that incorporates ecosystem services addresses several key questions (adapted from Haines-Young and Potschin 2008):

- **Which** ecosystems services in the area are important to human well-being?
- **Where** do these ecosystems services emanate from? Are they local, or do they come from outside the area under consideration?
- **Who** relies on the services, and in what kind of capacity? How important are they to groups or individuals within and outside the area?
- **What** is the value and priority of each service? Can the services be replaced, substituted or acquired elsewhere?
- **How** can management and policy actions enhance services? In particular, how might actions that address the flow of one service negatively or positively affect the flow of another?

6.3 SYNERGIES BETWEEN SPATIAL PLANNING AND BIODIVERSITY

Policies with the aim of promoting biodiversity are generally reactive in their approach to biodiversity and implement SEA or EIA processes (see section 6.5) or separate policy frameworks (eg Local Biodiversity Action Plans, see Box 6.6).

The traditional hierarchical approach to natural resource protection seeks to protect the 'best', generally rural, resources. In doing so it fails to value ecosystems as a whole, especially in urbanized regions. Recent spatial planning approaches to biodiversity reflect a more proactive approach to biodiversity through two linked

Box 6.5 Restoring ecosystem services to prevent flood damage: The Napa Living River Project, California

The Napa River Basin ranges from tidal marshes to mountainous terrain and is subject to severe winter storms and frequent flooding. The present value of damageable property within the floodplain is well over US$ 500 million. After a major flood in 1986, the federal government proposed digging levees and implementing a channel modification project. Local citizens, however, did not approve the plan. They were concerned by the risk of salinity intrusion due to channel-deepening, water quality degradation and problems associated with the disposal of contaminated dredge material.

In response to community concerns, the "Living River Initiative" was proposed – a comprehensive flood control plan to restore the river's original capacity to handle flood waters. Since 2000 it has converted over 700 acres around the city into marshes, wetlands and mudflats.

The project reduced or eliminated flood-related human and economic casualties: property damage; cleanup costs; community disruption; unemployment; lost business revenue and the need for flood insurance. By taking a cross-sectoral planning approach the project has also created an economic renaissance, instigating the development of several luxury hotels and housing along the river which, at one time, was viewed as a blighted area. Since approval, approximately US$ 400 million has been spent on private development investment in downtown Napa. Urban citizens' health has improved with access to trails and recreation areas.

At completion, the project will protect over 7,000 people and 3,000 residential/commercial units from flooding catastrophe. The project also has a positive benefit-to-cost ratio since over US$ 1.6 billion in damages is expected to be saved from flood protection expenditures.

Source: River restoration to avoid flood damage, USA. TEEBcase by Kaitlin Almack (see TEEBweb.org)

concepts – 'green networks' and green infrastructure:

a. **Green Networks** promote linked spaces and corridors of biodiversity resources, sustainable transport networks and formal and informal public open-spaces. This enables the identification of network 'gaps' and implementation of management priorities with a focus on linked networks rather than individual sites.
b. **Green Infrastructure** is a strategically planned and delivered network of ecosystems and green spaces including parks, rivers, wetlands and private gardens. It focuses on ecosystems that provide important services such as storm water protection, water and air quality improvement as

Box 6.6 Local biodiversity action plans

Local Biodiversity Strategy and Action Plans (LBSAPs) create a local framework that can concurrently address national and international conservation and biodiversity targets. LBSAPs functions are to:

- translate international and national policies and obligations into effective action at the local level.
- conserve important local and national biodiversity.
- provide a framework and process, coordinating new and existing initiatives, for biodiversity conservation at the local level.
- assist sustainable planning and development.
- raise public awareness and involvement in biodiversity conservation.
- collect and collate information on an area's biodiversity.
- provide a basis for monitoring biodiversity at a local level and make recommendations to regional and national levels of government.

Source: adapted from Local Action for Biodiversity (LAB) 2009 (www.iclei.org/lab)

well as regulation of local climate. If well planned, green infrastructure can be part of the economic and social capital of a region and a multifunctional resource capable of delivering a wide range of ecosystem services with significant benefits to the well-being of local communities (Natural England 2010). Tools like CITYgreen allow for the systematic integration of green infrastructure into spatial planning.

At the **local scale** such approaches range from local volunteer programmes (eg the UK Groundwork Projects) to more formal institutions (eg the Urban Ecology Agency of Barcelona). Local planning has seen development in approaches to strategic urban design, public realm strategies and urban ecology. The American 'Great Places' initiative, for example, annually identifies places with exemplary character, quality, and planning – distinguishing places that demonstrate significant cultural and historical interest, community involvement and a 'vision for tomorrow'.

At the **sub-regional and regional scale**, green networks are increasingly seen as part of wider infrastructure. The Verband Region Stuttgart regional plan for the Stuttgart metropolitan region (Germany) includes landscape and ecological specifications for green belts and wedges in the form of parks and green spaces which act as a counterweight to the spread of commercial and residential areas (www.region-stuttgart.org/vrs/main.jsp?navid=19). Planning at this scale may also identify important areas for ecological protection, such as biotopes or water catchment areas. In Miami (USA), the city has used the CITYgreen tool for systematically including green infrastructure such as parks, urban forests and wetlands into urban planning. This is mainly for the purpose of storm water protection, enhancement of air and water quality and climate regulation (TEEB-case Multiple benefits of urban ecosystems: spatial planning in Miami City, USA).

This kind of integrated planning is also possible at a **national scale**. Sweden has developed national urban parks (Schantz 2006) and the Dutch ministry for spatial planning has promoted a coherent network of nature areas and connection zones (Ecologische Hoofdstructuur) as part of a larger European Natura 2000 network (www.groeneruimte.nl/dossiers/ehs/home.html).

Mega-regional inter-state spatial planning is also emerging. Eleven countries in the Baltic Sea Region are collaborating on spatial planning (VASAB) (www.vasab.org). This approach is reflected in the 'America 2050 Initiative' (www.america2050.org) which promotes the concept of 'Ecopolis', a network of wild and working landscapes in metropolitan systems consisting of Portland and Seattle (USA), and Vancouver (Canada) (www.america2050.org/pdf/cascadiaecopolis20.pdf).

6.4 POTENTIAL FOR PROGRESS – ACTION POINTS FOR LOCAL POLICY

The potential for proactively making use of the multiple benefits provided by ecosystems in spatial planning is seldom realized. Few countries have good tools or professional resources for effective spatial planning (French and Natarajan 2008). Equally, few countries are using National Biodiversity Strategies and Action Plans as tools for integrating biodiversity into planning (SCBD 2010).

Mainstreaming biodiversity and ecosystem services in decisions made across a wide range of sectors, departments and systems (land, freshwater, sea) can be promoted by taking action in the following areas:

1. **Benchmark** the planning system and administrative arrangements to establish how they can be better integrated, more inclusive and sustainable. This can be done based on functional regions that reflect local ecosystems.
2. Develop **Green Infrastructure** if necessary, collaborate with bordering municipalities or the regional level to develop planning policy for shared ecosystems services.

3. Set **priorities** according to resource limitations (professional and financial). These can address the level of urgency needed to tackle ecosystem challenges (eg focus on vulnerable drylands with high population pressure and →*poverty* rates). Act before the risks to ecosystem services become critical.
4. Create **new forms of engagement** that can deliver more integrated policy. This involves consultation at early stages, hands-on participation, shared outcome targets and joint programmes between municipalities and other agencies (EEA 2009).
5. Use the available **tool-boxes**. Strengthen the competences of planners and policy makers generally. This can include utilizing the potential of GIS tools to make visible the impacts on ecosystem services of alternative scenarios, plans, policies and projects (Box 6.7).

Box 6.7 Tools for integrating ecosystem services into policy and decision making

Specific application software, such as **CITYgreen**, can be used to analyze the ecological and economic benefits of tree canopy and other green features in cities. Planners can use it for scenario testing – for projections related to stormwater run-off, air pollution control, carbon storage and sequestration and landcover. (CITYgreen: www.americanforests.org/productsandpubs/citygreen).

Planners also have access to free software, such **Marxan**, a conservation planning toolset that can help planners analyze a range of conservation design dilemmas (Marxan: http://www.uq.edu.au/marxan). It can also be used to develop multi-use zoning plans for natural resource management and can be applied to a wide range of problems associated with the management of reserves (including terrestrial, marine and freshwater systems) and generate options that can encourage stakeholder participation. This has been used in a range of situations, Madre Dios, Peru, for example (Fleck et al. 2010).

InVEST is designed to help local, regional and national decision makers incorporate ecosystem services into a range of policy and planning contexts for terrestrial, freshwater and marine ecosystems. It includes spatial planning, SEAs and EIAs and maps where ecosystem services are provided and utilized. It can provide biophysical results (such as meters of shoreline retained) and economic values (avoided property damage cost). It also creates a relative index of habitat quality (although biodiversity is not given a direct economic value). It can help design models which account for both service supply (living habitats buffers for storm waves) and the location and activities of people who benefit from services.

Depending on data availability, InVEST includes relatively simple models (with few input requirements) and more complex, data intensive models that can inform policy that requires certainty and specificity.

The InVEST process begins by identifying stakeholders' critical management choices which can be analyzed for effects on →*ecosystem processes*, biodiversity and flow of ecosystem services.
Outputs can inform:

- **Spatial planning:** assessing current and potential ecosystem services status under alternative, spatially-explicit future scenarios.
- **SEA and EIA:** identifying how policies, plans and programs can affect multiple ecosystem services, thus guiding selection of best alternatives.
- **Payments for ecosystem services (PES):** identifying how payments can be effectively and efficiently disbursed.
- **Permits and mitigation:** assessing impacts of proposed activities and providing guidance for where mitigation will provide the greatest benefits.
- **Climate adaptation strategies:** demonstrating how changes in climate patterns will influence services delivery.

Source: http://invest.ecoinformatics.org Background information on InVEST and the Natural Capital Project is available at www.naturalcapitalproject.org

6.5 INTEGRATING ECOSYSTEMS AND BIODIVERSITY IN ENVIRONMENTAL ASSESSMENT

For those concerned with promoting local and regional development, this section explains how assessment instruments such as Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA) can help maintain and enhance ecosystems and biodiversity values. It follows several key assumptions (Slootweg et al. 2009):

1. Biodiversity is about people, as people depend on biodiversity for their livelihoods and quality of life;
2. Safeguarding livelihoods is a major →*driver* in the application of impact assessment;
3. SEA and EIA have a major role in bridging economic, social and biophysical planning dimensions to assess future development opportunities;
4. Future opportunities for development are often unknown, but potentially hidden in ecosystems, species and genetic diversity;
5. Ecosystems services make economic sense as they provide direct or strategic support of all human activities;
6. SEA and EIA can highlight development opportunities provided by ecosystem services and assess the negative impacts on ecosystem services before they are affected;
7. SEA and EIA can promote and enable stakeholders' views on the importance of ecosystem services.

THE ROLE OF EIA AND SEA

Environmental impact assessment (EIA) was one of the first instruments to proactively identify and assess the consequences of human actions on the environment and to avoid irremediable consequences. Today, EIA is the process of identifying, predicting, evaluating and mitigating the biophysical and other relevant effects of development proposals prior to major decisions being taken and commitments made (IAIA/IEA 1999). It is generally conducted as a mandatory step to obtain planning approval for development projects such as dams, airports, highways, transmission lines, power plants, large industries, urban infrastructure developments and irrigation projects.

Legal requirements were established to enforce the application of EIA, and currently most countries around the world have enacted EIA legislation (see Box 6.8). However, the treatment of biodiversity within EIA has not been consistent. With the adoption of impact assessment guidelines by the Convention on Biological Diversity (SCBD and NCEA 2006; Slootweg et al. 2009), a framework has been provided which is consistent with the objectives and instruments of the CBD.

Box 6.8 EIA and SEA around the world

The United States is credited with first institutionalizing EIA in 1969, and was followed by other predominantly western countries. During the eighties, the EU instituted EIA legislation and the World Bank adopted EIA as part of its operations. Since then, over 100 countries have followed suit. In comparison, SEA is less widespread. Its application, however, is rapidly catching up. Approximately 35 countries have (as of 2009) adopted regulations for SEA, largely due to the 'Kiev Protocol' which entered into force in July 2010.

Interest in SEA also sparked the call for more holistic, integrated and balanced strategic decision making made in influential initiatives such as the 2002 Millennium Development Goals (MDGs). International financing institutions and co-operation organisations such as the World Bank and CIDA have played an important role in introducing SEA to developing countries, funding many SEA studies. Principle 17 of the Rio Declaration (1992) highlights the role of EIA in environmental policy for sustainable development.

Source: adapted from Kolhoff et al. 2009

A suite of impact assessment approaches with different foci have emerged over time, but most are based on the EIA principles of pro-active information provision before decision making, ensuring transparency and stakeholder involvement. Examples include social impact assessment, health impact assessment, cumulative impact assessment and biodiversity impact assessment.

Strategic Environmental Assessment (SEA) was developed to address development choices at a strategic level before projects begin. In order to be more effective, SEA considers alternative options, weighing and discussing the risks and opportunities they present (Partidário 2007; 2007a).

ECOSYSTEMS AND BIODIVERSITY IN ENVIRONMENTAL ASSESSMENTS

Biodiversity is commonly described in terms of ecosystem and species diversity, numbers of individuals per species and a number of other ecological terms. For planners required to deliver services and quality of life to people, this language may be difficult to relate to. Conservationists and planners frequently clash on biodiversity issues, particularly if SEA and EIA are perceived as legal requirements that can hinder development, driven by environmental authorities.

The CBD in its guidelines on biodiversity in impact assessment (SCBD and NCEA 2006), tries to **reconcile biodiversity conservation with development** by highlighting the role of ecosystem services as the basis for human well-being and livelihoods. By describing an ecosystem in terms of the services it provides to people (including future generations), it is possible to identify groups of people having an interest, or stake, in these services. Each ecosystem provides multiple services. A forest provides both timber and non-timber forest products, anti-erosion services and carbon storage. Coastal dunes provide protection against storm surges, protect the hinterland against underground seawater intrusion, conserve biodiversity and provide recreational facilities.

Stakeholders do not necessarily share the same interests. For example, seasonal floods in Bangladesh are accommodated by floodplains. This ecosystem service is highly appreciated by fishers, while farmers prefer to have embankments and regulated water supply to be able to produce two crops per year (Abdel-Dayem et al. 2004). EIA and SEA can help identify different interests, creating an important baseline for conflict resolution.

USING IMPACT ASSESSMENT TO RECOGNIZE ECOSYSTEM SERVICES

From a spatial planning perspective, three situations can be envisaged for impact assessment to effectively integrate ecosystem services into the planning process:

1. **Sustainability-oriented spatial planning with pro-active SEA:** SEA facilitates the planning process in a pro-active and strategic way. It identifies ecosystem services and their respective stakeholders in a defined geographic area and maps sensitivities. Both the status of biodiversity as well as direct and indirect drivers of change are assessed. Some ecosystem services may be over-exploited and remediation or rehabilitation is needed, while others may identify an unexploited development potential (case studies 1, 2 and 3, Box 6.9).
2. **Spatial planning with reactive SEA:** SEA can be used to assess consequences of proposed plans and developments in a defined spatial area. Proposed activities and the planning area are known, and an inventory of ecosystems and their sensitivity to identified drivers of change can be made (for example, making a sensitivity map). In consultation with stakeholders, potential impacts on ecosystems can be translated into impacts on ecosystem services, expressed as opportunities or risks to social and economic well-being (case study 4, Box 6.9).
3. **Detailed project planning and EIA:** if a spatial plan already subjected to an SEA has been established, and development is prioritized, alternatives may only need fine-tuning. EIA applied to these projects can make a detailed analysis of their potential consequences. Local biodiversity, related ecosystem services and the stakeholders can be determined. The assessment predominantly focuses on (i) avoiding or mitigating impacts (through adjusting location, changing magnitude or timing of the activity or applying alternative

technologies), and (ii) the creation of an environmental monitoring and management plan . The efficacy of each of these approaches will depend on intended outcomes and on the nature of the planning system in each local setting.

Box 6.9 SEA to recognize ecosystem services

Case Study 1: Catchment Planning in South Africa

In uMhlathuze municipality, an area identified as a biodiversity hotspot, a classic case of 'development' versus 'conservation' led to conflict in a rapidly industrializing municipality in favor of development, in large part due to poverty and lack of local opportunity. The municipality undertook a Strategic Catchment Assessment. The study highlighted the 'free' ecosystem services provided by the area (nutrient cycling, waste management, water supply, water regulation, flood and drought management). The annual value of these environmental services was estimated at R1.7 billion (nearly US$ 200 million). Politicians reacted positively once they realized the economic value of these ecosystem services. The municipality embarked upon a negotiating process to identify (1) sensitive ecosystems that should be conserved, (2) linkages between ecosystems, and (3) zones that could be developed without impacting on the area's ability to provide environmental services. More importantly (4), it identified management actions that would ensure not only the survival of key biodiversity assets, but also sustainable development opportunities using biodiversity resources.

Source: Catchment planning incorporates ecosystem service values, South Africa. TEEBcase by Roel Slootweg based on Van der Wateren et al. (see TEEBweb.org).

Case Study 2: SEA for Integrated Coastal Management, Portugal

Although not legally mandatory in Portugal, an SEA was used to assist with the preparation of the Portuguese Strategy for Integrated Coastal Zone Management (PS-ICZM). SEA and PS-ICZM teams collaborated closely to achieve a well-integrated outcome. The SEA proved to be key in placing ecosystem services on the agenda, facilitating the integration of environmental and sustainability issues into both strategy and design. An assessment of key strategic options for the coast assisted with fine-tuning the strategy, highlighting strategy-related risks and opportunities.

Source: SEA for including ecosystem services in coastal managment, Portugal. TEEBcase by Maria Partidário et al. (see TEEBweb.org).

Case Study 3: Restoration of wetlands for local livelihoods and health, Central Asia

Intensification and expansion of irrigation activities in Central Asia led to shrinking of the Aral Sea and degradation of the Amu Darya delta in Uzbekistan, leaving only 10% of the original wetlands.

The Interstate Committee on the Aral Sea, in consultation with the World Bank, requested the development of a coherent strategy for the restoration of the Amu Darya delta. An SEA approach was used to structure the decision-making process. Valuation of the ecosystem services was instrumental in changing the course of development from technocratic and unsustainable interventions, towards the restoration of natural processes, better capable of creating added value to inhabitants under the dynamic conditions of a water-stressed delta.

The process created a strong coalition of local stakeholders and authorities, resulting in necessary pressure to convince national government and the donor community to invest in a pilot project, the restoration of the Sudoche wetlands. The project resulted in an increase in productivity of the region; the best →*indicator* of success is the return of young people to the villages.

Source: Wetland restoration incorporates ecosystem service values, Aral Sea, Central Asia. TEEBcase by Roel Slootweg et al (see TEEBweb.org).

Case Study 4: Irrigation rehabilitation through water transfer, Egypt
In the desert area west of the Nile Delta, groundwater based export-orientated agriculture has an annual turnover of about US$ 750 million. Groundwater is rapidly depleting and becoming saline. To reverse this situation, the Egyptian government has proposed pumping 1.6 billion cubic meters of fresh Nile water from the Rosetta Nile branch into an area of about 40,000 ha.

The use of SEA at the earliest stages of planning has guaranteed that environmental and social issues beyond the boundaries of the project area were incorporated into the design process. Valuation of ecosystem services focused on those services affected by the transfer of water from the Nile to the desert area. Simple quantitative techniques provided strong arguments for decision makers in the government ministry and the World Bank to significantly reduce the scale of the initial phase.

The diversion of water from relatively poor smallholder farmers in the delta to large investors west of the delta posed →*equity* problems, so a phased implementation was agreed. This provided time for the National Water Resources Management Plan, which includes a water savings program, to be implemented.

Source: Water transfer project influenced by ecosystem service evaluation, Egypt. TEEBcase by Roel Slootweg (see TEEBweb.org).

SEA AND EIA TO CREATE OPPORTUNITIES FOR LOCAL AND REGIONAL PLANNING

Both SEA and EIA provide a means to highlight the interests of biodiversity and its stakeholders. By proactive work in the early stages, SEA and EIA can explore the opportunities and risks from proposed development, identify the impacts of human actions on ecosystems and biodiversity, and advance the necessary planning guidelines or project mitigation measures in order to avoid or reduce negative consequences. SEA and EIA can help spatial planning in four ways:

1. **Prevent** changes that create **increased pressures on biodiversity** by influencing spatial planning strategies and territorial models (case examples 1 and 2);
2. Help **identify opportunities created by existing ecosystems** to improve the quality of both urban and rural life, through identification and quantification of ecosystem services (case example 1);
3. Influence project design in order to **avoid or mitigate irreversible negative impacts** on ecosystems and biodiversity and enhance the positive impacts (case examples 3 and 4);
4. **Implement legal and international obligations** concerning biodiversity such as nationally protected areas or species, internationally recognized areas (Ramsar, UNESCO, World Heritage) protected ecosystem services (water supplies, coastal defences) and indigenous protected areas (case examples 2 and 3).

PRINCIPLES TO GUIDE THE PLANNING AND ASSESSMENT PROCESS

By ensuring the long term viability of ecosystem services, SEA and EIA also contribute to ensuring that →*natural capital* is not 'traded in' to meet short term needs in a manner which limits the freedom of future generations to choose their own development paths (SCBD and NCEA, 2006). Meeting these general requirements in concrete decision-making settings constitutes a challenge for which some guiding principles provide direction (see Box 6.10).

The Millennium Ecosystem Assessment states that understanding the factors that cause changes in ecosystems and ecosystem services is essential. Drivers of change can be natural (earthquakes, volcanic eruptions) or human-induced. Impact assessment is primarily concerned with human-induced drivers as they can be influenced by planning and decision making.

Box 6.10 Principles to secure the long-term development potential of biodiversity

No net loss: Loss of irreplaceable biodiversity must be avoided. Other biodiversity loss has to be compensated for (in quality and quantity). Where possible, identify and support opportunities for biodiversity enhancement through 'positive planning'.

The precautionary principle: Where impacts cannot be predicted with confidence, and/or where there is uncertainty about effectiveness of mitigation measures, be cautious and risk adverse. Employ an adaptive approach (several small steps instead of one big step) with safety margins and continuous monitoring (see also The Precautionary Principle Project, www.pprinciple.net/).

Participation: Different groups or individuals in society have a stake in the maintenance and/or use of biodiversity. Consequently, valuation of biodiversity and ecosystem services can only be done in negotiation with these stakeholders. Stakeholders thus have a role in the impact assessment process.

Local, traditional and indigenous knowledge is used in impact assessment to provide a complete and reliable overview of issues pertaining to biodiversity. Views are exchanged with stakeholders and experts. While physical drivers of change (such as hydrological changes) can be modeled by experts, impacts are 'felt' by people and are location specific (for an example see Sallenave 1994).

Source: SCBD and NCEA 2006

SEA and EIA need to distinguish between drivers that can be influenced by a decision maker and others which may be beyond their control. The temporal, spatial and organizational scales at which a driver of change can be addressed are crucial (SCBD and NCEA 2006). For example, overexploitation of groundwater cannot be dealt with at the level of one individual groundwater well, but is better addressed at the level of regional groundwater extraction policy. At higher and strategic levels of planning, the indirect drivers of change may become relevant, making them particularly relevant in SEA. Changes in production and consumption processes, for example, through international trade agreements, will act as indirect drivers. This in turn leads to direct drivers of change (Slootweg et al. 2009).

6.6 WHEN AND HOW TO INTEGRATE ECOSYSTEM SERVICES IN EIA AND SEA

EIA and SEA perform differently in their capacity to integrate ecosystem services: EIA follows a process characterized by an internationally accepted sequence of steps:

- **screening:** used to determine which proposals be subject to EIA (usually legally embedded).
- **scoping:** to identify which potential impacts are relevant to be assessed in EIA, resulting in a TOR for the assessment (usually with public involvement).
- **assessment study** and reporting: the actual study phase should result in an environmental impact statement (an EIS or EIA Report) and environmental management plan (EMP).
- **review: quality check** of the EIS, based on the TOR (usually with public involvement).
- **decision making**
- **follow up:** monitoring during project implementation and implementation of the EMP.

When looking at the inclusion of ecosystem services in EIA, special emphasis should be given to the screening and scoping stages. The need for an impact assessment study is defined by good screening criteria and procedures; it is beyond the scope

Table 6.3 Checklist of how to address ecosystem services in SEA

Ecosystem service triggers	Key questions to ask	Actions to address ecosystem services
Trigger 1 – Spatial Policy is affecting a known area that provides ecosystem services.	*Does the policy, plan or programme influence:* • important ecosystem services? • important biodiversity? • areas with legal and/or international conservation status?	*Focus on area* • Map ecosystem services. • Link ecosystem services to stakeholders and beneficiaries. • Invite stakeholders for consultation. • Systematic integration of ecosystem services and biodiversity in conservation planning.
Trigger 2 – Sectoral direct Policy is affecting direct drivers of change with immediate biophysical consequences (area not defined).	*Does the policy, plan or programme lead to:* • biophysical changes such as land conversion, fragmentation, extraction? • other changes such as human relocation and migration, change in land-use practices?	*Focus on direct drivers of change and potentially affected ecosystem* • Identify drivers of change. • Identify which ecosystems are sensitive to expected biophysical changes. • Identify expected impacts on ecosystem services.
Trigger - Combination of 1 and 2 Policy is affecting known direct drivers and area.	*Combination of 1 and 2 above*	*Focus on area and direct drivers of change* *Knowledge of intervention and area of influence allows prediction of impacts on ecosystem services and biodiversity.* *Actions include a combination of 1 and 2.*
Trigger 3 – neither area nor sector are defined Interventions affecting indirect drivers of change, without direct biophysical consequences.	*Are indirect drivers of change affecting the way in which a society:* • produces or consumes goods? • occupies land and water? • exploits ecosystem services?	*Focus on understanding* the complex linkages between indirect and direct drivers of change. • *Review existing cases and methodology (like the MA).* • *Undertake original research.*

Source: adapted from SCBD and NCEA (2006)

of this document to discuss biodiversity-inclusive screening criteria.

In the scoping phase, experts, stakeholders and competent authorities play a role in defining the issues that need further study. The CBD Guidelines provide an extensive 13 step approach to do good scoping for biodiversity and ecosystem services (see SCBD and NCEA (2006) below).

Unlike EIA, the SEA process is not structured according to a given procedure. The principal reason is that best practice SEA should be fully integrated into a planning (or policy development) process, and these differ between eg national sectoral or regional spatial plans, or policy development processes. Different approaches and guidance documents are available in 'for further information' below.

There are, however, some procedures to verify the need to include ecosystem services in the SEA process. Table 6.3 identifies ecosystem services triggers in a policy, plan or program (Full detail is provided in SCBD and NCEA 2006 and Slootweg et al. 2009).

6.7 LESSONS LEARNED FROM PRACTICE

From a study of 20 cases where valuation of ecosystem services actually influenced planning and decision making, Slootweg and Van Beukering (2008) derive the following lessons for practical policy:

Recognizing ecosystem services enhances transparent and engaged planning. The quality of planning processes and SEA is greatly enhanced if stakeholders are at least informed of, or preferably invited into, the planning process. Linking ecosystem services to stakeholders provides a good approach to involve relevant actors.

Poverty and equity issues are highlighted by looking at the distribution of ecosystem service benefits. In early planning stages, recognition of ecosystem services and identification of stakeholders can provide important clues to the winners and losers resulting from certain changes and thus provides better understanding of poverty and equity issues. Benefits and costs can occur in geographically separate areas and affect social differentiation (see case study 4, Box 6.9).

Valuing ecosystem services facilitates the **financial sustainability** of environmental and resource management, highlights **social equity** issues and provides a better insight into the **long- and short-term trade-offs** of planning decisions.

Valuation of ecosystem services is influential with decision makers. Monetization of ecosystem services puts biodiversity considerations on many decision makers' agenda. Politicians may react more positively once they realize that environmental services have an economic value.

SEA provides a platform to include valuation results in decision making. SEA also guarantees the inclusion of stakeholders in the process and leads decision makers to take valuation results into account.

Urban managers are faced with reconciling competing needs for land by a growing population - as here in Addis Ababa, Ethiopia

FOR FURTHER INFORMATION

Guidelines on sustainability oriented Urban Planning
Global Report on Human Settlements (2009) Planning Sustainable Cities. United Nations Human Settlements Programme (UN HABITAT). This comprehensive report reviews recent urban planning practices and approaches, discusses constraints and conflicts, and identifies innovative approaches to current challenges of urbanization. www.unhabitat.org/downloads/docs/GRHS2009/ GRHS.2009.pdf

Practical guidance on effective spatial planning as well as on metropolitan mitigation measures is available on the website of the Network of European Metropolitan Regions and Areas METREX www.eurometrex.org

The Revised Metrex Practice Benchmark of effective metropolitan spatial planning. www.eurometrex.org/Docs/InterMETREX/Benchmark/EN_Benchmark_v4.pdf

The Biodiversity Planning Toolkit uses interactive maps to incorporate biodiversity in spatial planning. www.biodiversity planningtoolkit.com

Metropolitan Mitigation Measures Sourcebook www.eurometrex.org/Docs/EUCO2/Metropolitan_Mitigation_Measures_Sourcebook.pdf

Guidelines on Good Environmental Governance
WRI (2003), World Resources 2002-2004: Decisions for the Earth: Balance, voice, and power, 2003 This easily accessible report with several maps and figures points out the importance of good environmental governance by exploring how citizens, government managers, and business owners can foster better environmental decisions www.wri.org/publication/world-resources-2002-2004-decisions-earth-balance-voice-and-power.

The Precautionary Principle
Guidelines, workshop report and several case studies are available on the Precautionary Principle Project http://www.pprinciple.net/publications___outputs.html including Cooney, R. (2004) The Precautionary Principle in Biodiversity Conservation and Natural Resource Management: www.pprinciple.net/publications/PrecautionaryPrincipleissuespaper.pdf

Guidelines on Biodiversity-inclusive impact assessment
SCBD and NCEA (2006). Biodiversity in Impact Assessment: Voluntary Guidelines on Biodiversity-Inclusive Impact Assessment (www.cbd.int/doc/publications/cbd-ts-26-en.pdf). Using case studies (www.cbd.int/impact/case-studies) the approach of ecosystem services has been applied to develop guidelines for a better integration of biodiversity in impact assessments.

Slootweg et al. (2006) Biodiversity in EIA and SEA. Further information on the CBD guidelines is presented in this multilingual CBD technical series. www.cbd.int/doc/publications/cbd-ts-26-en.pdf

Ramsar Convention on Wetlands (2008) Resolution X.17 Environmental Impact Assessment and Strategic Environmental Assessment: updated scientific and technical guidance. www.ramsar.org/pdf/res/key_res_x_17_e.pdf

Slootweg, et al. (2010) Biodiversity in Environmental Assessment - Enhancing Ecosystem Services for Human Well-Being. This elaborate academic work provides in-depth conceptual as well as extensive case evidence on the CBD guidelines.

Environmental Impact Assessment
Petts, J. (1999) Handbook on Environmental Impact Assessment. This handbook on EIA provides an international perspective on practices, requirements and challenges.

UNEP (2002) Environmental Impact Assessment Training Resources Manual. This guidance forms the centrepiece of a package of EIA training materials and assist trainers in preparing and delivering courses on the application of EIA. http://www.unep.ch/etb/publications/envImpAsse.php

Glasson et al. (2005) Introduction to Environmental Impact Assessment. The introduction to EIA addresses concepts and practice in EIA, including process and legislation. Furthermore, different EIA systems are compared and a wealth of reference material and case-studies is provided.

Abaza, H. et al. (2004) Environmental Impact Assessment and Strategic Environmental Assessment: towards an Integrated Approach. This manual contains guidance on good practice, with particular application to developing countries. http://www.unep.ch/etu/publications/textONUBr.pdf

Strategic Environmental Assessment
IAIA (2001) SEA Performance Criteria. This 1-pager presents a set of criteria for good SEA performance which is an accepted benchmark for SEA. http://www.iaia.org/publicdocuments/special-publications/sp1.pdf

OECD-DAC (2006) Applying SEA: Good Practice Guidance for Development Cooperation. The report explains the benefits of using SEA in development co-operation and provide guidance using checklists and more than 30 case examples. http://www.oecd.org/dataoecd/4/21/37353858.pdf

OECD (2008) Strategic Environmental Assessment and Ecosystem Services. DAC Network on Environment and Development Co-operation (ENVIRONET). 26p. URL: http://www.oecd.org/dataoecd/24/54/41882953.pdf Advisory Note that supplements (OECD DAC 2006) with a focus on how to integrate ecosystem services in SEA.

Various training manuals and best practice examples on SEA are available on the SEA Network website http://www.seataskteam. net/library.php, e.g. Partidário, M. R. (2007a) Strategic Environmental Assessment, Good practices Guide.

UNEP (2009) Integrated Assessment for Mainstreaming Sustainability into Policymaking: A Guidance Manual. This handbook draws on international experiences and highlights the connections between proposed policies and desired results such as job creation and poverty reduction. Its "building-block" approach provides a powerful tool flexibly adapt assessment to different contexts and policy processes. http://www.unep.ch/etb/publications/AI%20guidance%202009/UNEP%20IA%20final.pdf.

A luxury cruise ship approaches Puerto Williams, a remote village in the Cape Horn Biosphere Reserve at the Southern-most tip of Latin America, where tourism is becoming an important economic activity.

7 ECOSYSTEM SERVICES AND PROTECTED AREAS

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Content of this chapter

Local protected areas are an important resource for policy makers and can be a benefit, not a burden to local populations. By considering the ecosystem services they provide, local policy makers can identify these benefits, and provide motivation for the establishment of protected areas (PA) beyond conservation – that of enhancing local human well-being.

This chapter examines why PAs are important to local policy, in addition to being important to conservationists (7.1). It looks at different options for local policy makers to become involved in PAs (7.2). Finally, it explores how looking at ecosystem services can help in various ways to face the challenges of PA management (7.3).

Key Messages

- **Protect your assets.** Protected areas (PA) can be an important asset to local government. They secure ecosystem services, can create jobs and bolster a community's reputation. To enhance local benefits, protected areas need to be integrated in the management of the surrounding landscape.
- **Get to know your neighbors.** Where PAs are primarily aimed at national/international conservation objectives rather than local ones, cooperation between local authorities and PA administration harmonizes action. This helps lower costs, both for PAs and neighboring municipalities.
- **Tailor-made fits better.** There are different solutions for different challenges in and around protected areas. Get involved. Local policy makers can (i) collaborate or co-manage with park authorities; (ii) set up and run municipal PAs; or (iii) support indigenous and local communities to manage their own areas.
- **Discover the benefits.** A focus on ecosystem services uncovers the benefits beyond protecting species. This can help secure higher level backing and inform zoning and management. It also helps create partnerships and raise conservation funds.
- **A way to deal with conflicts.** Local authorities are intermediaries between actors with diverse social and economic interests. They can use an ecosystem services perspective to understand how costs and benefits of conservation are distributed. This helps address conflicts related to PAs.

7.1 WHY ARE PROTECTED AREAS IMPORTANT IN LOCAL POLICY?

Protected areas are a flexible →*management* tool aimed primarily at achieving nature conservation; they also provide **a range of associated economic, social, cultural and spiritual benefits**. Protected areas cover 11.9% of the terrestrial and coastal waters of the world excluding Antarctica (UNEP-WCMC 2010); most countries have PAs with associated policies, legislation and staff and their benefits are widely appreciated. Many local authorities have PAs managed by other agencies within their jurisdiction but retain some responsibility for these places; in addition, local governments are increasingly setting up PAs themselves, to meet regional conservation objectives and to provide →*ecosystem services*; some also see them as sources of revenue.

PAs also create challenges for local policy makers. While there is widespread agreement that it is important to protect these areas, tensions arise over policies that restrict access to natural →*resources* for local communities. The social and economic cost of maintaining PAs has caused local conflicts around the world (Dowie 2009).

Although most PAs are not managed by local authorities in a legal sense, they are de facto important areas for local policy makers because they can have significant positive and negative effects on local communities. In many situations, **the way in which a PA is implemented determines whether it is a problem or an asset** for local development. Implementation comprises issues such as coordination with the surrounding lands, the rules in use and the organisation of management. A focus on ecosystem services and an interest in how PAs are implemented and managed helps policy makers to **assess whether local benefits can be enhanced** – or the costs to local communities can be lowered.

Conservation and local development efforts need to be coordinated. Taking a long-term perspective, we see that these objectives are often aligned,

Box 7.1 Reasons for policy makers to consider PAs in local development

- PAs are connected to surrounding land, water, and local communities. They are part of a larger social and ecological landscape.
- Coordinating regulation and management inside and outside PAs can decrease conservation-related costs and increase conservation-related benefits.
- Good coordination can enhance and secure the flow of ecosystem services to local beneficiaries.
- Conservation and local development face common challenges; a growing demand on natural resources, funding shortages, and contradicting sector policies. Coordinating efforts can be mutually beneficial.
- If local authorities establish and (co-)manage their own PAs, they have more control over community resources and objectives.
- Many local communities and indigenous peoples want PAs so they can conserve their landscape, livelihoods, collective rights and culture.

because maintaining →*natural capital* is essential to the well-being of a community. In turn, PAs flourish best if they are embedded in a healthy landscape or seascape in which the welfare of all →*stakeholders* is considered.

CONNECTED WITH SURROUNDING LAND AND SEASCAPES

Protected areas do not exist in isolation but interact constantly with their surroundings. When establishing or dealing with a PA, policy makers should consider what 'passes through' it. For example, is it located on a watershed (like the Danube Delta reserve in Romania)? Is it located on a migratory corridor (as in Kitengela, Kenya)? Are the animals that use it reliant on a wider landscape for survival (such as grizzly bears in Yellowstone National Park, USA)? Secondly, it is important to consider what **benefits the PA can supply beyond its own border** in terms of ecosystem services, for example:

- About a third of the planet's largest cities receive a significant proportion of their drinking water from watersheds inside protected areas (Dudley and Stolton 2003).

- The Tubbataha Reef National Marine Park in the Philippines restricted unsustainable fishing practices, leading to a doubling of fish biomass (Dygico 2006) (See also TEEBcase Temporary closures in octopus reserve increase catch, Madagascar).

Box 7.2 What are protected areas?

The International Union for Conservation of Nature (IUCN) defines PAs as "a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural →*values*" (www.iucn.org/about/work/programmes/pa/pa_what). The Convention on Biological Diversity (CBD) says it is "a geographically defined area which is designated or regulated and managed to achieve specific conservation objectives". It is recognized that both definitions convey the same general message (Dudley 2008).

PAs vary enormously in management and →*governance*. Management models range from strict, exclusionary protection to protected landscapes and seascapes that include farmland, forestry and settled areas. PAs are governed and managed by national, regional or local authorities, trusts, indigenous peoples, local communities and private individuals, often in collaboration with each other (Borrini-Feyerabend et al. 2004).

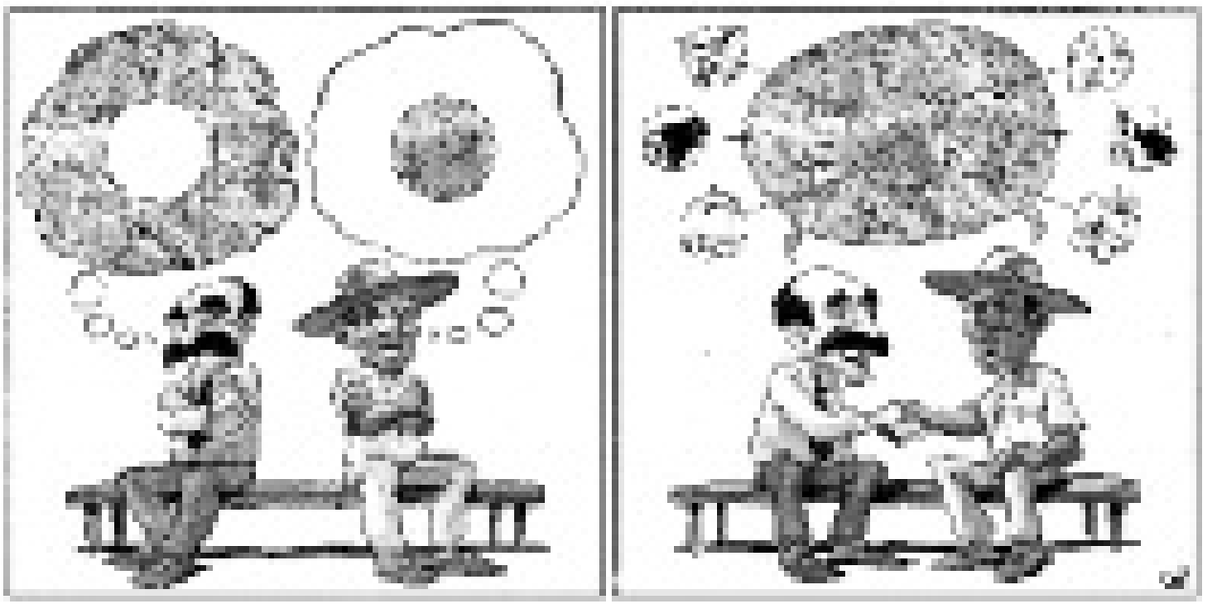


Illustration by Jan Sasse for TEEB

Looking at ecosystem services helps local authorities and conservation managers to see the interdependency between a protected area and surrounding land

The development and **activity on adjacent lands influences the protected area**, particularly when it exists as fragmented 'island' of intact nature in an otherwise transformed landscape. For example, wind and water can transport fertilizers, pesticides and toxins. In turn, local communities can have a positive impact on PAs because often **traditional land-use practices** maintain →*biodiversity*:

- In Serbia, extensive livestock production with indigenous sheep, goats and cattle maintains mountain meadow →*ecosystems* of the Stara Planina Nature Park (Ivanov 2008).

However, **human-wildlife conflict** also occurs near many PAs, where wildlife density is high and animals stray into adjacent fields or grazing areas:

- In China, people living in close proximity to Xishuang Banna Nature Reserve, claim that Asian elephants cause crop and property damage that account for 28-48% of their annual income (Zhang and Wang 2003).

While some of these concerns are beyond the scope of local policy, **local authorities often make choices that impact protected areas through planning, regulation, agricultural extension and public investment**. Local authorities have the opportunity and obligation to ensure that PA management represents as fully as possible the needs of local stakeholders. The Ecosystem Approach (see Chapter 2) comprises an internationally endorsed set of principles for an →*integrated management* of different land uses.

Box 7.3 Ecological corridors: A tool for connecting PAs with surrounding landscapes

'Ecological Corridors' connect PAs with adjacent areas in a coordinated management regime so migrating animals and ecological processes fare better even if land-use in neighboring land intensifies.

The Oak Forest Corridor in Colombia's Eastern Mountain Range, includes 67 municipalities in an area of ~1 million ha. The corridor comprises oak forest and moorland in a region where less than 10% of the original Andean forest remains. Inside the corridor, municipalities incorporated the unique characteristics of the forest into their development plans and collaborated with environmental organizations in sustainable production projects (Solano 2008).

Source: www.corredordeconservacion.org

SHARING THE COSTS AND BENEFITS OF CONSERVATION

Communities adjacent to PAs benefit directly from the services flowing from them. At the same time, many also bear the costs of restricted access to local resources. While most people support the existence of PAs, those in close proximity may have a more ambivalent view, especially if the implementation of PAs translates into loss of land-use rights, missed development opportunities and reduced access to life-supporting services. **A major challenge for managers is to balance the long-term, 'global' benefits of a protected area with the immediate needs of a local community.** In particular, women's livelihoods often depend on the collection of wild natural products inside protected areas.

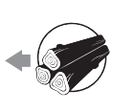
- **Nagarhole National Park** in India has around 10,000 people living inside. A study on a sample of these tribal settlements found that they relied on non-timber forest products (eg wild food, gum, fibres, medicinal plants) for an average of 28% of their total household income, reaching almost 50% in some areas (Ninan 2007).

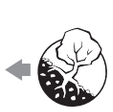
- In **Caprivi Game Park**, Namibia, sustainable harvesting techniques of palms enabled local women to supplement household incomes by selling woven palm baskets to tourists. Producers grew from 70 in the 1980s to more than 650 by the end of 2001, providing one of the few sources of income for women (WRI 2005).

Protected areas often limit certain ecosystem services, such as crop production, in order to enhance wildlife habitat and a range of regulating services, such as erosion control. While this makes sense for the wider landscape, it may have negative implications at the local level. Therefore, those who experience restrictions need alternative subsistence solutions – or sufficient monetary compensation. **Local governments and NGOs can seek to facilitate agreements between stakeholders; their knowledge of local costs and their links to higher policy levels allows them to make agreements with distant stakeholders that can benefit local ones.**

- The Banc d'Arguin National Park in Mauretania has helped secure rich fishing grounds off the coast. European fishing companies have so far captured most of the benefits, based on European payments to the national government of Mauretania. In 2006 a new fisheries partnership protocol with the European Commission specified that annually € 1 million of the financial contribution should directly serve to support the management of the park (EC 2006). Management activities are geared to marine conservation and sustainable coastal development. Lobbying from local government and NGOs were instrumental in this arrangement.

Many PAs attract tourists. This is usually considered to benefit the local community because it generates revenue. However, in some cases, conservation-related tourism rapidly changes local lifestyles and can generate largely private, unevenly distributed, benefits within communities. Policy makers can intervene by pushing for appropriate regulations. **If PAs are well-managed, both small-scale tourism and externally managed high-end tourism can benefit local stakeholders.** For example, Point Pelee National Park in Canada annually attracts over 200,000 visitors and birdwatchers (Parks Canada 2007), who bring millions of dollars of additional revenue into the local area every year (Hvenegaard et al. 1989). **Policy makers can invite capacity and market development from outside investors, but should take care about not losing options for adapting tourism to local needs** (see Chapter 5).





Box 7.4 An economic success story of developing tourism within ecological limits

The small tropical island of **Fernando de Noronha** (Brazil), a former naval base with beautiful beaches, was declared a national park in 1988. The island government ruled that the number of tourists on the island should be kept within a limit so as to maintain the island's ecological and socio-economic balance. Furthermore, only people permanently living on the island were allowed to provide tourism services. In consequence, most of the ~3000 inhabitants have a stable income from tourism, for example, more than 100 families developed small family hotels on the island.

Source: MMA 2001; IBAMA et al. 2005

A thorough understanding of costs and benefits associated with PAs can be achieved by a close examination of the flows of ecosystem services. A clear picture of the economic benefits available at a local level can help people understand the role of PAs in their livelihoods. This can help ensure that benefits areshared equitably and in some cases can aid in the development of realistic compensation mechanisms for people who have exchanged their immediate concerns for the 'greater good'.

In addition, such understanding is key to deciding which areas will be protected and how to manage them. Policy makers should consider local dependence on PAs for food, fibre and cash income because these factors contribute to access-related conflicts.

Ideally, people in buffer and transition zones should have secure incomes from eco-friendly resource-use to support PA conservation. As seen in the case of Namibia, **communities benefit if local authorities promote tourism-related private businesses** such as accommodation, souvenir shops and wildlife viewing tours. Keep in mind, however, that while these businesses can play a key role, well-targeted government or private financial support mechanisms may

Table 7.1 Costs and benefits of PAs in Namibia at local, national and global levels

Currently PAs cover 17% of Namibia's national territory. Annually 540,000 visitors come to the country for their holidays. Namibia's 400 private hunting farms and conservancies on communal land cover 14% of the territory (2004). The national benefit from tourism (US$ 335.6 million) is far higher than the management costs (US$ 39.4 million). However, the number of local tourism-related jobs within or near a PA is low. This table shows costs and benefits at different policy levels and provides data where available:

	Costs	Benefits
Global	- approximately **US$ 8 million** International transfers for PA management **Costs carried by:** - International donors	- Option/→*existence value* of biodiversity - International tourism **Beneficiaries:** - Global community - Foreign tourists, tour operators, airlines, etc.
National	- US$ 18.6 million spent on management - US$ 20.8 million spent on operational costs of tourism facilities **Costs carried by:** - Ministry of Environment and Tourism - Directorate of Parks & Wildlife Management	- Habitat value & cultural value (not quantified) - Water provision (minimal) - Tourism-related jobs (about 20,000 people) - Over 2,200 tourism-related businesses **Beneficiaries:** - Households (rural 16%, urban 20%) - Private enterprises (39%) - Government (20% in taxes)
Local	- Foregone income from agriculture (low) - Crop damage, livestock losses and damage to infrastructure due to wild animals (figure not known) **Costs carried by:** - Local communities	- Employment in PAs (1,100 people) - Accommodation near PAs (US$ 51.4 million); tour operators/guides (US$ 13 million) - Revenue from tourism inside PAs (US$ 12.9 million – min. 4% of PA revenue for local communities) **Beneficiaries:** - PA management, government - Private business in rural areas - Local communities

Source: adapted from Turpie et al. 2009

also prove necessary (see Chapters 8 and 9).
In order to develop sound policies, local authorities, civic organizations and local businesses have to collaborate – and local governments play a key role in this arena.

7.2 GETTING INVOLVED IN LOCAL CONSERVATION MANAGEMENT

Designating an area as protected does not guarantee its security. Many are under immediate or future threat – from illegal practices, legal challenges, changing national policies and climate change (Carey et al. 2000).

Strong local involvement is key to protected area success. Conservation must build on local expertise and support in order to conserve biodiversity without harming local livelihoods. There is no blueprint for implementation, but at least three options exist for local government and stakeholders to become involved:

1. Engage in co-management arrangements;
2. Set up a municipal PA;
3. Support community conserved areas.

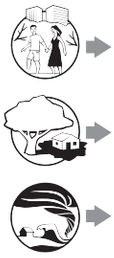
CO-MANAGEMENT WITH PA AUTHORITIES

Many PAs are owned or managed by national government, charitable trusts, communities or private individuals. **Local involvement can extend to a co-management role, even if overall control remains elsewhere.** Local governments, sector agencies and park authorities can harmonise their actions and joint-management committees or inter-agency working groups can meet regularly to discuss issues.

In the mid-term, the benefits of exchanging expertise and establishing a common agenda outweigh the obstacles of bringing stakeholders with different interests to the same table. In fact, some conservation approaches, such as the UNESCO biosphere reserve concept, explicitly foresee the collaboration of local organizations and various government agencies in developing models for sustainable local resource-use in buffer zones (www.unesco.org/mab).

MUNICIPAL PROTECTED AREAS

Today, local governments themselves designate and manage an increasing number of PAs to meet regional conservation objectives and enhance the flow of ecosystem services to local beneficiaries. For example, in the metropolitan areas of Sao Paulo (Brazil), Toronto (Canada) and Beijing (China), municipal authorities have created 'greenbelts', a combination of public parks, green spaces, and PAs with restricted access and specific rules for private land (see Chapter 4). Greenbelts are intended to improve citizens' quality of life, and influence the dynamics of urban sprawl; they secure important ecosystem services such as the regulation of air temperature and the provision of natural flood control in urban areas. This concept has also been taken up by small municipalities



Box 7.5 Key features of successful co-management

- Co-management brings together a diversity of people, with distinct strengths, from different institutions. Actors bring their own knowledge, interests, and views to the table. For this reason, **skilled facilitation is essential**.
- Co-management involves negotiation, joint decision making and power sharing. Responsibilities, benefits and management resources are shared. **Each participant expects to have influence and benefit from their involvement.**
- Co-management is a flexible process. It requires on-going review and improvement rather than a fixed set of rules. **The success of co-management depends on partnerships.**

Source: adapted from Borrini-Feyerabend et al. 2004

Box 7.6 Collaboration in the Dyfi Biosphere Reserve in Wales, UK

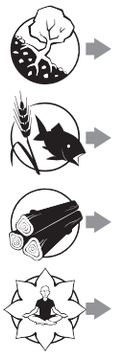
Proposals for the Dyfi Biosphere Reserve were coordinated by EcoDyfi, a local NGO with representation from local councils, farmers' organizations, the tourism industry and environmental and social NGOs. Its mandate is to promote environmentally sustainable developments within a watershed and it already had a history of several years working in the community and consequent support from a wide range of key stakeholder groups. EcoDyfi worked with the government-run conservation body, the Countryside Council for Wales, to develop plans for the reserve.

Source: www.dyfibiosphere.org.uk

Box 7.7 Protecting biodiversity in Cape Town: Multiple agencies and objectives

Some of the richest biodiversity in Southern Africa is within the city limits of Cape Town: Table Mountain National Park, 22 municipal PAs and several natural reserves serve to protect this natural heritage. They are managed by national and local authorities. A city-wide biodiversity strategy guides inter-agency collaboration. While the National Park is a key attraction for Cape Town's tourism industry, PAs in poorer neighborhoods are used for community development. They facilitate education and social work with youth by allowing people to reconnect with nature (Trzyna 2007).

with the same objectives. In the Brazilian city of Alta Floresta (population < 50,000), a greenbelt is being developed connecting forest on public land inside the urban area with private property (Irene Duarte, pers. comm. 2010).



By making small changes to regulations, local governments can enhance local benefits from PAs. For example, in Keoladeo National Park near the city of Bharatpur (India), park fees are waived for people who exercise between 5-7 am. In the heat of summer, up to one thousand 'morning walkers' take advantage of this opportunity every day (Mathur 2010).

INDIGENOUS AND COMMUNITY-BASED CONSERVATION

Some areas and their associated economic and cultural values have been conserved through the decisions and actions of indigenous peoples and/or other local communities. These areas are known as **indigenous peoples' protected areas, indigenous peoples' conserved territories or community conserved areas.** Local governments and stakeholders can support the efforts of local communities to maintain or establish indigenous or community conserved areas (ICCAs).

Community-based conservation is suitable for protecting areas where collective needs, such as protection against erosion, outweigh private needs. This kind of conservation is likely to be most successful in areas **where people's livelihoods depend on the responsible use and collective management of jointly owned resources** like fishing areas, grazing grounds or forests, or where the site has important cultural and spiritual values. **Here, conservation consists of place-specific land-use practices** that local inhabitants have developed, often over generations.

A common feature of ICCAs is stakeholders' concern for ecosystem services because their quality of life and livelihoods often directly depend on them, encouraging them to create regulations and protection measures that effectively protect key areas of

Box 7.8 Indigenous and community conserved area (ICCA)

ICCAs are natural and/or modified ecosystems containing significant biodiversity values, ecological services and cultural values, voluntarily conserved by Indigenous peoples and local communities, both sedentary and mobile, through customary laws or other effective means.

Source: www.iccaforum.org

Box 7.9 Pastoralists of the Chartang – Kushkizar Wetland, Iran

Since time-immemorial, the stewardship of the Chartang-Kushkizar wetland has been shared between the Kuhi and the Kolahli sub-tribes of the Qashqai nomadic pastoralists of southern Iran. It is a crucial stopping point in the Kuhi's yearly migration between wintering and summering grounds and provides many ecosystem benefits – water, reeds for handicrafts, medicinal plants, fish and wildlife.

Recently, the government earmarked part of the area for agricultural use. In response, the Council for Sustainable Livelihoods of the Kuhi Migratory Pastoralists have petitioned and proposed to government authorities that the wetland and surrounding rangelands become an ICCA regulated by community elders. At present, the petition is under review and has received some support from government. Major agricultural use of wetland water has been stopped.

Source: adapted from Borrini-Feyerabend et al. 2008

an ecosystem. Conservation is here **a communal effort with its own set of use rules**, eg for harvesting forest products (Hayes 2006). Members adopt and are expected to respect land and water related regulations and communities agree on sanctions for people who breach rules. **Substantial political autonomy, stable economic conditions, land tenure security and a culture of trust and collective concern are usually critical for the success of ICCAs** (Becker 2003).

Policy makers should keep in mind, however, that **different objectives and perceptions** of what constitutes successful community-based conservation makes **external support a delicate affair**. Financial support for ICCAs can have destructive effects on a community's collective capacity – influencing and altering a community's motivations (Axford et al. 2008). Also, rural societies are subject to political and economic change, and not all indigenous and local communities equally maintain appropriate ecological knowledge (Atran 2002).

That said, local governments have a role to play in supporting ICCAs, which need to be identified and assisted at a local scale. **Policy makers can play a key role** in recognizing their legitimacy, communicating their self-identified needs and supporting them **in negotiating with national government, donors and PA agencies.**

Copyright: Nigel Dudley

Tropical leaves in the Ecuadorian cloud forest ensure water capture

Box 7.10 The Shuar Protected Territory, Ecuador

In 1998, the government of Ecuador recognized constitutional collective rights for the 10,000 Shuar Arutam people and their territory of 200,000 ha. In 2004, an Assembly of Shuar members decided to create the Shuar Protected Territory (SPT). The SPT is not part of the National Protected Areas regime, it is an autonomous territory governed by the Shuar people with a local indigenous government that sustainably manages forests. The main objective of the SPT is to guarantee the survival and development of the Shuar culture as well as the conservation of their land.

Shuar community participation has been key to the implementation of an effective conservation strategy: only 8.8% of the forests in the SPT have been deforested. The SPT has allowed the Shuar people to clearly limit their territory, create a legitimized authority, and determine the rules and vision of their development model under the principles of autonomous governance based on Shuar tradition.

Source: Kingman 2007; UNDP 2010

7.3 REASONS FOR ASSESSING ECOSYSTEM SERVICES OF PROTECTED AREAS

A focus on ecosystem services helps local and conservation authorities:

1. Build political support for conservation.
2. Make informed planning and management decisions.
3. Address conservation conflicts.
4. Build alliances.
5. Raise funds for conservation.

BUILDING POLITICAL SUPPORT FOR CONSERVATION

Protected areas are best understood as far-reaching protection of the natural capital of a region – the →*assets* upon which →*human well-being* and economic development are built.

Stakeholders often are not aware that **environmental stewardship is in their economic interest**. In fact, the return on investment in PAs is often high. On a global scale, it has been estimated that every dollar invested in PAs produces close to US$ 100 in ecosystem services (Balmford et al. 2002). Although such figures are necessarily highly approximate, they give an impression of the magnitude of the return for investing in, and successfully managing, these areas (see also TEEB in National Policy, Chapter 8).

There is evidence that PAs are economically beneficial. Lake Chilwa (Malawi), for example, is a protected wetland of international importance. It has an annual fish catch worth US$ 18 million and produces more than 20% of all fish caught in Malawi (Schuyt 2005; Njaya 2009). Leuser National Park in Indonesia was estimated to be capable of generating US$ 9.5 billion →*total economic value* (TEV) between 2000-2030 from a range of ecosystem services, if under effective conservation management (Van Beukering et al. 2003).

If local policy makers focus on ecosystem services, the economic importance of a protected area becomes clear. This knowledge can help local authorities effectively garner support for conservation, especially when conflict is exacerbated by outsider interests in natural resources – like logging, mining or industrial fishing.

To gain support at the regional level, local policy makers should ask: Which regional benefits will we miss out on if we do not start caring for this area now? This can also work for less tangible benefits, such as the appreciation of wolves as a charismatic species. (TEEBcase Local value of wolves beyond a protected area, USA)

Box 7.11 Flood regulation: Political support for a protected wetland in New Zealand

The Whangamarino wetland is a highly biodiverse peatland in New Zealand. It is home to many rare plant communities, 60% of which are indigenous. Several are endangered, rare or vulnerable.

The case for protecting the wetland was furthered by highlighting its role in flood control and sediment trapping. Its annual benefits are estimated at US$ 601,037 (2003). In flood years, this estimate is much higher – US$ 4 million in 1998. The Department of Conservation concluded in 2007, "If Whangamarino wetland didn't exist, the regional council would be faced with constructing stopbanks along the lower course of the river at a cost of many millions of dollars."

Source: Department of Conservation 2007

MAKING INFORMED PLANNING AND MANAGEMENT DECISIONS

Policy makers are faced with many questions when designating a PA. Where should it be, and what size? What restrictions should it have? How should it be managed? What activities should be permitted? How will communities be affected? **Asking the right questions is crucial to effectively creating and managing a PA.**

Assessment of ecosystem services can help to decide where to locate protected areas, their size, shape, management model etc. Total evaluation studies for a range of alternative management models can compare and balance different options within regional planning processes. In general, an **ecosystem services assessment** connects ecological knowledge (how big does the area need to be for an ecosystem to function properly?) with economic and political concerns (how will the PA alter the community's economic and social prospects?). For example, if policy makers are considering instituting an antelope hunting ban, this assessment model **can help them get a clear picture of all the relevant issues** – such as, how will the ban affect the larger ecosystem? The antelope population? Peoples' meat demands? Tourism income? If carried out well, and in a partic ipatory manner, an ecosystem services assessment provides a holistic view of a community's concerns and enables a healthy, participatory, decision-making process.

There are different kinds of exercises for assessing the make-up and distribution of ecosystem services (See Pabon-Zamora in 'for further information' section). For example:

- A **Cost-Benefit Analysis** can determine which PA regulations have the potential for the most balanced distribution of ecosystem benefits to stakeholders.
- Using participatory planning methods, stakeholders can **assign different 'weightings' to different ecosystem services** to be considered in the overall decision.
- Policy makers can **evaluate a PA's potential to generate revenue** under effective management.

Such exercises are especially productive if the PA is considered within the context of wider regional planning exercises (see also TEEBcase Ecosystem Services for PA network planning, Solomon Islands).

Box 7.12 Hazard protection in Switzerland: Using an ecosystem services assessment for conservation planning

For 150 years, a proportion of Swiss forests have been managed to control avalanches, landslides and rock-falls, especially in the Alps (Brändli and Gerold 2001). Some 17% of Swiss forests are managed for hazard protection, usually on a local scale. Support for these measures, and help in identifying specific locations, is strengthened by calculations projecting that these 'protection forests' provide services estimated at US$ 2-3.5 billion annually (ISDR 2004).

While conservation priorities are necessarily high in areas where unique biodiversity is under threat, some level of compromise in less-threatened areas can dramatically benefit people's quality of life and their local development outlook. (See also Chapter 6 on spatial planning tools).

Box 7.13 Protected area zoning in the Mbaracayu Biosphere Reserve, Paraguay

This reserve, once 90% forest, is now highly fragmented. It supports large-scale cattle ranching and soybean production as well as small-scale farming, hunting and foraging by indigenous Ache people. When looking for solutions for this fragmentation, policy makers mapped cost and benefits and concluded that linking two large forest patches with one wildlife corridor would provide more net benefits than two alternative corridor options.

The study identified and assessed five ecosystem services provided by the Mbaracayu Biosphere Reserve in order to determine those areas where the benefits from restricting access would outweigh the costs of foregone benefits from not extracting resources. These were: Sustainable bushmeat harvest, sustainable timber harvest, pharmaceutical bioprospecting, existence value (→*intrinsic value* of unspoiled wilderness), carbon storage.

To calculate conservation benefits in different parts of the reserve, the study determined two things: (i) Who would benefit; (ii) The value of each ecosystem service – per forest parcel, across six forest types.

How ecosystem services were calculated:

- Bushmeat is not traded so it has no market price. Its value was estimated by multiplying the local price of store-bought beef (US$ 1.44/kg) by expected bushmeat production for each forest hectare, from 12 wild game species.
- Market prices of sixteen economically important tree species in the reserve were used to estimate an average value of marketable timber (US$ 6.87/tree) – this was combined with a sustainable harvest rate of four trees per forest hectare).
- The bioprospecting value was calculated based on literature on drug companies' willingness to pay for potentially marketable drugs derived from endemic forest species.
- Existence value was conservatively estimated at US$ 5/hectare, based literature on the willingness to pay for tropical forest preservation.
- Carbon storage value was calculated based on estimates of biomass per forest parcel and a conservative CO_2 emissions-trading market price of US$ 2.50.

Localizing costs and benefits allowed for interesting insights:

- Costs and benefits of forest conservation varied considerably across a relatively small landscape, implying that some zoning options would pursue conservation at far lower costs than others.
- When only bioprospecting, bushmeat, timber were included in the analyses, few parcels passed the cost-benefit test for conservation.
- When carbon values were added (the highest value service/ha), benefits exceeded →*opportunity costs* for 98% of the forests.

Certainly these results have to be considered with care – some costs have not been calculated (conservation management costs, for example) and opportunity costs are based on assumptions about future development of the region which is difficult to anticipate. However, what the study demonstrates is that a cost-benefit map is a highly useful tool for discussing options with stakeholders and authorities.

Source: adapted from Naidoo and Ricketts 2006; Gross 2006

ADDRESSING CONSERVATION CONFLICTS

Protected areas can both solve conflicts and create conflicts. Local communities and indigenous peoples are increasingly calling for new protected areas to address what they perceive as threats to traditional lands and water from extractive industries and conversion. 'Peace parks' are now a recognized way of addressing cross-border conflicts and tensions. Conversely, PAs can themselves cause conflicts, particularly over access and resources.

Evaluation of ecosystem services can make a case for or against a PA to the people who have to legislate or pay for it, and who have to answer to their local communities. Experience shows that the most acute and intractable conflicts around PAs come when an outside power imposes management on people who are already living there. If costs and benefits are discussed openly so people can see exactly what they will gain and lose, there is far more basis for sound negotiation.

A proper understanding of what ecosystem services are available from a PA and who has access to them can therefore be a valuable tool in addressing conflicts both inside and outside the PA.

Regulation and management decisions can alter the availability of ecosystem services with consequences for people, often through loss of access to what had hitherto been free resources such as fuelwood and food. Such consequences are not captured by broad social →*indicators*, like 'income per capita'. **Poor people often suffer most from restricted access to a PA** because they rely on natural resources for survival. If new livelihood opportunities are not created, restrictive regulations are not only socially unjust, but often ecologically ineffective, because people may be forced to pursue their former practices illegally (see box 7.14). An ecosystem services assessment can make all the costs and benefits visible and thus assist in both the negotiation process to determine just and workable regulations and, if necessary, the creation of fair compensation mechanisms. For example in Moyabamba, Peru, inhabitants of a municipal PA are paid for restricting their activities in the watershed (TEEBcase Compensation scheme for upstream farmers in a municipal PA, Peru).

One way of addressing →*trade-offs* between different users is through compensation payments although this option is not always available. Compensation might be a fairly minimum value to encourage adherence to a restriction (like not collecting firewood) or a more substantial sum reflecting the full value of a PA's benefits to society. Those offering payments usually shape the terms of compensation. For this reason, **a monetized ecosystem services model is useful to policy makers; it can be a tool for addressing unequal distribution of costs and benefits in communities**. However, the monetary value of ecosystem services is not the only negotiation tool. **Rights also play a key role** and protected area managers are increasingly negotiating rights to →*sustainable use* of various natural resources within protected areas with local communities.

Ecosystem services →*valuation* can also be a **helpful tool in combating corruption**. In countries with weak governance and high levels of corruption, attempts to use PAs to strengthen local communities and reduce inequality are often blocked by the interests of a rich, powerful minority. By placing a value on ecosystem services, everyone can know exactly what values are being provided and to whom. While transparency about the distribution of costs and benefits cannot solve corruption-related problems, it can make law-breaking more difficult to cover up.

BUILDING ALLIANCES

Understanding and emphazising the importance of the ecosystem services of a natural ecosystem can **help create management partnerships in a PA**, either due to direct self-interest or because stakeholders become convinced of the area's wider, inherent values.

Importantly, **PAs are seldom an exclusively local issue** – national agencies, scientists and conservationists from around the world have an interest in, and feel entitled to, involvement in conservation management. While each has their own agenda, dynamics and resources, these actors can be powerful allies.

Box 7.14 Who benefits from Giant Panda tourism in Wolong?

Wolong Biosphere Reserve, one of China's most famous PAs, is home to the giant panda. In 2008, there were more than 4,500 people living inside the reserve, most of them farmers. Their activities (logging for fuelwood, agriculture, plant-collection, ranching) have significantly degraded and fragmented panda habitat within the reserve. Since 2002, →*ecotourism* has been promoted in Wolong as a source for financing conservation and additional income for park inhabitants.

A study of stakeholders (restaurant staff, souvenir-sellers, infrastructure/construction workers) revealed that those outside the park had the largest share in tourism-related income. What was significant were the differences between groups of farmers living inside the PA. Those living close to roads had a larger share in tourism-related income, while those living in the panda habitat of the forest had no access to the market of tourism trelated services and products and therefore had to continue to rely on agriculture for their livelihoods.

In order to protect the Giant Panda, it would make sense for park policy making to involve those farmers who, for want of alternatives, continue to threaten panda habitat.

Source: adapted from He et al. 2008

RAISING FUNDS FOR CONSERVATION

Accurate and comprehensive assessments can help to identify and generate the funding necessary for effective management of PAs in the following ways:

- Attracting donor funding
- Payment for environmental services
- Bioprospecting
- Carbon sales
- Wildlife viewing and wilderness experience sales

Attracting donor funding: Many donor countries and agencies link aid funding, even for environmental issues, with →*poverty* alleviation. Most agencies broadly interpret 'poverty' to include, beyond monetary value, physical health and general well-being, factors which the ecosystem services model also consider. However, demonstrating the economic benefits of a project is often a major factor in attracting funding. For example, the World Bank and the UN Global Environment Facility both require annual assessments of management effectiveness from the PAs they support. A clearly outlined report on ecosystem service flows can make a strong argument for the essential nature of their support and

Box 7.15 Management of Kaya forests in Kenya: Positive alliances

In Kenya, coastal Kaya forests are under severe pressure from exploitation and conversion. They are sacred sites for local people and of interest to conservationists, who value them as irreplaceable relics of a once-extensive East African coastal forest.

Both socio-economic and valuation studies demonstrated the dependence of local communities on the forests for fuelwood, food, medicinal herbs and building materials. These studies also revealed the unsustainable nature of this exploitation. Local communities approached the National Museum of Kenya for management and conservation assistance, in hopes that they might develop sustainable utilization of the forests' resources (Mhando Nyangila 2006).

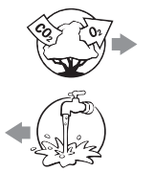
As a result, new sources of revenue were created. The Kaya Kinondo Ecotourism Project uses local guides to take visitors through the forests. In 2001 communities around Arabuko Sokoke Forest earned US$ 37,000 from guiding, beekeeping and butterfly farming (Gachanja and Kanyanya 2004).

for new or continued funding.

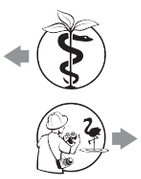
Payment for environmental services: Evaluating benefits can attract funds from those using the PA's ecosystem services. For example, Coca Cola outside Bogotá in Colombia pays a fee to maintain natural páramo vegetation in Chingaza National Park above its bottling factory because of the clean water it provides. Similarly, in Ecuador, Quito's water supply company pays residents in two national parks to maintain the forest cover in order maintain water purity and reduce treatment costs (Pagiola et al. 2002; Postel and Thompson 2005). These schemes are often coordinated by local authorities (see Chapter 8).

Bioprospecting: Increasingly, PAs are selling the rights to benefits from biodiversity, such as potential pharmaceutical products. In Costa Rica, the National Institute for Biodiversity (INBio) has signed agreements with 19 industry bodies and 18 academic institutions to prospect in PAs in return for biodiversity conservation funding. In the United States, the bacterium *Thermus aquaticus*, collected from a hot spring in Yellowstone National Park, is useful in clinical testing, forensics, cancer research and in helping to detect the virus causing AIDS. Despite the major profits eventually gained by the health industry from developments linked to the use of this bacterium, it did not initially result in any direct benefits for the National Park Service and took substantial lobbying to secure any payments (Stolton and Dudley 2009).

Carbon sales: As the carbon economy continues to expand, both voluntary and official offset schemes are considering PAs as delivery mechanisms. Forest PAs are often linked with possible REDD schemes (although these schemes are still being developed). Calculations need to be precise, particularly with respect to sequestration potential and measurement, but there is potential for substantial funding. For example, research by consultants working for The Nature Conservancy calculated that PAs in Bolivia, Mexico and Venezuela contain around 25 million ha of forest, storing over 4 billion tonnes of carbon, estimated to be worth US$ 39 and US$ 87 billion in terms of global damage costs avoided (Emerton and Pabon-Zamora 2009).



Wildlife viewing and wilderness experience sales: Some PAs have the opportunity to charge visitors. Serengeti National Park in Tanzania earns several million dollars a year and fees charged for mountain gorilla viewing trips at Bwindi Impenetrable Forest National Park in Uganda generate the majority of funds to support the Uganda Wildlife Authority. Funds can also be generated from private or charitable-owned PAs. In the Lupande Game Management Area, adjacent to the South Luangwa National Park (Zambia), two hunting concessions earn annual revenues of US$ 230,000 for the 50,000 residents, distributed both in cash to the local community and to village projects such as schools (Child and Dalal-Clayton 2004).



Box 7.16 Raising park entrance fees in Komodo National Park, Indonesia

Komodo, home to the Komodo dragon, attracts a large number of foreign and national visitors.

A study assessed people's willingness to pay higher entrance fees (in 1996 < US$ 1). Over 500 visitors were asked whether they would still come if entrance fees were increased to US$ 4, $ 8, $ 16 or $ 32. The study showed that income could be maximized if visitors fees were set at around US$ 13. However, the increase in fees would reduce visitor numbers. These 'lost' visitors would not spend on tourism-related services such as accommodation and tour guides, so gains in entrance fees would be offset by losses for the local economy.

Taking these regional economic effects into account, the study suggested that a moderate increase to around US$ 5 would be a good strategy for increasing park income without losing a significant number of tourists. Further, having a differentiated pricing strategy (charging foreign visitors more than national visitors), and providing clear information on how entrance fees are being utilised seem to increase park income and acceptance of higher fees.

Source: adapted from Walpole et al. 2001

7.4 ACTION POINTS

Economic assessments of PAs can secure urgently required political backing for conservation. But valuation is not a panacea. Some important values that these areas protect are difficult to capture through economic analysis, including existence rights of species, sacred values of particular places to faith groups or the health and recreational values of living inside or near a healthy natural landscape.

Using the broader ecosystem services perspective – (see Chapter 10) is a powerful approach to inform management planning, to bring different motivations for conservation to the same table and also to shed light on who carries which burdens in consequence of access restrictions.

As initial action points for local governments and PA authorities we suggest:

- Check the natural and social linkages between your PAs and the surrounding landscapes.
- Appraise the local flow of ecosystem services from the PA to the inhabitants of your municipality. Identify your greatest local needs in relation to the PAs. Search for hidden or as yet unrecognized and underdeveloped opportunities which the PAs present to your municipality.
- Assess the desirability and options for being more closely involved in PA management, possibly through some form of co-management.
- Actively communicate the ecosystem services flows from your PA to close and to distant beneficiaries. This will enhance political backing, build alliances and secure funding.
- Identify the beneficiaries of ecosystem services as well as who carries the costs, as a first step to tackle conservation-related conflicts.

FOR FURTHER INFORMATION

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The LAB Guide Book: A Practical Guide to Local Government Biodiversity Management by ICLEI, IUCN and SCBD (forthcoming) URL: www.iclei.org/index.php?id=10019. The guide provides advice for planning and managing local biodiversity drawing on the experiences of 21 local authorities. It covers the topics biodiversity and climate change, mainstreaming and managing biodiversity, legislative frameworks and implementation mechanisms.

8 PAYMENTS FOR ECOSYSTEM SERVICES AND CONSERVATION BANKING

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Content of this chapter

Payments for ecosystem services (PES) and conservation banking are both relatively new instruments for conservation. This chapter outlines the challenges policy makers face when using payments for ecosystem services and conservation banking to promote sustainable natural resource management. It explains why PES is relevant to local policy makers (8.1) and offers a description and definition of PES and outlines issues related to the effective design and implementation of PES (8.2). The sub-chapter on conservation banking (8.3) starts with a description of offsetting and a discussion of its opportunities and limitations. It then turns to conservation banking, addressing its advantages and the pre-conditions for conservation banking to be successful.

Key Messages

- **Finding balance may be possible.** When the actions of one stakeholder group are carried out at the cost of another, payments for ecosystem services (PES) can compensate for lost ecosystem-related benefits.
- **Make sure everyone's on the guest list.** A successful PES scheme is socially, ecologically and economically appropriate. It should incorporate transparent, credible governance; appropriate incentive-based structures; and effective monitoring and enforcement.
- **Static schemes don't help in dynamic settings.** Sustainable PES schemes are adaptable to changing ecological and economic conditions.
- **Some doors may already be open.** Significant opportunities for local governments may arise from REDD and REDD-Plus schemes.
- **It's possible to take the pressure off.** Well-designed conservation banking can alleviate development-related pressures on biodiversity at a regional level.
- **If the shoe doesn't fit, don't wear it.** Conservation banking and offsetting are not always appropriate. To be viable, they must meet several preconditions.
- **You might find out you're on the same team.** Defending biodiversity need not create economic adversity. Offsetting and conservation banking systems may be flexible, cost-effective instruments for mitigating tension between development and biodiversity conservation.

"I would feel more optimistic about a bright future for man if he spent less time proving that he can outwit Nature and more time tasting her sweetness and respecting her seniority."

Elwyn Brooks White 1977

8.1 WHAT PES IS AND HOW IT WORKS

PES is an incentive-based approach to protect ecosystem services by compensating landowners or managers who adopt practices that are favorable to an ecosystem. Simply put, those who use →*ecosystem services* pay those who provide them – and when providers are compensated, conservation becomes more attractive. PES can focus on a variety of services, from water flows to carbon sequestration and storage, →*biodiversity* protection, landscape beauty, salinity control and soil erosion prevention. →*Stakeholders* are encouraged through incentives to conserve or engage in less environmentally-damaging activities on a voluntary basis.

RELEVANCE OF PES TO LOCAL POLICY MAKERS

Local governments can effectively initiate both small and large-scale PES schemes, and local authorities play a key role from inception onwards – they can help with design, implementation, policy-enforcement and fundraising.

PES schemes are of interest to local policy makers because they:

- **aid in biodiversity conservation** and sustainable ecosystem service provision (where conventional regulatory approaches have failed);
- **provide revenue and employment** opportunities at the local level;
- **finance and mobilize sustainable conservation initiatives** that support the economic development of rural populations;

- ensure that →***ecosystem*** **benefits are compensated by those exploiting them**;
- create **opportunities for local governments to benefit from REDD-Plus**, projects which reduce Emissions from Deforestation and Forest Degradation and enhance carbon stocks. Significant potential for these projects exists from various national and international donors. Carbon mitigation potential is estimated at € 23.6 bilion (~ US$ 33 billion) annually (Point Carbon 2007);
- can help **alleviate** →***poverty***;
- can be **combined with other programs** like →*eco-labeling*, local subsidies and →*ecotourism* to strengthen such programs.

PES schemes, however have a number of preconditions. Policy makers should keep in mind that any social hurdles, such as low levels of →*institutional* and legal capacity, may result in failure of PES schemes. PES programs require a great deal of cooperation that depends on state and/or community engagement. Local confidence often has to be won and small stakeholders often need increased bargaining power with more powerful stakeholders.

DEFINING PES

Direct private payments are transactions that take place between private service providers and users. Typically, they involve firms, conservation NGOs or households that benefit directly from certain environmental services. Stakeholders are motivated to conserve for a diversity of reasons – from 'pure profit' (for example, a mineral water company that depends on water quality and availability) to conservation concern. Payments may also be made by stake-holders who want to manage risk (avoid running short of a →*resource* they rely on) or to pre-empt anticipated regulations. For example, firms are increasingly participating in carbon offsetting because of climate change concerns. These are often voluntary and initiated without regulatory incentives or requirements. Direct private payment schemes tend to work well because it is in the buyer's interest to secure and monitor the service. Local policy makers can consider initiating and supporting direct private payment arrangements.

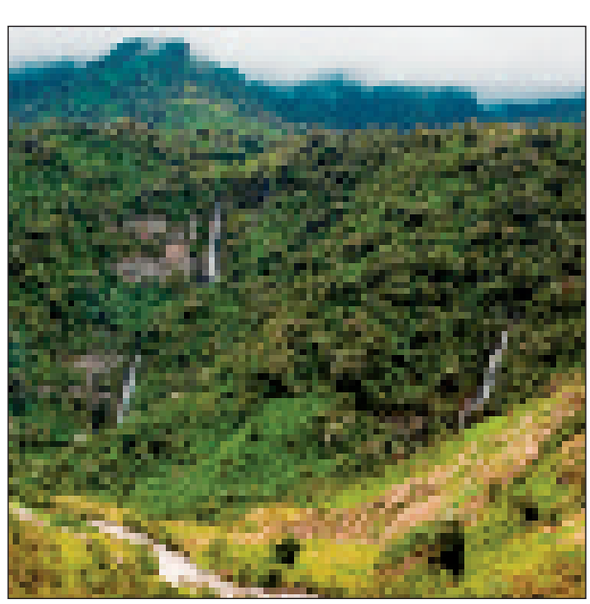
Direct public and government payments are government-financed schemes where the government pays service providers on behalf of their constituents. Governments participate in these schemes to secure ecosystem services:

- where the service is a →'*public good*' with many beneficiaries (like water provision);
- where the beneficiaries are difficult to identify;
- if an asset such as an endangered species will be lost if government does not act.

Communities profit from payments for ecosystem services that are a public good by receiving income from such payments and by shifting to less environmentally damaging economic activities.

WHAT KIND OF PES SCHEMES ARE THERE?

At present, most PES schemes protect **watershed services** (sediment and salinity control and flow regulation, for example). These schemes benefit easily identifiable local and regional users such as households, municipalities, industry, hydroelectric facilities, farmers, fisherfolk and irrigation services. Often, different users experience different benefits from the same area. The farmer, the fisher and the mineral water company, for example, all depend on a watershed for different services. These stakeholders' interests may intersect or conflict, but there is usually room for collaboration.



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Box 8.1 PES as private and public payments

Direct private payments in Japan: The recharge ability of the Shirakawa river is forecasted to decrease by 6.2% between 2007 and 2024 due to a combination of reduced rice production and increased groundwater extraction. In 2003, Kumamoto Technology Centre, extracting groundwater for manufacturing purposes, developed an agreement with local farmers to re-use the water to flood farmers' fields between crop cultivation. This facilitates the recharging of groundwater, which the company uses (Payments for ground water recharge, Japan, TEEBcase by Hayashi and Nishimiya).

Direct public payments in China: The 'Paddy to Dryland' program, initiated in 2005, involves direct payments from a Beijing municipality to farmers in the upper watersheds of reservoirs. These payments provide financial incentives to convert water-intensive rice paddies to corn and other low water-use dryland crops. Payments were originally set at approximately US$ 980/ha and have been increased to approximately US$ 1,200/ha in 2008 (all values calculated using 2010 exchange rates). To date, more than 5,600 ha of paddy fields have been enrolled in the program (Converting water-intensive paddy to dryland crops, China, TEEBcase based on Bennett).

While watershed services schemes often benefit stakeholders at more local levels, **carbon markets** mostly have global beneficiaries. Potential buyers include local, regional and national governments, international organizations, national and international carbon funds, conservationists, and firms. Carbon sequestration schemes can include agroforestry, reforestation and REDD programs. Markets for REDD have significant funding potential. International donor agency funding for REDD projects is strong and growing, providing a unique opportunity – the linking of local PES schemes with international conservation strategies.

Biodiversity conservation services include habitat, species and genetic resource protection. These services benefit local, national and global communities. Potential buyers include international and national NGOs. Increasingly, governments act as buyers as well. For example, agro-environmental programs in Europe target conservation of endangered species. **Landscape services** encompass a variety of services such as wildlife conservation and the protection of landscape beauty. They also benefit a variety of stakeholders, from the local to the global level. Potential buyers include municipalities, park authorities, tourism operators, rafting companies and hospitality-related businesses. These markets are similar to biodiversity markets but target services that depend on access to scenic beauty and wildlife.

Determining which ecosystem services are targeted varies among PES schemes. In certain cases, the protection of a single service protects several others. Often, if a forest is protected for carbon sequestration, an area's beauty, biodiversity and watershed services are also protected (a '**bundling of ecosystem services**').

FINANCING PES SCHEMES

PES schemes succeed only if payments can be sustained over the long-term. Their success depends on funding availability – from implementation and operation to the cost of program maintenance, including continued payments to service providers.

Often, external funding is required to establish a PES scheme. External funds can be raised through contributions from international organizations such as the World Bank and the Global Environment Facility, or from subsidies from national governments with conservation mandates. Further financial support can be raised by earmarking revenues, collecting taxes, direct voluntary payments from beneficiaries, trust funds, user fees and charges and public-private partnerships. These direct payment mechanisms require that beneficiaries are convinced of program benefits. Local governments are advised to explore various financing solutions, rather than relying solely on external funding. To ensure a program's long-term sustainability, a PES scheme can be linked with other programs and partnerships (such as international carbon markets, or public-private partnerships).

Box 8.2 Cases from around the globe: different PES initiatives

Hydrological services: In China, the NGO Shan Shui Conservation Centre initiated a fresh-water conservation program in 2007 in response to over-harvesting of community forests and the use of chemical fertilizers in farming (in Pingwu County, Sichuan Province). These village practices threatened both water quantity and quality downstream. The NGO, in cooperation with local government, designed a program for lending money generated through water fees in Pingwu city to the village community. Villagers were given loans and provided training for new, profitable, skill-sets (such as bee keeping and techniques for converting animal waste to fertilizer and domestic biogas). (Payments for fresh water conservation in China, TEEBcase by Lu Zhi).

Biodiversity protection: In Rhode Island (United States) the practice of harvesting hay twice a year has been identified as a key reason for a 40 percent drop in the bobolink population – because the bird's nesting season coincides with the hay harvest. The bobolink project was created, an initiative that raises money through voluntary contributions. These contributions subsidize farmers for the cost of delaying their first harvest – giving the birds time to nest (Conserving Bobolink through voluntary payments, Rhode Island, TEEBcase based on Stephen Swallow et al.).

Carbon sequestration: Farmers who participate in the Scolel Té program in Chiapas (Mexico) exchange responsible farming and reforestation practices for carbon offset payments. They receive financial incentives through the sale of voluntary emission reduction credits to private individuals and firms (Carbon offsets for sustainable land use, Mexico, TEEBcase by Alexa Morrison).

Landscape beauty: The Bunaken Marine Park in North Sulawesi, Indonesia, is located in the Coral Triangle. The park contains nine fishing villages that were engaged in environmentally destructive fishing practices. Through a seven year process, central and local stakeholders established the 'Council for the Park Governance,' which comprises park authorities, local government, local businesses and community leaders. The council re-zoned the marine park and established a dive fee and a park entrance fee in 2000. Park communities also agreed to acknowledge rezoning and participate in a park patrol system. A portion of the fees covers the costs of increased management effectiveness and administration. In addition, it supports economic empowerment (village infrastructure and microcredit schemes). As a result, the reef and fish populations are improving and the community is benefiting (Revenue sharing from marine park benefits communities' livelihood and conservation, Indonesia).

Bundled services: In 2004, the Mexican government launched CABSA, a program aimed at developing markets for carbon capture and biodiversity in order to establish and improve agroforestry systems and complement existing PES schemes for hydrological services. CABSA supports reforestation activities and land-use change in Mexico by linking them to national and international carbon capture and biodiversity programs (Bundling of ecosystem services in agroforestry, Mexico. TEEBcase based on Kosoy et al.).

Box 8.3 Financing PES programs through water funds

The Quito water fund in Ecuador (also known as FONAG) is a sustainable finance mechanism that allows for long-term protection of natural ecosystems and the provision of important ecosystem services. The watershed in Quito supplies around 80% of fresh water. Water users pay into the funds in exchange for the fresh clean water that they receive. The fund in turn pays for forest conservation along rivers, streams and lakes and also funds community-wide reforestation projects to ensure the flow of safe drinking water. FONAG has served as a model for other water funds across the region. PES programs are financed through water funds in some municipalities of Columbia, Peru and Brazil as well.

Source: Water fund for catchment management, Ecuador. TEEBcase by Veronica Arias, Silvia Benitez and Rebecca Goldman

Table 8.1 Schemes for financing PES programs

Type of scheme	Location	How it functions
Voluntary contribution	Mexico (Coatapec Muncipality Veracruz)	Domestic and commercial users may voluntarily contribute (Mex$ 1) on their water bill to finance watershed conservation, to recognize the link between deforestation and water scarcity (Voluntary user contributions for watershed protection, Mexico. TEEBcase based on Porras et al.).
Monthly salary contribution	China (Xinjian Auto-nomous Region)	In China, the Forest Ecological Benefit Compensation Fund was set up to provide →*economic incentives* to organizations, collectives and individuals who manage key protection and special-use forests. Local and provincial governments are encouraged to provide matching funding. The Xinjian Autonomous region raises the funds through wage deductions from the monthly salaries of employees (PES scheme funded through monthly salary contributions, China. TEEBcase based on Xiaoyun et al.).
Annual fee	Indonesia (North Sumatran district gov-ernment)	PT INALUM, an aluminum smelter and hydroelectric producer, pays an annual fee to the North Sumatran district government. The fee covers investment in the reha-bilitation of critical lands in five districts within the catchment areas of the Lake Toba – where the company draws its water for hydropower generation (Critical land rehabili-tation through annual industrial user fee, Indonesia. TEEBcase based on Suyonto et al).
Endowment fund	Brazil	The program Bolsa floresta rewards traditional communities for their commitment to stop deforestation. The funds are generated by the interest on a core fund first established with contributions from Amazonas Government and Bradesco Bank (Financing forest conservation through grant funds, Brazil. TEEBcase mainly based on FAS).
Share of water charge	Japan (Aichi Prefecture and others)	Citizens pay the fee of JPY 1 per m^3 of water usage and the city setup the 'Toyota city tap water source conservation fund' (Tap water fee for forest management, Japan, TEEBcase based on Hayashi and Nishimiya).
Watershed protection fee from industry	South China (Xingguo County)	The 'Household Responsibility' system requires that industry pays a share of their sales revenue to support tree-planting and management for soil conservation (chemical 3%; metallurgy 0.5%; coal, 0.1 Yuan/ton produced; hydropower, 0.001 Yuan/kWh) (Industries share sales revenue for watershed protection, China, TEEBcase based on Bennett).
Certificate for environmental services	Costa Rica	Individuals or organizations purchase certificates to pay for environmental services (1 certificate = 1 ha of forest set aside for conservation). Buyers can specify how they would like their funds invested or let the National Forestry Finance Fund decide. Individuals can deduct their contribution from their gross income tax (Certificate for environmental services, Costa Rica. TEEBcase based on Russo and Candella).
Ecological sales tax	Brazil	Funds raised through sales tax are allocated by ICMS Ecológico (a common name for initiatives launched by several Brazilian states) to municipalities depending on their support and maintenance of protected areas or their level of municipal sanitation infrastructure (Financing conservation through sales tax, Brazil. TEEBcase based on Ring).

8.2 DESIGNING PES SCHEMES

When designing PES initiatives, policy makers are faced with several important considerations:

- the form of payments and how to disperse them;
- which services to pay for – and who to pay;
- the size of the payment;
- how to evaluate the program's cost-effectiveness and effectiveness;
- the role of intermediaries;
- whether secure tenure rights are necessary;
- how compliance with the program's requirements will be monitored and enforced;
- whether PES should be linked to poverty alleviation.

ADDRESSING KEY ISSUES

How are payments made and dispersed?

Program designers can determine whether payments will be made in kind, in cash, or a combination of the two. Whether to choose cash or in-kind payments is entirely context-specific, as each has its own advantages and limitations.

Cash payments offer considerable flexibility, as well as financial autonomy for participants. In-kind payments may take several forms such as loan waivers, access to finances, provision of inputs for agriculture, the provision of drinking water facilities and access to micro-credit. In some cases, in-kind payments are both more effective and more favored by participants than cash. Payments made in the form of agricultural input or credit-access may be of great benefit if these markets are limited or non-existent, for example. When an ecosystem service requires community-level →*management* in order to regulate an even and fair distribution of benefits, payments in the form of social services (such as health care and education) may be preferable to cash.

Once the form of payment has been determined, a decision has to be made – whether payments should be 'one-off' or be made in periodic installments. While investments in PES schemes are immediate, environmental benefits often arise later and take place over the long-term. Although participating landowners may experience immediate income losses, they may eventually experience high-returns. If this is the case, 'one-off' payments may be sufficient. However, if the long-term returns of land-use changes are not sufficient, continuous payments may be necessary. In some circumstances, a combination of 'one-off' and continuous payments may be most effective (see Box 8.10).

Who gets paid for what?

In some developing countries, land is often collectively owned with rights to common access for local community members. In this situation, an important issue

Box 8.4 PES Benefits from in-kind payments for farmers and communities

Colombia: In Cuencas Andinas, a municipality initiated a PES scheme to reduce nutrient loads in Fuquene Lake. Payments were made in-kind in the form of provision of inputs (such as farm tools) to promote and implement improvements such as a transition to organic fertilizers. Farmers in the municipality also benefited in another way – funds from the PES scheme served as a guarantee (for 10% of the debt) to assist them in securing loans (Reducing nutrient loads through providing debt-guarantees, Columbia. TEEBcase by Marcela Munoz).

India: The Biorights Program in East Kolkatta is an innovative financial mechanism that provides micro-credits to local communities in return for active involvement in conservation and restoration of wetlands. The micro-credits are converted into definitive payments upon successful delivery of conservation services at the end of a contracting period. The global and local stakeholders pay local communities to provide ecosystem services (Conserving wetlands through microfinance programs, India. TEEBcase based on Dipayan).

to consider is whether payments should be made to individuals, communities or to community representatives. For example, in Mexico land was redistributed among organized groups of peasants (called 'ejidos') as part of agrarian reforms. While individuals have land rights, land is community-owned, so authorities decided, rather than paying individuals, to pay representatives of the 'ejidos' who chose how to distribute and use the PES funds.

Because the aim of PES is to deliver a well-defined commodity, both a careful identification of ecosystem services and consideration of the degree to which service provisions are measurable, determines whether payments can be made directly or require proxies (such as particular land-use requirements). Forest protection schemes, for example, have clearly measurable benefits for carbon sequestration, but not necessarily for biodiversity. When determining who gets paid for which service, payments can be made directly for carbon sequestration. Payments for biodiversity may be made through a proxy – such as biodiversity-friendly forestry practices or the rehabilitation of degraded areas.

A related issue is to consider whether payments should be based on adherence to certain measures or on obtaining specific results – whether they will be 'effort' or 'performance' based. In Indonesia, a community group that performs soil and water conservation practices (River Care) is paid according to sediment load reduction (from US$ 250 for reductions of less than 10% to US$ 1,000 for a reduction of 30% or more) (Outcome based payments for improved water quality, Indonesia, TEEBcase). Measuring performance, however, is not always possible. In such cases, easy to monitor substitutes may be available such as afforested or undistributed area.

How much should participants be paid?

To ensure that providers participate, incentives need to compensate for →*opportunity costs* – what participants would expect to make if they engaged in other land-use practices (such as agriculture, animal husbandry or construction). In addition, further costs of program participation, such as administrative costs for providers, must be covered by the payments. Given that conservation budgets are limited, payments that exceed costs mean that fewer providers can take part in the scheme. This results in less benefit.

When participants provide equally, local governments can pay all providers the same amount. When benefits differ, however, and funds are not sufficient to cover the costs of incentives to all participating providers, governments may examine the feasibility of paying more to those who provide more, prioritizing projects with the greatest benefits (Boxes 8.5 and 8.9). Accounting for both opportunity costs and the quality of the environmental service delivered may lead to the inclusion of more environmental services within a given conservation budget.

Evaluating effectiveness and cost-effectiveness of PES programs

Evaluation of a PES program ensures that environmental services are actually provided and that financial resources for PES are not wasted. The effectiveness of a PES scheme can be measured by its outputs. It is effective if the result of implementation is an increase in ecosystem services or a halt in ecosystem degradation. This is not always the case, especially if the effect of measures on intended outputs is not well-known (Box 8.6). Therefore, monitoring results is important.

Box 8.5 Determining payment size

Mexico: Mexico faces both high deforestation and severe water scarcity. The Payment for Hydrological Environmental Services Program was designed to respond to these problems. It is designed as a two-tiered fixed-price program. Cloud forest comprised the upper tier and non-cloud forest the other tier, because cloud forests provide higher benefits than other forest due to their important role in capturing water from fog in the dry season. To reflect these differences in benefits, it was determined that participants would be paid Mex$ 400/ha (US$ 36.40) for cloud forests and Mex$ 300/ha (US$ 27.30) for other forests.

Source: Munoz-Pina et al. 2005

Box 8.6 Implementing a PES scheme does not guarantee program effectiveness

The Netherlands: Roughly 20% of farmland in the European Union is regulated by agri-environmental schemes aimed at counteracting the negative impacts of modern agriculture on the environment. A study of agricultural land in the Netherlands which compared land managed under agri-environmental schemes and conventionally-managed land revealed that those under the schemes were not effective in protecting the species richness of certain groups. It was determined that there were no positive effects on plant and bird communities and in fact, the four most common wader birds were observed even less frequently on fields with agri-environmental management.

Source: Kleijn et al. 2004

→*Cost-effectiveness* is measured by a program's ability to achieve targeted ecosystem service-provision goals at minimal costs. It can be improved with a targeted approach to site-selection or measure-selection – an approach that designs payments in such a way that participating sites or measures are selected for available financial resources where the benefit/cost ratio is highest. This implies that sites with high benefits and low opportunity costs are preferable to ones with low benefits and high opportunity costs. Scoring indices can help to enable targeting. For example, in silvopastoral projects in Costa Rica, Colombia and Nicaragua, the payments were linked to such a scoring index. It combined an index for biodiversity that assigns a numerical →*value* to operations based on biodiversity friendliness, and an index for carbon sequestration that assigns points per ton of carbon sequestered. The project resulted in a 71% increase in carbon sequestered and an increase in bird, bat and butterfly species as well as a moderate increase in forested area along with reduction in use of pesticides (Measuring ecosystem services through scoring index, Costa Rica, Colombia and Nicaragua, TEEBcase based on Pagiola et al.).

What is the role of intermediaries in PES programs?

In theory, direct transactions between providers and beneficiaries are ideal. While intermediaries can contribute to the success of programs, they increase transaction costs. However, an intermediary is often necessary to facilitate transactions because exchanges between buyers and providers can be complicated. Intermediaries can be national or local governments, environmental NGOs, development NGOs and donors, or they can be created by the PES program. Intermediaries can play three different roles:

- Represent beneficiaries (buyers such as NGOs, private businesses or government agencies)
- Represent providers (the suppliers of the ecosystem services such as farmers)
- Serve as wholesale managers (acting as a financial intermediary that buys services and sells them to national and international buyers)

Intermediaries can be utilized at various stages, from facilitating stakeholder dialogue to program administration support. At the dialogue stage, they can identify

Box 8.7: Identifying sites with high benefits through a two-tier target approach

In the municipality of Copán Ruinas, Honduras, a PES program was developed to mitigate the impacts of damaging activities to the watershed on which many families depend. A two-step approach has been adopted to target sites where the provision of ecosystem services is both high and under threat. First, the municipality ranked water sources based on the number of households they service, current levels of water extraction, and the number of potential future households using the sources. Second, they ranked sites based on their potential for providing watershed services and their →*vulnerability* to reductions of these services. After targeting the program to high-benefit, high-risk sites, the next step was to precisely measure the hydrological services these sites provide by developing an index of 15 combinations of land uses and land management practices commonly observed in Copán.

Source: PES as incentive for farmers to shift to sustainable activities, Honduras, TEEBcase based on Madrigal and Alpizar

which environmental services buyers expect and then negotiate the prices for trading these services. At the program design stage they can conduct feasibility studies, design mechanisms for payments, develop management plans, establish monitoring systems and ensure the delivery of services. At the support stage, intermediaries can design technical, social and institutional land-management instruments for both providers and buyers. Finally, at the administration stage, they can draw up contracts, manage funds, coordinate monitoring and oversee technical issues that arise (Porras et al. 2008).

The role of tenure rights in program development

Determining who 'gets paid' for services usually hinges on who 'owns' the area in question. Providers with land tenure have a lot of control – they can choose whether or not to participate and they can stipulate how much their cooperation is worth. If providers have access rights, but not private land tenure, they retain rights to access the services provided by the area in question. If these services will be limited by the proposed scheme, these providers should be entitled to a share of payments.

Property rights relevant for PES program development are:

- rights to land, water, forests or other resources, as well as the right to buy and sell ecosystem services (government or private ownership).
- rights to manage resources, even if resources are collectively owned (by traditional communities, for example).
- rights to income and other benefits from ecosystem services (these are guaranteed by law in the case of some indigenous peoples).

When implementing PES programs, preference may be given to areas with clear tenure rights. Secure tenure rights are generally necessary for a well-functioning PES scheme, especially as they decrease the risk of 'elite capture' – when more powerful individuals or groups benefit over others. However, this bias may act against landless or mobile communities (pastoralists). Therefore, in appropriate contexts, strategies for including people without formal rights or titles can be explored. For instance, when customary rights exist but land titles are unclear, policy makers can make an effort to legalize titles or clarify individual or group ownership. Such efforts may improve the participation of small landowners. For example, when Costa Rica's PES schemes were first developed, only landholders with clear titles to land could participate (Pagiola and Platias 2007). This regulation blocked many poor farmers and so, in later schemes, methods were developed to include the landless. In another case, in Indonesia, community forestry permits have been issued since 2000 (TEEBcase Community forest permits as rewards for provision of ecosystem services, Indonesia). These permits were instrumental in the implementation of a conditional land tenure scheme using tenure security rather than cash payments as a reward. Cooperation between government and local community for this type of mechanism is important.

The success of a scheme is dependent on its socio-economic, cultural, political and institutional context. A careful assessment of tenure rights followed by the implementation of small but significant changes in access or regulations may 'make or break' a PES scheme.

Monitoring compliance and results

Close monitoring in three areas in particular is crucial to a successful PES program:

1. program implementation and participant compliance;
2. the scheme's impact on the generation of services;
3. the scheme's impact on local users.

Careful program monitoring ensures that services are generated, payments are adjusted and technical assistance is provided where necessary. Beneficiaries need evidence that their investments are instrumental in effective change in order to continue participating. Well-regulated monitoring practices allow for payment adjustments and contributions – they optimize the system.

Depending on the scale of the project, several methods can be employed, from regular site visits to small sites, to random inspections in the case of more remote and inaccessible ones. Satellite imagery can also be used, followed up by ground-truthing assessments.

Box 8.8 Providing legal support for PES programs

Costa Rica: In 1996, the country adopted a law which explicitly recognized several of the services provided by forests: mitigation of greenhouse gas emissions; hydrological services; biodiversity conservation; and the provision of landscape beauty for tourism and recreation. This law provides both the legal framework for regulating contracts with landowners as well as a mechanism for paying participants. Under this law, the National Forestry Investment Financing Fund (FONAFIFO) is also empowered to issue contracts for environmental services provided by privately-owned forests.

Source: Enabling the legal framework for PES, Costa Rica, TEEBcase based on Bennet and Henninger

Policy makers often need to 'get the law on their side'. As compliance with PES regulations is critical to PES success, compliance also needs to be monitored. Legal enforcement, one of the most complicated aspects of PES programs, is often crucial. In some cases, failure to monitor compliance with the law may result in the degradation of the ecosystems concerned. If contracts have been breached, adequate sanctions need to be imposed. Such sanctions are easy to implement in schemes involving periodic payments but more challenging in the case of 'one-off' payment strategies.

In general, a healthy legal environment is necessary for a healthy PES program. Such an environment allows for amendments to existing laws, explicitly recognizes the environmental services provided by certain ecosystems, clearly defines buying and selling rights, legally acknowledges property rights, acknowledges the autonomy of certain communities, ensures compliance with legal requirements and has the ability to issue decrees in regards to environmental compensation. In some cases, the recognition of environmental services in national law helps pave the way for local schemes. At the same time, local schemes can be implemented without changes to national laws – through minor changes to municipal legislation (for example, investing revenues from water levies).

AVOIDING COMMON PITFALLS

Common pitfalls for policy makers include:

- sub-optimal payments to encourage desirable land-use practices;
- paying for practices that would have been adopted regardless of the scheme (lack of additionality);
- direct and indirect 'leakage' (whereby the PES scheme only displaces a certain 'undesirable' activity to a different area);
- lack of permanence (the program is not viable over the long-term);
- high transaction costs.

SUB-OPTIMAL PAYMENTS

Payments must, at minimum, cover opportunity costs. Payments that are too low will not be sufficient to motivate landowners to adopt socially desirable practices. Another common problem arises out of concern to motivate participants. This may lead to the overpayment of service providers. Overpayment is a problem because available financial resources are limited and if some providers are overpaid, too little is left for others. This results in less environmental services provision.

The ideal scenario for avoiding this pitfall is to offer differential targeted payments depending on the opportunity cost of land. However, opportunity costs may not be known to the policy maker. Service providers have an incentive to overstate them in order to receive higher payments. One way to overcome this problem is to use →*auctions* to determine the payment. Auctions often reveal information about opportunity costs. Participants know that if they exaggerate opportunity costs there is a risk that they cannot participate in the program. However, this approach is expensive and may present problems with implementation, particularly in countries with limited institutional capacity. Several countries, however, are testing this approach – among them Vietnam, India, New Zealand and Australia.

LACK OF ADDITIONALITY

If a program's desired outcomes would occur without the scheme, the program lacks additionality. Targeting

Box 8.9 Avoiding overpayments through auctions

USA: The Conestoga Reverse Auction Project in Pennsylvania was a two-phase scheme that paid farmers to implement best management practices (BMPs) to reduce phosphorus losses in local waterways.

- In phase one, farmers bid to implement specific BMPs based on the USDA Environmental Quality Incentive Program (EQIP) The cost of these practices was pre-determined based on standard BMP costs and cost-share amounts.
- In the second phase, farmers bid on the price they were willing to accept to implement a BMP (which could exceed the BMP implementation costs).

Bids were ranked based on the cost of phosphorus reduction. Based on the ranking, policy makers determined the cut-off price for the auction budget. Bids lower than the cut-off price were successful

Source: Reverse auctions help farmers to reduce phosphorous content in local waterways, USA. TEEBcase based on Selman et al.

financial resources at practices that would be adopted anyway is certainly not a good use of limited financial resources!

For this reason, ensuring additionality is an important step in achieving the desired outcomes. Projects demonstrate additionality when:

- they face implementation barriers that can only be overcome with PES schemes;
- without a PES scheme, a project is not the most economically or financially attractive course of action for participants, although it is socially desirable.

Local governments can help ensure the additionality of a project by prioritizing areas with high degradation rates (due to competing land-use practices) over those with relatively low degradation rates. But sometimes even if projects do not satisfy the additionality condition, they are still implemented in order to minimize risk that ecosystem services are lost.

Direct and indirect leakage

In some cases, a PES project may only displace environmentally damaging activities. Rather than creating benefits, it shifts environmentally harmful activities somewhere else. This unintended side-effect is referred to as 'leakage' or 'spillage.' For example, a project aimed at restoring pastureland degraded by overgrazing in an area may simply cause herdsman to shift the same overgrazing practices elsewhere.

Leakage, however, is a risk that can possibly be addressed in program design. For example in the case of pastureland recovery, allowing restricted grazing within project areas may limit displacement and associated impacts. As discussed earlier, a well-designed monitoring plan can help mitigate project-related risks.

Besides this type of 'direct leakage', 'indirect leakage' is also possible. For example, enrolling agricultural land in a scheme aimed at afforestation may cause the price of agricultural goods to increase. A reduced crop area may lead to a reduced supply of agricultural goods – raising the price of these goods. If the price of agricultural goods rises, agricultural activities may become more attractive relative to other activities and land in neighboring areas may be converted to agricultural production.

Unfortunately, indirect leakage is more difficult to avoid than direct leakage. However, it may only take place in circumstances where PES programs are large enough to affect the price of goods, through reduced supply.

Lack of permanence

The long-term success of a program depends on its sustainability which, in turn, depends on the scheme's ability to maintain payments over the long-term – either through government funding or payments from willing beneficiaries.

Similarly to the issue of leakage, some permanence issues can be addressed at the design stage. If payment schemes and contracts are designed to provide a structure of rewards that encourage landowners or users to continue targeted activities far into the future, a program is likely to be successful in the long run. This may present a challenge, however, since long-term

Box 8.10 Controlling leakage

The Costa Rican national carbon offset program: In 1997, the government established the Protected Areas Project to consolidate their national parks network. It purchased privately owned land within the park in order to prevent the release of CO_2 from deforestation in these areas. The government, however, anticipated that the landowners would continue with their damaging activities outside the park boundaries. It initiated a parallel program, the Private Forests Project (PFP), which provided farmers with financial incentives to engage in forest-related land-use practices to prevent deforestation. The environmental services of the program included CO_2 fixation, biodiversity, water quality, and landscape beauty. The project was independently certified, and the potential for slippage and leakage was considered negligible.

Source: Vöhringer 2004

contracts may lack the flexibility necessary to adapt to changing market conditions. This may deter some landowners, who want to keep their land-use options open, from participating.

For this reason, policy makers may opt to design a scheme that differentiates between short and long-term payment options. While long-term payments may be more attractive as they fetch a higher price, short-term payments are still available for 'hesistant' participants. Under the →*Kyoto Protocol*, for example, participation in CDM afforestation and reforestation projects can be increased by creating temporary credits that are issued with a defined expiry date. These credits can be reissued or renewed every five years after independent verification confirms that sufficient carbon has been sequestered.

High transaction costs

Transaction costs refer to costs incurred by buyers, providers and the authorities to set up and run PES schemes. They include the costs for gathering the necessary information to design and implement a proper scheme, the administrative costs related to running the scheme (including monitoring and enforcement activities) and the administrative costs of participants. Taking transaction costs into account is crucial because if they are too high they may render a scheme unsustainable.

Transaction costs tend to be highest during the start-up phase, decreasing significantly over time. Several factors determine transaction costs, such as:

- size of the scheme (a large program may have lower costs/unit than smaller programs);
- number of parties included in the scheme (many parties with many small land parcels may drive operational costs up per parcel);
- type of contract the scheme employs;
- waiting-times for contract approvals;
- mode of payment for participants.

While it may seem attractive to keep transaction costs down by selecting large parcels of land and minimizing the number of users, such actions may decrease cost-effectiveness and result in inequity – excluding poor people from involvement in PES programs. While considering strategies for minimizing transaction costs, policy makers may want to consider the following recommendations:

- **Simplify guidelines for design and formulation of PES schemes.** When feasible, contract directly between users and providers because intermediaries, though useful for facilitating the process, can also push up the transaction costs. Another way to simplify the program is to opt for collective contracting – where several small-scale farmers conduct the contracting process together, reducing the cost of individual transactions.
- **Reduce the costs of monitoring and measurement.** While proper monitoring is essential, there may be opportunities to save on monitoring costs. PES programs can utilize local experts (provided they are appropriately skilled and independent) rather than relying primarily on external experts. Policy makers can also keep up to date with technological advances in monitoring schemes which may decrease monitoring costs.

- **Adopt institutional innovations.** There is a lot of room for innovation – from forming specialized services to building on existing community development programs, bundling environmental service payments, reducing data costs, establishing large-scale area-wide projects and creating cost-sharing mechanisms (Smith and Scherr 2002).

ARE PES SCHEMES INSTRUMENTAL IN POVERTY ALLEVIATION?

While the primary goal of PES programs is to manage environmental and natural resources effectively and cost-effectively, they also often help to alleviate poverty.

PES schemes have the potential to provide financial stability to poor households (as consumers or providers), generating income directly or indirectly. An equitable scheme typically considers those things that poor people often lack – well-defined or secure land rights and access to certain resources (market contacts, communication infrastructure, and capital for start-up costs). A PES strategy that overcomes these market handicaps may develop ways to assign equitable rights to land and environmental resources to financially disadvantaged participants. The scheme might invest in education and training, establish market support centers or provide start-up capital. They may also encourage land bundling and consolidation (Landell-Mills and Porras 2002; WWF 2006).

A recent study estimates that markets for biodiversity conservation could benefit 10-15 million low-income households in developing countries. Carbon markets could benefit 25–50 million. Markets for watershed protection could benefit 80-100 million and markets for landscape beauty and recreation could benefit 5-8 million by 2030 (Milder et al. 2010).

PES may lead to increased income for land-users if it is possible to market the improvement in environmental services. This may require participation in an eco-labeling scheme to be able to sell goods produced in a sustainable manner to consumers. If payments focus on the conservation of charismatic species and improving landscape beauty, eco-tourism can provide an additional source of income for a region.

Box 8.11 40 years of PES in Sukhomajri (India)

While the term 'PES' is fairly new, the concept has existed for quite some time. In the 1970s, agricultural land degradation led villagers in Sukhomajri to practice indiscriminate free-grazing, land-clearing and tree-felling – perpetuating a cycle of land degradation and poverty. These actions affected the water supply for communities downstream. In response, the Centre for Soil and Water Conservation Research and Training Institute, supported by the Ford Foundation, constructed soil conservation structures to reduce lake siltation and capture rainwater. As these structures could benefit only landowners, an important element of the plan was to have better water sharing arrangements which could benefit all the villagers.

In return for protecting vegetation, a water-users association constructed rainwater collection dams which improved village water supply and allocated tradable water rights to every household. Over time, the tradable water right system was replaced by a user fee and in return the villagers received the revenue from sale of forest products. In addition, families with no land or marginal land have been given land rights, and those who wish to can sell water entitlement. An affiliated reforestation project is further expected to benefit the community through timber extraction from communal property.

This PES scheme has, in the past 40 years, generated high economic returns for the once-poor community. It has improved agricultural productivity and increased household income. Siltation in Sukhna Lake has fallen by 95%, which saves the city downstream (Chandigarh) about US$ 200,000 annually in dredging and related costs. The hillside vegetation is expected to raise the value of the forest to an estimated US$ 700,000 annually (1997 exchange rate) from the sale of forest products and babbhar grass.

Source: Equitable sharing of benefits in Sukhomajri India. TEEBcase based on Kerr

Box 8.12 PES, Eco-labeling and Ecotourism in Toyooka City, Japan

The Oriental White Stork, reliant on traditional rice-paddies for hunting, nearly became extinct by modernized rice farming practices. In Toyooka, Japan, a **PES** scheme was introduced to restore the habitat quality of the fields and this has benefitted both rice farmers and the stork. Since 2003, rice farmers have been encouraged to use compost, organic fertilizers, and reduced or chemical-free pesticides. They have also been encouraged to flood paddies deeper, retain water longer and keep a diary of living creatures. From 2003-2007, participating farmers were paid US$ 330 per 1000m^3 (US$ 80 to those joining today) for income and labor compensation. As a result, the stork population has increased to 36. Importantly, the reintroduction of the stork has raised municipal income by 1.4%.

Eco-labeling

Although growing rice to conform to eco →*standards* reduces yields by 25%, rice grown with reduced pesticide use can be sold at 23% higher and organically grown rice at 54% higher.

Ecotourism

Stork-related tourism is estimated to generate more than US$ 11 million annually. Visitors to Toyooka include school children, students from China and Russia, farmers and researchers from Korea. Japan's largest travel agency sells 1,000 package tours to Toyooka every year.

Source: PES for habitat restoration to reintroduce Oriental White Stork. TEEBcase by Hayashi and Nishimiya

ACTION POINTS FOR PES SCHEME IMPLEMENTATION

Designing and implementing a successful PES scheme is a complicated but economically rewarding process. There are no simple prescriptions, but a plan that integrates local people, local infrastructure and the bio-physical context of the ecosystem services associated with the scheme is most likely to be successful. Importantly, a successful plan is most likely adaptable, inclusive and creative – one that treats both land and people as valuable resources.

Find ways to use human resources that are available. This may involve generating commitment to participate from communities, landowners, institutions, organizations or local leaders.

- Collective action at the community level can be mobilized through education (describing and explaining the program's ground rules).
- Capacity building can take place for both buyers and service providers.
- Credible intermediary organizations like NGOs, civil society institutions, community-based organizations can help raise awareness about the link between new practices and their subsequent environmental benefits.

It may be possible to turn deficits into opportunities for improving institutional structures when ineffective government structures, corruption and poorly defined land-use rights are limiting resources and options.

- Land managers can be assisted in obtaining secure property rights or legal clarification about customary rights.
- Tailor-made PES schemes can be created when this is not possible.
- Legal enforcement can be improved, as it is key to PES success.
- The inclusion of poor people and women can ensure greater collaboration and increase program effectiveness.

Explore practical ways to support effective and cost-effective PES schemes

- Find ways to establish trust between buyers and providers. Support buyers of eco-products. This will help to increase demand for products that support sustainable resource use. Provide access to credit and promote appropriate technologies. Support the creation of new markets.
- Help community organizations or associations to keep transaction costs low.
- Choose payments that are slightly higher than the opportunity cost to the service providers,

and lower than the benefits generated from increased environmental services provisioning.
- Ensure that land enrolled in schemes passes the additionality test. Minimize leakages and do your homework to ensure permanency.

Make sure that the people who make decisions are informed
- Make use of credible scientific findings to show how changes in land-use practices affect the quality of ecosystem services provided.
- Make use of existing valuation studies that link PES with increased environmental service provision.

Find ways to make sure the plan can change when circumstances change. A flexible plan is open to improvements and new economic opportunities.
- Monitor outcomes regularly. If there is a provision in national laws, local governments can use this or create their own guidelines and regulations to help raise finance for PES schemes.
- Remove perverse incentives which may impede the success of PES.
- Bolster the strength of the program by using a mix of subsidies, eco-labeling and ecotourism, if appropriate.

8.3 CONSERVATION BANKING

If a unique habitat is to be destroyed by an economic development project and it cannot be restored elsewhere, there are strong arguments in favor of halting development projects. However, many habitats, especially where landscapes have been dominated by human land use for centuries, can be restored relatively quickly. In these cases, there is an argument for allowing economic development projects when adequate compensation (habitat restoration, creation or enhancement) takes place elsewhere in the region (Briggs et al. 2009). This kind of compensation is often referred to as 'offsetting' (see also TEEB in National Policy 2011, Chapter 7.3). Conservation banking refers to the concept that markets can deliver 'offsets' to those who need them. The term 'conservation banking' covers both 'habitat banking', where particular habitat types are conserved through the compensation activity, and 'species banking', where the purpose of the compensation activity is to generate a gain in population of particular species. **Local authorities may be involved** in offsetting and conservation banking as:
- **Regulators:** Approving sites, offset design, biodiversity and offset value assessment, monitoring and enforcement, ensuring that schemes meet the criterion of additionality;
- **Sellers and buyers:** Providing area for habitat restoration, voluntary or mandatory compensation of local road construction and industrial or residential zone establishment – necessitating the involvement of local authorities in offsetting trade;
- **Lobbyists:** Lobbying higher levels of government to establish offset legislation because it benefits local communities.

OFFSETTING

The goal of biodiversity offsets is to achieve no net loss, and preferably a net gain of biodiversity with respect to species composition, habitat structure, →*ecosystem function*, land use practices and cultural values associated with biodiversity. Offsets have a number of potential advantages and provide opportunities for local communities, business, environmental policy makers and conservationists.

There are, however, limits to offsetting and risks that offsets will fail to reach their goals (see ten Kate et al. 2004; BBOP 2009a; Wissel and Wätzold 2010). Some considerations for policy makers are:
- For areas of unique and irreplaceable biodiversity value, offsetting is neither possible nor appropriate. Proposed development projects, in this case, can be carried out on sites with lower biodiversity value complemented by compensation (or not carried out at all).
- The formulation of offset legislation needs to ensure compensation is appropriate. Otherwise, the goal of 'no net loss of biodiversity' is unlikely to be achieved.
- Using 'currencies', biodiversity losses (in destroyed areas) and gains (increases in biodiversity value of

Table 8.2: Opportunities from offsets

Who Benefits	Potential benefits created by offsetting
Local communities	• Avoid negative side effects of development projects. • Developers leave a legacy of rehabilitated project sites. • Increased amenity values of a region. • Local employment opportunities in restoration projects. • A mechanism for mitigating local conflicts between biodiversity conservation and economic development.
Environmental policy makers	• An opportunity to ensure that business makes increased contributions to biodiversity conservation. • Development projects required to meet the growing demand for energy, minerals, food, fibre and transport may be carried out in a way that biodiversity is not negatively affected.
Biodiversity conservation organizations	• Increased conservation activity. • An opportunity for more successful conservation – when impacts to areas of low biodiversity are offset with habitat restoration in more highly biodiverse areas (such as priority sites and ecological corridors). • A significant new source of funding. • A mechanism to integrate conservation into the investment plans of companies.
Developers, investors and other companies	• An enhanced reputation and better relationship with local communities and environmental groups. • Increased regulatory goodwill, leading to faster permitting. • A practical tool for managing social and environmental risks and liabilities. • 'First mover' advantage for innovative companies resulting from strategic opportunities in the new markets and businesses that emerge as biodiversity offsets become more widespread.

restored areas) can be measured. At present, currencies can be categorized under three principal approaches: area alone (increasingly discredited); area and condition or quality of biodiversity (current best practice, of which many of US and German currencies are variants); and metrics of species' populations and persistence (see for more details BBOP 2009b, BBOP 2009c).

- The principle that 'destroyed and restored habitat should be as similar as possible' needs to be balanced

Box 8.13 Developing a wetland offset to mitigate habitat losses from copper mining

In the mid-1990s, Rio Tinto Kennecott Utah Copper mine, North America's largest copper mine, needed additional storage capacity for 'tailings'. The company purchased an area of degraded saltpans and industrial land containing designated wetland habitat. To offset their impact on the wetlands (required by US law), Kennecott purchased water shares and 2,500 acres (1,011 hectares) of degraded lands for creation of a shorebird and waterfowl refuge. A wetland plan was designed, establishing Kennecott's obligations for construction, operation, maintenance and monitoring. After the initial successes, Kennecott went beyond its obligation by purchasing additional land and water to expand the site to more than 3,600 acres (1,460 hectares) with the added benefit of mitigating for impacts from other projects affecting wetlands in the same watershed. After completion, 'The Kennecott Inland Sea Shorebird Reserve' now shows a 1,000-fold increase in bird use.

Source: ten Kate et al. 2004

with conservation priorities. These may suggest restoring a type of habitat unlike the destroyed one. Several governmental policies espouse a 'like for like or better' approach under 'no net loss' policies.

- Offsetting strategies depend on stakeholder support – which often hinges on stakeholder involvement. This does not mean that →*ecological values* are negotiable. However, stakeholder involvement can ensure that plans address local community needs (cf. BBOP 2009d).
- Adequate governance structures support successful plans. Well-trained personnel (able to assess the ecological value of sites) and adequate administrative resources (to ensure compliance with legal requirements for offsetting) are key to effective plans.
- To ensure additionality, offsets should achieve conservation outcomes above and beyond results that would have occurred if the offset had not taken place. It is important that offsets do not replace conservation activities carried out by government bodies or which are their original tasks.
- Restored sites often require long-term management. One way how policy makers can assure funds for long-term management is by stipulating in offset arrangements that a trust fund is set up to finance management with the interest rates generated.

While individual offsets are a step forward (in comparison to no compensation on the part of developers) there are some pitfalls. This kind of 'case by case' compensation (restoration projects carried out separately for each impact), makes it difficult to ensure spatial cohesion of habitats and to find firms with a sufficient expertise in habitat restoration. For this reason, conservation banking may be a cost-effective, flexible and ecologically effective alternative to offsetting.

HOW CONSERVATION BANKING WORKS

The concept behind conservation banking is that the market can deliver suitable offsets for those who need them. It applies the policy instrument of tradable permits to biodiversity conservation. So far, very few conservation banking systems exist (Species Conservation Banking and Wetland Mitigation Banking in the US, Biobanking in Australia).

Box 8.14 Conservation Banking in California, USA

California introduced conservation banking to protect endangered species in 1995 (the term 'bank' is used for a mitigation project). To receive approval to sell endangered species offset credits, agencies must agree to preserve high quality habitat in perpetuity. Additionally, a conservation easement, legally restricting the usage of the conserved land, must be signed. Typically, a permanent (non-wasting) endowment fund is set up to pay for ongoing site management and maintenance. Credits can be sold to compensate for public infrastructure projects or the impacts of private development.

More than 100 conservation banks have been set up in California since the introduction of the policy, and the annual market volume has been estimated to be around US$ 200 million for the entire US. Prices for credits per acre can be more than US$ 125,000, depending on habitat type and region. The majority of credits are sold for a given area's preservation, requiring either minor (or no) enhancements. In some regions, categories are used to determine threat levels for certain species and trade between categories is allowed. There are no explicit spatial trading rules but official guidance documents recommend that mitigation sites should be located in what has been identified as core habitat areas or corridors.

In general, conservation banking is seen as an improvement over previous 'case-by-case compensation', in which mitigation projects were often poorly implemented and carried out in close proximity to impact, which increased habitat fragmentation. In contrast, conservation banking projects tend to be spatially coherent and better implemented as they are carried out by specialized firms. A criticism of conservation banking is that it does not strictly follow a 'no net loss policy'. If a habitat is destroyed, there is no need to restore new habitat but just to preserve existing ones (though the quality of this habitat may be enhanced).

Sources: Carroll 2008; Madsen et al. 2010

Within a conservation banking scheme, habitat destruction for economic development projects is allowed if the developer submits a credit to a regulatory authority. Credits can be generated by restoring, creating or enhancing habitat elsewhere. Credits are tradable. For example, firms can specialize in habitat restoration, earning money by selling credits to economic developers. Effective trading rules ensure that the value of destroyed habitat is equivalent to the value of restored habitat. Similar to offsetting, a 'currency' is necessary to compare the ecological value of destroyed and restored habitats.

Demand for credits may come from private firms, government departments (planning economic development or infrastructure projects) or individuals and NGOs interested in enhancing a region's conservation value (keeping credits rather than selling them). Farmers, forest owners, ecological consultancies, state authorities and conservation groups may supply credits. The education and expertise of these groups potentially results in well-managed conserved areas. A competent regulatory authority is needed to best assess habitat values, oversee monitoring, enforcement and credit exchanges.

ADVANTAGES OF CONSERVATION BANKING

A properly designed and implemented conservation banking system has several advantages:

- It is a flexible approach which conserves biodiversity and allows for economic development simultaneously.
- Market forces work in favor of biodiversity conservation; land owners are able to earn money by creating or restoring habitats.
- Conservation banking is cost-effective; it generates incentives for conservation in areas with low opportunity costs (in terms of foregone benefits from economic development) and allows economic development in areas with high benefits from economic development.
- A sufficiently large credit market enables firms to specialize in restoration, resulting in better quality restoration and cost-saving.
- The conservation value of a region may be enhanced if trading rules stipulate that restored habitat is of higher value than destroyed habitat. By better integrating new habitats into an existing habitat network, for example.

PRE-CONDITIONS FOR SUCCESSFUL CONSERVATION BANKING

In addition to meeting the basic requirements of any biodiversity offset, there are several important preconditions for conservation banking to be a successful form of offset implementation:

- A certain level of market activity is necessary. This enables sellers and buyers to find adequate trading partners. In extreme cases, an expected lack of demand deters land owners from engaging in habitat restoration, potentially leading to market break-down.
- Destroyed and restored habitat types should be the same; otherwise, there is a risk that certain habitat types will decline, potentially leading to a rise in extinction risks of some endangered species. However, if regulators focus on the conservation of highly endangered species, trading rules can be designed to provide incentives for scarce habitat restoration.
- For the conservation of many endangered species the spatial location of habitats and their connectivity are important. If spatial aspects are relevant trading rules need to take them into account.
- Conservation banking is only suitable for habitats that can be restored within a reasonable time frame. Lengthy restoration processes can lead to significant ecological damage (if destruction is allowed before restoration) or a lack of credit supply (if destruction is not allowed before restoration) because investors in habitat restoration have to wait too long to receive investment returns.
- It is particularly relevant for habitats with highly endangered species that at the time of habitat destruction, restoration or creation is completed. Otherwise, the time lag between destruction and creation may threaten the survival of the species. If a species is less threatened, a mechanism might be implemented to compensate for temporal loss. An example for such a mechanism is a multiplier that requires offsets to have higher conservation values than the destroyed habitat (see BBOP 2009b).
- Areas with habitats may provide ecosystem services other than conservation (carbon storage, recreation,

maintenance of water cycle). This does not present a problem for conservation banking if differences in these other services are not significant. If they are significant (for example, sites may differ in terms of recreational value), there is a risk that sites of high value will be replaced by sites of low value. To avoid this, trading rules may forbid sites of low value replacing sites of high value. Bear in mind that the introduction of this kind of regulation has the potential to restrict credit trade.

Box 8.15 Conservation banking in New South Wales, Australia

In 2008, the New South Wales Department of Environment and Climate Change established Biobanking (a biodiversity banking and offsets scheme). The aim of the scheme is to allow for economic development while addressing biodiversity loss and threatened species. Credits are created by landowners through the establishment of Biobanking sites and active management is required (fire, weed, grazing and human disturbance). Credits may be purchased to offset the impact of economic development projects or to support conservation (retired credits).

Two main types of biodiversity credits exist: credits for species and credits for ecosystems. Each site may generate a number of different ecosystem or species credits which may be sold together or in groups. The number of credits generated depends on various factors such as site values (structure and function of ecosystems), and landscape context (values for connectivity and area of vegetation). Part of the revenue from selling the credits goes to a BioBanking Trust Fund which uses this money to pay Biobanking site owners for subsequent management of their areas. To protect valuable and scarce habitats and species, development is, in principle, not allowed in so-called 'red flag' areas.

Sources: Department of Environment and Climate Change NSW 2007; 2009

FOR FURTHER INFORMATION

Payments

Landell-Mills, N. and Porras, T. I. (2002) Silver bullet or fools' gold? A global review of markets for forest environmental services and their impact on the poor. IIED London www.cbd.int/doc/external/iied/iied-silver-report-2002-en.pdf This report sheds new light on the issues through a global review of emerging markets based on 287 cases from both developed and developing countries.

Wunder (2005) Payments for environmental services: some nuts and bolts, CIFOR Occasional Paper no 42. Can be downloaded from www. cifor.cgiar.org. This paper explains PES and provides practical 'how-to' hints for PES design for non-economists.

Payment for watershed services: The Bellagio Conversations, Fundación Natura Bolivia 2008 discusses lessons learned from recent global experiences with payments for watershed services (PWS). Available at www.paramo.org/portal/files/recursos/The_Bellagio_Conversations_FINAL_2.pdf.

Getting Started: An Introductory Primer to Assessing and Developing Payments for Ecosystem Service Deals – This primer is designed to provide a solid understanding of what Payments for Ecosystem Service are and how PES deals work for an audience interested in exploring the potential of PES. This includes also a comprehensive PES learning tool (www.katoombagroup.org/learning_tools.php). Further material is available at: www.ecosystemmarketplace.com

Payments for environmental services from agricultural landscapes (Source: www.fao.org/es/esa/pesal/index.html) - This website has lot of information on the potential of agriculture to provide environmental services along with guidelines on how to set up a PES scheme that can potentially also contribute to reducing rural poverty.

Conservation Banking

BBOP (2009a-d) are handbooks for practitioners on various aspects of offsetting and conservation banking eg on Offset Design, on Offset Cost-Benefits and the Biodiversity Offset Implementation. They are available at www.bbop.forest-trends.org/guidelines/

An overview of current developments in credit markets can be found on www.ecosystemmarketplace.com/pages/dynamic/biodiversity_market.landing_page.php

Recent overviews of offset and banking schemes worldwide are found in Madsen et al. (2010) and eftec, IEEP et al. (2010)

9 CERTIFICATION AND LABELLING

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Content of this chapter

Key Messages

- **Labels inform.** Labelling can highlight ecosystem services connected with particular products. They provide the opportunity for consumers to choose products that maximise environmental and social benefits.
- **Certification assures.** By setting and ensuring standards certification provides a credible guarantee, that goods and services have been produced in a sustainable way. This helps to ensure the flow of ecosystem services for local development.
- **Labels pay.** Certified products sometimes achieve a significant price premium; even if not certification can help to ensure improved market access, increased market share or improved reputation.
- **Labels create common ground.** The process of working together with other stakeholders in finding appropriate standards and working towards certification can help local actors to jointly address ecosystem services.
- **Choose your own path.** Local governments, NGOs have many different options to support local business through certification and labelling. They can inform, support, participate or develop their own schemes.

This chapter gives an overview of certification and labelling. It defines certification and discusses its role as an instrument for sustainable resource management. It outlines how certification can be supported and implemented, drawing from several regional and globally based schemes.

9.1 INCENTIVES FOR ECOSYSTEM SERVICE AND BIODIVERSITY CONSERVATION

For many people, nature has important cultural and spiritual →*value*. In addition, →*ecosystem* services such as clean water, food production and forest →*resources* are necessary to the long-term viability of local development – from agriculture to industry. These benefits, however, are often not immediately visible and therefore not reflected in the costs of many production processes. **Typically, markets do not distinguish between products by the ways in which they affect ecosystem services.** Producers who take extra care to ensure that they do not undermine →*ecosystem services* are unlikely to see this reflected in the value of their product; thus, incentives for sustainable production are often weak. As a result, the public, rather than the polluter, often bears the cost of pollution and over-exploitation.

This is changing however. Consumer decisions are now an increasingly powerful force in driving sustainable management, as a growing number of consumers are demanding goods that are produced in ways that protect ecosystem services and →*biodiversity*. Demand is growing for a range of sustainably produced products such as cosmetics, food and textiles. Consumers are also looking for products that are more resource-friendly, such as energy-saving electronics.

Certification and labelling assist consumers to make good choices in purchasing decisions. They are effective instruments for producers who wish to communicate their efforts towards environmentally-friendly production.

The process of certification is usually linked with an exchange of knowledge. Producers learn about more sustainable methods. Certification organizations usually help to market products, such as organic meat, by informing consumers about the benefits of adhering to environmental standards or about the environmental and social costs associated with conventional production methods.

Certification markets the benefits of ecosystem services and biodiversity. Achieving certification of sustainable goods produced from a particular locality can help to secure market share and employment for a region. Local authorities can benefit directly from certification. For example, their reputation can be enhanced if they use certification schemes to create recreational areas, openings for →*public management* and opportunities for local producers. Equally, certification may improve the overall environmental appeal of a region, attracting tourists and other business. The exchange of information and adoption of standards can also increase productivity and lead to more efficient management practices. Environmental risks resulting from company operations can

Box 9.1 Definitions

Certification: A procedure by which a third party gives written assurance that a product, process or service is in conformity with certain standards.
Accreditation: The evaluation and formal recognition of a certification programme by an authoritative body.
Standard: Documented agreements containing technical specifications or other precise criteria to be used consistently as rules, guidelines or definitions, to ensure that materials, products, processes and services are fit for their purpose. Standards include environmental standards; organic standards; labour standards; social standards; and normative standards.
Label: A label or symbol indicating that compliance with specific standards has been verified. Use of the label is usually controlled by the standard-setting body.

Source: FAO 2003

also be reduced. Further, certification standards often result in higher worker and external →*stakeholder* satisfaction, reducing the risk of criticism, boycotts and blockades in the case of otherwise controversial products (Araujo et al. 2009; Kooten et al. 2005).

For many reasons, **the shift towards sustainable production is usually costly**. For example, more expensive production processes and reduced harvests affect overall production expenses. Further costs may be borne by the producer for assessment and monitoring. In addition, the upfront cost of obtaining certification may be prohibitive, particularly for small-scale producers. For this reason, some certifiers and NGOs are searching for alternative non-third party certification or verification mechanisms for small-scale producers (see box 9.2 and 9.4). One example is Participatory Guarantee Systems (PGS), with approximately 10,000 small-scale farmers involved in over 20 countries worldwide. Farmers can establish their own democratic organization, deciding on which standards they want to follow and which verification procedures they would like to implement. The most significant operational cost for smallholders tends to be time spent developing and running the scheme. Time invested, however, leads to capacity building, empowerment and the protection of local biodiversity (TEEBcase Participatory Guarantee Systems for organic agriculture, India).

In some regions, certified products can be sold at a premium, helping local producers to defray certification costs and increase their profit. For example in Asia Pacific timber products can obtain premiums of more than 20% for industrial plantations (TEEBcase Benefits of Forest Certification, Solomon Islands). However, this premium can be negligible when the costs of certification are taken into account (Sedjo and Swallow 2002).

Even if certification does not lead to price premiums, there are **other economic arguments for certification**. Local businesses may choose to sell certified products in response to consumer demand or legislation (such as biomass in Germany), or in order to remain competitive. Certified timber does not necessarily get producers more money but allows them access to retailers and users who insist on certified products. In Wallonia one community lost PEFC (Programme for the Endorsement of Forest Certification, one alternative to FSC) certification in March 2010, because they did not succeed in managing the game population. Sawmills in the region now fear they will not be able to sell their products, because of the strong demand for certified products. Similar problems exist in surrounding communities, creating a strong incentive for them to fulfil standards and remain certified (Druez and Burgraff 2010).

Box 9.2 Forest certification: benefiting local communities in Tanzania

In 2009 the Forest Stewardship Council (FSC) awarded a certificate to two Tanzanian communities for community-managed natural forest in Africa. Villagers participating in the Mpingo Conservation Project have been able to develop sustainable forest management plans in accordance with Tanzania's system of Participatory Forest Management. This grants them secure tenure over the valuable timber resources. Certification helps consumers to differentiate between timber produced from well-managed community forests and illegally logged timber.

The timber (African blackwood or mpingo) is highly prized for making clarinets, oboes and bagpipes. Certification is anticipated to enable communities to earn more than US$ 19 per log, compared to a previous US$ 0.08. Central to the project's success is consumer demand for sustainably harvested timber (particularly from an international market), an important →*driver* for future community wood production in the country.

Source: FSC Certification for maintaining ecosystem services, Tanzania. TEEBcase by Sara Oldfield (see TEEBweb.org)

9.2 HOW DO CERTIFICATION AND LABELLING WORK?

Product labels inform customers about production methods and resource use as well as the environmental, social and cultural standards of a product or service. It is important that certification labels are recognizable, simple (but informative) and credible. For example, if a label claims organic production methods or ethical working conditions, this must be valid and verifiable. For this reason, certified producers undergo a **certification process to guarantee consumers that specified standards are fulfilled**. Certification is carried out by an independent third party.

Whether eco-labelling is relevant to the marketing of certified products depends on both the level of consumer awareness and consumer demand for certified products. While consumers may care, people generally are neither able nor willing to give much time to understanding and reading labels. Many supermarket products carry multiple labels that often cover similar standards, but the overwhelming amount of information leads to confusion among consumers. →*Labels* are therefore kept simple, rarely communicating the full range of ecosystem services benefiting from certain production practices. Building consumer demand often relies on the involvement of 'middlemen', such as retailers and wholesalers. The functions of middlemen, which differ between industries, must be understood to be able to market certified products (Russillo et al. no date).

Box 9.3 Standard setting process of the Roundtable on Sustainable Palm Oil

The 'Roundtable on Sustainable Palm Oil' (RSPO) is a global, non-governmental multi-stakeholder initiative whose members include palm oil producers, retailers and environmental and social NGOs. The aim of the RSPO is to develop and implement global standards for sustainable palm oil that focus on the protection of the ecosystem services of palm oil plantations. Setting standards is the key mechanism employed for achieving RSPO goals.

The standard setting processes can be divided in two phases: standard development and certification (von Geibler 2009). In the standard development phase of the RSPO, eight principles and 39 criteria for sustainability were defined in respect to social and ecological issues with participation of various stakeholders and public consultations. To ensure that the global principles and criteria consider national needs and regulations, →*indicators* for individual countries were specified by different national interpretation working groups, with engagement of sub-national organisations. The standard criteria have been evaluated in practical pilot studies for two years from 2005 to 2007 (RSPO 2010). The certification phase implies independent auditors checking palm oil mills as well as respective supply chain audits in order to ensure compliance with the RSPO principles and criteria. In case of complaints against RSPO members a grievance process aims to resolve disputes (RSPO 2010).

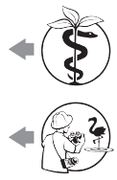
First certificates were given out in 2008 under the label of 'GreenPalm'. Producers who can produce according to the RSPO standards can register online with GreenPalm and receive certificates per ton sustainably produced palm oil. The certificates are then sold on the Green Palm web-based trading platform, where manufacturers or retailers buy certificates and thus support sustainable palm oil production. The certification system will be reviewed by RSPO after two years.

Source: Palm Oil Certification, Indonesia. TEEBcase by Justus von Geibler (see TEEBweb.org)

An enormous number of certification schemes exist for a wide variety of different products, such as fisheries (Marine Stewardship Council, MSC) or natural cosmetics. Schemes cover different industries from food to electronics to green financial investments (see also TEEB in Business 2011, Chapter 5). Schemes also exist for tourism, building standards (such as LEED and BREEAM) and management practices (see Chapter 4) to name a few.

Certification schemes can differ in many ways:

- **Target market:** Some schemes are designed for international trade and export markets, (such as forest and marine councils) while others are designed for a regional market (see Box 9.5).
- **Management:** Businesses, NGOs and consumers or state-led schemes (such as the new Euro-leaf organic certification scheme run by the EU) can manage certification schemes.
- **Attributes:** Certification standards may address environmental, social and/or ethical issues.
- **Scope:** The impacts of market products or services can be measured at different levels — the product itself (for example timber) during production (for example organic agriculture), chain of custody or the whole life cycle of a product (from production, transport, consumption to disposal).



9.3 THE ROLE OF LOCAL POLICY IN CERTIFICATION

Stakeholders such as businesses, consumer organizations, local governments and NGOs can use certification schemes if there is a market for certified products and certification helps to achieve their policy aims.

Following an analysis of the role of ecosystem services in local development, appropriate certification schemes can be sought out (see Figure 9.1). Before selecting a particular certification scheme, it is prudent to define the aims and goals of a scheme. Not all schemes serve all purposes. Some may aim to support biodiversity while others may seek to maintain social and cultural values. In addition, different schemes have different outcomes. Some may help to secure local jobs better than others and certain production methods may be easier to adapt for sustainability standards. In addition, not all sectors are relevant for every region.

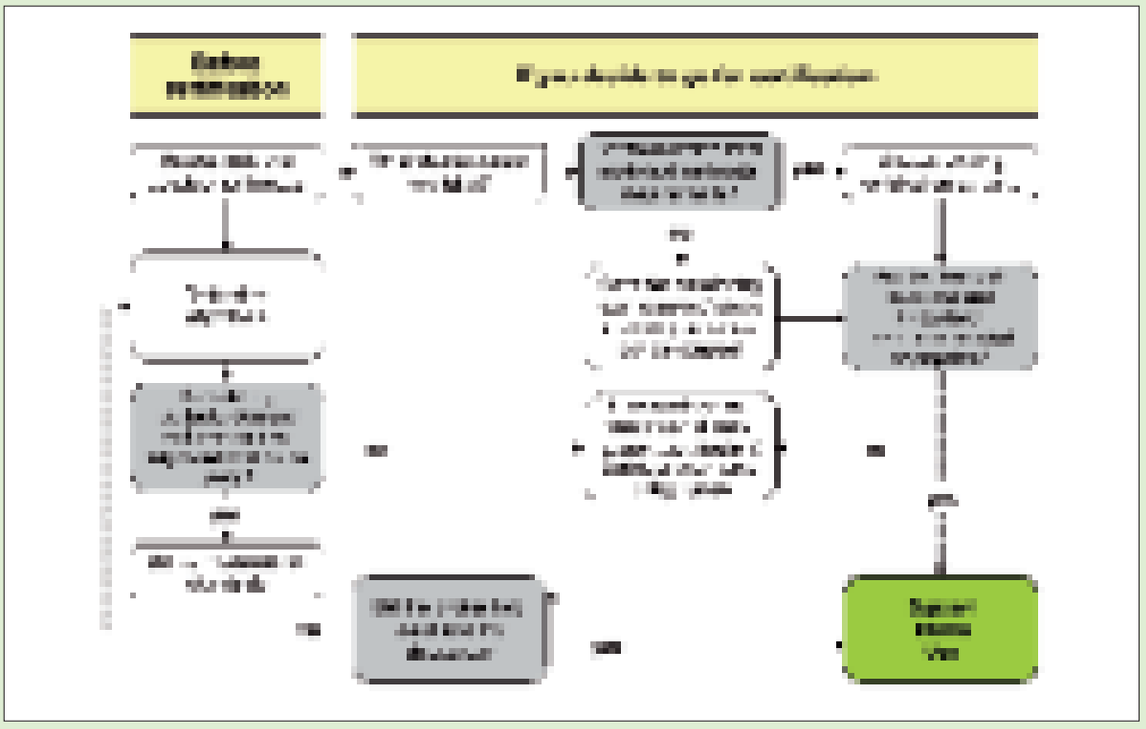
In order to decide whether certification is a useful instrument, assess ecosystem services and development needs. When developing a certification scheme, it is important to determine what is most important to the region concerned. For example, an ecosystem services assessment could be carried out to determine which standards are needed and what kind of certification scheme might be most suitable (see also Chapter 2). This assessment could be carried out for the purpose of the project or as part of another process. Those with an interest in developing a certification scheme often evaluate whether the cost of certification exceeds the benefits. If the costs are too high, other policy options may be more effective in achieving the stakeholder's objectives.

There is a broad range of opportunities for local administration, producer corporations or NGOs to use or support certification for regional goals.

Providing information to consumers and producers: Workshops can be organized and meetings arranged with experts. Consumers and producers can be provided with handbooks and best practice guides. In Florida, for example, citizens have access to resources such as 'A Meeting Planner's Guide to Going 'Green'. Tips and Best Management Practices' (www.dep.state.fl.us/greenlodging/files/MeetingPlannerGuide.pdf) and the Green Lodging website (www.treeo.ufl.edu/greenlodging/).

Support for small-scale producers: Due to issues related to cost and regulatory standards, certification currently favours producers in Northern countries compared to small-scale producers in developing countries (Pattberg 2005). While some certification schemes have developed approaches to support and enable the certification of smaller businesses, problems remain. Small-scale farmers, for example, often need to find new structures and organizations

Figure 9.1 Steps to consider when applying certification



Source: own representation inspired by von Geibler 2009

if they choose to become involved in organic or sustainable certification. In countries with weak farmer groups and limited cooperative culture, local governments and NGOs can support processes to strengthen farmer groups and progressively build PGS. They can encourage PGS projects by providing facilities such as meeting rooms and market stalls, in addition to skilled extension staff and access to land and local procurement policies. Legislation can also be a means to improve the status of small producers exemplified by the case of Brazil's 'Social Fuel Seal' which requires large biodiesel producers to purchase a significant share of their raw materials from family farmers. Although the program has garnered criticism from some corners, it is nonetheless a pioneering illustration how policy making can create a trickle-down effect to small producers (Leopold and Aguilar 2009).

Active promotion and integration of more bottom-up approaches to certification: Some local policy makers choose to take leading roles as mediators between local and external players and interests, particularly because small-holder producers are generally the weakest players in the value chain – even when certified. Local governments may choose to increase the organizational and business capacities of smallholders. At the same, policy makers may take it upon themselves to address external players (global corporations, in particular) that may need to be convinced to more effectively adapt their production methods to local conditions. This would allow for more sustainable, tailor-made certification within more equal partnerships.

Public procurement and other incentive for certification: Requiring certified products in public procurement creates demand. For example, since 2009, the United Kingdom requires that all forest products purchased by the public sector for construction, office furniture or office products such as paper, should be from legal and sustainable sources. In Florida (USA) state employees are required to book hotels for conferences and meetings that are part of the 'Green Lodging program' whenever possible. Australia gives advantages to certified boat operators through extended licensing. It is within the power of

Box 9.4 NGO support for Participatory Guarantee Systems in Southern India

Nilgiris, a hill district in southern India where most of the native forests have been destroyed. The areas that are not destroyed are under continual pressure from the unsustainable collection of Non Forest Timber Products (NFTP) (such as wild nutmeg, cinnamon, and herbal plants) by local indigenous communities.

Both sustainable harvesting and effective marketing of NFTP is central to rural development and the protection of the full range of forested ecosystem services as well as the areas' underlying biodiversity. Keystone, an NGO, aims to help the local Nilgiris community develop a PGS. This PGS is intended to provide an affordable model of organic labelling with integrated ecological monitoring and capacity building functions – ensuring sustainable harvesting.

Working with individual farmers, Keystone is reviving traditional crops, providing food security, improving health and livelihoods. Its goal is assist in finding alternatives to the monoculture plantations which have destroyed the ecology of the area. Keystone also hopes to decrease the local community's dependence on nearby plantations for income. To this end, it has helped the local community establish a number of 'green shops', set up village seed banks and plant nurseries.

Source: Participatory Guarantee Systems for organic agriculture, India. TEEBcase by Robert Jordan (see TEEBweb.org)

some governing bodies to give tax breaks and reduce import duties for certified products (see TEEB in National Policy 2011, Chapter 5).

Tailoring certification to meet local and regional needs: Local governments and regulators often know best about their region and the threats facing its local ecosystem services. This knowledge can be valuable to developing appropriate certification schemes, standards and monitoring systems. Some certification schemes include national and regional adaptation (for example FSC or RSPO), in others it may have to be added on. Experience has shown that the process of negotiating this can be helpful in better understanding local needs.

Development and support of regional labels: Support for regional labels can be a very direct way in which local governments can help producers in their area but this approach requires a significant amount of expertise and resources. Success requires that the labelled products or services have a ready and informed consumer base and market with purchasing power. Such markets may be found in nearby cities or, if a biosphere reserve or similar attraction is within the region, visiting tourists can provide a suitable market. In regions with a high recreational value, or regions with well recognized ecosystem services, there may be an option to use regional labelling to improve the marketing potential for regional products.

Box 9.5 Regional branding in biosphere reserve areas

The management of Schorfheide-Chorin, a UNESCO biosphere reserve in north east Germany, has developed a regional brand ('Prüfzeichen'). The 'Prüfzeichen' is a voluntary labelling scheme targeted at local businesses and other stakeholders with the aim of encouraging the production of local and sustainably produced goods and thus conserving the reserve's rich cultural and environmental legacy. Under this scheme, in rural areas, short paths between points in the production line are given preference (a preference for regional markets) because this reduces the need for transport.

The 'Prüfzeichen' currently exists for a range of different sectors including food, handicrafts, hotels, nature tourism and sustainable timber processing. At present, there are more than ninety labelled enterprises, with additional pending applications. The nearby capital, Berlin, is a potentially large market for certified products and services.

Source: Regional labelling in biosphere reserve, Germany. TEEBcase by Beate Blahy and Jörg-Dieter Peil (see TEEBweb.org)

Box 9.6 The Blue Flag certification for coastal areas: an economic argument?

A blue flag is awarded annually to beaches and marinas that meet certain environmental, amenity and safety criteria and assures recreational users of a quality visit to the beach. Those locations holding a Blue Flag can use the award scheme to attract tourists and recreational users to the area (Cumberbatch 2005). The Blue Flag certification scheme is targeted at local authorities, the public and the tourism industry in coastal areas. Schemes now operate in 41 countries and more than 3,400 beaches from Europe to Latin America and the Caribbean to Africa.

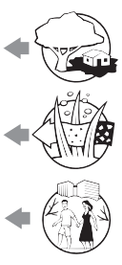
Some evidence suggests that the initiative has a significant effect. Studies from South Africa show economic benefits from increased tourist visits due to the Blue Flag award. In the holiday town of Margate along the Kongweni Estuary, the loss of Blue Flag status is estimated at a potential economic loss of between US$ 2.7 million and US$ 3.4 million per annum (Nahman and Rigby 2008. In Durban, a decrease in consumer confidence was attributed partly to the lost status in 2008 (personal communication, Alison Kelly, National Blue Flag Program Manager at WESSA).

On the other hand, case studies focussing mainly on European and North American beaches did not find a clear relationship between the award and tourist visits, providing a weak economic argument for achieving the award (McKenna et al. in press).

Source: Blue Flag certification for beach quality, South Africa. TEEBcase by Anna Spenceley (see TEEBweb.org)

Participation in national and international competitions and awards: A number of →*certification* schemes target community and regional levels. Participation may improve a local government's reputation and lead to an exchange of information and access to new strategies for best practices. This can also help to improve reputation of the region and build identity and pride.

A region's tourist industry, for example, can apply for certification with Green Globe which certifies sustainability within the tourism sector. In North America, the National Wetlands Awards are awarded to individuals who make extraordinary contributions to wetland conservation. In the Slow Cities movement, local communities jointly promote the maintenance of cultural values, quality of life and other ecosystem services. Agricultural products can apply for AOC-certification (Appellation d'Origine Contrôlée) which guarantees the origin of a product and traditional production methods.



There is also potential for the sustainable management of a region or city to be recognized by several award systems such as the Habitat Scroll of Honour Award run by UN-HABITAT or the European Green Capital award, first won by Stockholm in 2010. Since 2001, cities in Japan compete to become the 'top eco-city' (www.eco-capital.net). The top city has to achieve an ambitious score out of 15 criteria including waste reduction, the adoption of an environmental management system and a transportation policy. Nagoya, one of the cities that has recently competed, has created region-specific waste policies which will both protect tidal flats that are valuable for migratory birds and save economic costs. Less sustainable waste-management practices fill the tidal pools with waste while new waste policies have helped reduce the amount of waste and protect tidal flats. For this achievement Nagoya won the Environment Grand Prix Award in 2003 (TEEBcase Waste reduction to conserve tidal flat, Japan).

There is potential for international cooperation from local to local. Some regions or cities may create special partnerships, and, in other cases, relations between countries stemming from migrants and holidays or business contacts may initiate international relationships. These relationships may assist with creating trade opportunities and implementing certification or labelling. One example for this is JustUs!, a Canadian Coffee Roaster that created a partnership with producers in Mexico.

The benefits of this relationship are threefold. Mexicans get improved salaries, migrating birds are protected through more sustainable plantation practices and Canadians have a guaranteed coffee quality (TEEBcase Fair Trade Certification for coffee, Canada).

9.4 POTENTIAL PITFALLS AND CHALLENGES OF LABELLING AND CERTIFICATION

Setting standards is an essential part of certification and its impacts on ecosystem services. For example, setting similar, possibly even global, standards in different countries may be feasible for industrial production (such as capping carbon dioxide emissions). While technologies may be known and transferable across the board, social standards are not homogenous. Workers' rights, for example, differ from nation to nation. Furthermore, ecosystems and their associated requirements differ regionally, making it difficult to generate criteria that are applicable to a broad range of ecosystems, economic and social conditions (Rehbinder 2003).

A challenge for setting standards is ensuring that they can be **adapted to local, site-specific conditions**. Some certification standards, such as the Forest Stewardship Council (FSC), attempt to address this challenge by creating national standards through wide consultation with many different stakeholders. There are, however, examples of adopted standards which do not reflect what is relevant for an underlying ecosystem (see Box 9.7).

Not only do differences in ecological conditions play a role, but so do cultural and structural differences. A study of third-party-organic shrimp farming in Indonesia has shown that technical standards developed by Western countries are often not understood and accepted. This may lead to non-compliance, suggesting that strong stakeholder involvement and communication efforts in the setting of standards improve their effectiveness (Hatanaka 2010).

Increased demand can make it difficult to maintain standards: Increased consumer demand can have negative impacts on ecosystems. For example, most of the coffee grown in Latin America is sun, or plantation coffee. The market for shade grown coffee, however, is the market that is growing. Producers face three possibilities in response to this demand. Firstly, if they already produce shade grown coffee, they may seek certification. Secondly, if they have sun coffee, they may replant (with high investment costs) their plots with shade loving varieties along with newly planted trees. Thirdly, producers may respond by abandoning their sun coffee plots and starting a new plantation in the forest. While this is prohibited under the certification scheme, it is hard to verify.

Effective monitoring and enforcement can ensure that standards are adhered to. While certification standards may be fulfilled in principle, there may be indirect impacts that are difficult to measure. One example is the Renewable Energy Directive of the EU that protects land identified as significant to biodiversity and areas with large carbon stores (such as peatlands) from being converted for the production of biofuels. However, biofuels might displace other land uses that are not protected by the directive. To date there is no methodology that accounts for impacts of indirect land use change in certification schemes (Gawel and Ludwig, submitted).

Certification requires a high level of organization and capacity: Producers with sufficient knowledge, technical capacity and information can implement sustainable production techniques. Unless effective monitoring systems for certification are in place, compliance with standards cannot be guaranteed. This is a particular challenge for developing countries with small-holder producers. Some developing countries have a tradition of production co-operatives that can help to share information and organise certification processes.

Box 9.7 Protection of biodiversity through certification? Forest coffee in Kaffa and Bench Maji Zone, Ethiopia

Ethiopia is the world's sixth largest coffee producing country. Due to its popularity with coffee drinkers worldwide, shade coffee contributes to about 20% of Ethiopia's export earnings. Organic certification of Ethiopian coffee began in the late 1990s and by 2007 a total of 12 forest coffee co-operatives were certified according to Fairtrade Organic (an EU standard) and Utz Certified standards.

Research has shown, however, that forest coffee certification does not necessarily lead to the protection of the forest ecosystem and biodiversity. Certification standards are designed for plantation or sun coffee and not forest coffee. There is evidence that the increased demand and higher profits from certified coffee provides an incentive for coffee farmers to intensify production by slashing the undergrowth and felling larger trees, effectively destroying the forest and its biodiversity.

These findings are not an argument against certification, which can have substantial positive impacts. These findings do, however, illustrate that, in order to avoid indirect and unwanted impacts, an appropriate standard is one that fits the commodity being certified. In the case of Ethiopian forest coffee, a step forward may be to certify the ecosystem coffee forests – not only the coffee or the coffee cooperatives – and to reward sustainable forest management with a price premium.

Source: Certification for forest coffee, Ethiopia. TEEBcase by Till Stellmacher, Ulrike Grote and Jörg Volkmann (see TEEBweb.org)

Supporting governance: Certification is currently not in a position to effectively compensate for weak governance. Forest certification has been most successful in states which have an acceptable forest governance framework (Ebeling and Yasué 2009; Guéneau and Tozzi 2008). However, certification systems with independent reviewers can also help to support governance. An important impact of certification is that it can bring stakeholders together to discuss regional and national standards. That process leading to standards based on exchange and negotiation is valuable. This may also be a stepping stone for the future development of compulsory standards.

9.5 ACTION POINTS: LOCAL POLICY MAKERS ENGAGING IN CERTIFICATION

- **Use available assessment** tools to make sure a standard is appropriate: Is it economically feasible? Ecologically effective? Socially appropriate? Is the ecosystem services perspective useful (see Chapter 2)?
- Establish ways for local governments to **make sure** national and international **schemes reflect the needs of local producers and ecosystem services**. Local support for national and international certification schemes could be conditional on local criteria.
- NGOs and local governments can **offer support to overcome prohibitive upfront costs** that prevent small scale producers from participating in certification schemes.
- Local authorities can play an important role in ensuring that certification schemes offer the **best opportunities to producers in their region**, perhaps even developing their own regional certification schemes.
- Local authorities, NGOs or other stakeholder groups can **facilitate the development of local certification schemes** by providing infrastructure, capacity building, promotional efforts, and advise local producers.

FOR FURTHER INFORMATION

Certification

CREST (undated) Ecotourism Handbooks on Certification I-IV. The user-orientated guide series provides an overview as well as information on funding, marketing, finance of tourism certification programs in an easy accessible format. English and Spanish versions are available at: www.responsibletravel.org/resources/index.html#EcotourismHandbooks;

Cashore et al. (2006) Confronting sustainability: forest certification in developing and transitioning countries. By presenting case studies from around the world, this comprehensive report (617 pages) provides insights into forest certification. environment.research.yale.edu/documents/downloads/o-u/report_8.pdf

Labelling

ICLEI (2006) Buy Fair – A guide to the public purchasing of Fair Trade products. The short leaflet introduces Fair Trade principles and gives advice in how to implement it in public procurement. www.buyfair.org/fileadmin/template/projects/buyfair/files/buyfair_guide_final_www.pdf

IIED (2005) Organic Cotton: A New Development Path for African Smallholders? By presenting case studies from Sub-Saharan Africa this brochure illustrates the multiple benefits of organic cotton. www.iied.org/pubs/pdfs/14512IIED.pdf

Standards

In an effort to achieve sustainable development the German Technical Cooperation GTZ launched its Programme on Social and Environmental Standards. An introduction, guidelines and case studies are available at www.gtz.de/social-ecological-standards.

Information on voluntary standards for sustainable tourism and the recently formed Tourism Sustainability Council (TSC) are available at www.sustainabletourismcriteria.org.

Further sector specific information on certification and eco-labelling is available on websites of the following organisations:

- **Organic agriculture:** IFOAM (International Federation of Organic Agriculture Movements) www.ifoam.org
- **Fisheries:** MSC (Marine Stewardship Council) www.msc.org
- **Forestry:** FSC (Forest Stewardship Council) www.fsc.org, PEFC (Programme for the Endorsement of Forest Certification Schemes) www.pefc.org
- **Sugar cane:** BSI (The Better Sugar Cane Initiative) www.bettersugarcane.com
- **Overarching (agriculture, forestry, tourism):** Rainforest Alliance www.rainforest-alliance.org
- **Carbon credits:** CCB Standards (Climate, Community and Biodiversity Project Design Standards) www.climatestandards.org, Gold Standard www.cdmgoldstandard.org/
- **Environmental and Social Standards:** ISEAL (International Social and Environmental Accreditation and Labelling Alliance) www.isealalliance.org
- **Mining:** ARM (Alliance for Responsible Mining) www.communitymining.org

Awards

Habitat Scroll of Honour: www.unhabitat.org/content.asp?typeid=19&catid=588&cid=6601

European Green Capital: ec.europa.eu/environment/europeangreencapital/index_en.htm

National Wetlands Awards: www.nationalwetlandsawards.org

Japan's Top Eco-City Contest: www.eco-capital.net

Which window leads to the best policy option? Successful strategies take into account different rights to nature's benefits, they consider local knowledge, and they involve stakeholders.

10 MAKING YOUR NATURAL CAPITAL WORK FOR LOCAL DEVELOPMENT

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Content of this chapter

Key Messages

- **We need to change the way we think.** Environmentally oriented policies and public investments are often considered a luxury, rather than life insurance. Other needs and objectives may seem more pressing and desirable. This is a lost opportunity. Natural systems can save on future municipal costs, boost local economies, enhance quality of life and help secure livelihoods.
- **It's easier to see with the lights on.** Understanding the full range of ecosystem services makes trade-offs visible and helps local policy makers make informed choices about different policy options. Examining which services will be enhanced and which ones degraded, can illuminate the various costs and benefits of each policy option – as well as their distribution between different community groups.
- **We can all speak the same language.** The set of ecosystem services provides a common language for stakeholders from different backgrounds. Diverse interests and views can be recognized. This facilitates dialogue and negotiation.
- **You have the tools you need.** TEEB's stepwise approach to considering ecosystem services in local policy can help you identify which analytical procedure and methodology is most appropriate for your situation.
- **Making it happen.** Three issues, beyond the analysis itself, need your attention to make natural capital work for local development: the de facto distribution of rights to nature's benefits; the optimal use of available scientific and experience-based knowledge; and well-informed facilitation of the participatory processes.

"What one needs is not a common future but the future as a commons. A commons is the plurality of life worlds to which all citizens have access. It is not merely the availability of nature as being but of alternative imaginations, skills that survival in the future might require."

Shiv Visvanathan 1991: 383

In the preceding chapters we explored reasons and options for taking an ecosystem services perspective to a range of local policy areas: municipal service provision, spatial planning and impact assessments, natural resource management and extension for rural development, protected area management and market-based instruments for conservation.

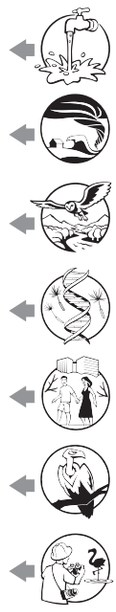
This chapter first synthesizes the key lessons (section 10.1) and then presents typical local policy scenarios where the consideration of ecosystem services would be useful, for example by applying TEEB's stepwise approach (10.2). This leads us to pinpoint three common challenges to many local policy and decision-making processes (10.3). Finally, we provide answers to a series of very practical questions related to making use of the concept of ecosystem services in local policy (10.4).

10.1 ECOSYSTEM SERVICES IN LOCAL POLICY: SOME KEY LESSONS

As illustrated throughout this report, explicitly accounting for nature's potential to provide →*benefits* for →*human well-being* through the appraisal of →*ecosystem services* has significant benefits. It allows us to assess →*trade-offs* involved when building infrastructure or other large-scale projects that affect nature and its services. It also allows us to identify cost-saving options where →*ecosystems* can replace or complement infrastructure, for example, in water management or disaster prevention. With these services nature provides important co-benefits such as habitat, recreation, or biological control. Further, appraising ecosystem services allows us to secure and develop natural →*assets* for the local economy, for example, to support tourism or agriculture. Finally, it helps identify who is affected by environmental changes and how they are affected – bringing local livelihoods to the center of policy attention.

LESSONS: ECONOMIC AND SOCIAL POLICY

- **Sound environmental policy is sensible long-term economic policy.** The ecosystem services perspective helps identify important natural assets. Mindful management helps ensure the long-term functioning of the natural system from which these services flow. Some services (like carbon sequestration) are global in nature while many (indeed most) affect local and regional ecosystems and thus livelihoods.
- Local development efforts often focus on the production of goods and services with a high market price. Intensifying production often results in degrading less visible, equally important, local ecosystem services. From an ecosystem services perspective, large-scale intensive monocultures are often a less attractive land-use option, despite their short term revenue stream. They have side effects. They often decrease water catchment capacity, pollute soils and rivers and degrade the functioning and habitat quality of the wider ecosystem. Even when prioritizing the pressing needs of those living in →*poverty*, this kind of short-sightedness causes problems in the medium term. Instead, **a balanced land-use policy** that maintains a diverse mosaic in the landscape can sustain a healthy natural system, **providing a broad range of ecosystem services**.
- **Official statistics** and national accounting data **rarely capture the →*values* that nature provides** for human well-being and the local economy. If a local fish is sold on a distant market, the value enters the national accounts (measured as 'GDP' or National Income). If it is eaten by the fisher's family or sold or traded locally, this is rarely accounted for in statistics. Local policy can better decide on issues affecting the environment if official numbers and economic →*indicators* are complemented with insights into non-traded parts of the local economy. An ecosystem services perspective is an excellent way to capture such insights. (see TEEB in National Policy, Chapter 3)
- **Sound environmental policy is also good social policy:** in many instances, poor people are most dependent on intact ecosystems. Poverty alleviation is not just about meeting subsistence needs – the issue for local policy makers is to ensure that policies and projects do not unintentionally degrade those ecosystem services upon which the livelihoods of the less well-off depend. The ecosystem services framework makes clear who is most affected by environmental degradation and who benefits most from its protection. This information is essential for choosing the right policy measures.
- **Local government plays a critical role in securing** not only availability of ecosystem services, but also **access** to them. The extent to which the costs and benefits derived from ecosystem services are spread equitably amongst →*stakeholders* is strongly influenced by the quality of local governance. Inadequate or poorly implemented policy or legal systems are likely to result in corruption and rent-seeking by a few powerful people.
- **Costs and benefits** from conserving ecosystems



and their services are unevenly shared between local, national and global policy levels and this has negative consequences for →*ecosystem management*. If benefits occur mainly beyond municipal boundaries, pointing this out can help local governments secure support from higher levels.

LESSONS: ENVIRONMENTAL POLICY AND MANAGEMENT

- The **ecosystem services perspective** facilitates collaboration among diverse actors and agencies. It translates different interests and visions into a common 'language' of 'provisioning', 'regulating', 'supporting' and 'cultural' services. Considering the full set of ecosystem services **makes visible the trade-offs** between different land-use options – and helps to identify options where interests can be made compatible without jeopardizing nature itself.
- Some ecosystem services are more tangible and seemingly 'useful'. Their direct link to local well-being is apparent – examples include freshwater quantity and quality. But other regulating and →*supporting services*, such as maintaining the diversity of microbes in soils, sustain these benefits. We need to be **cautious not to exceed recovery thresholds** of less visible services. Many ecological connections are still poorly understood. Future costs of damage to ecosystems may be enormous.
- There are a **variety of ways to assess ecosystem services**, all with varying degrees of detail and different emphases. A stepwise approach for a first appraisal has been described in Chapter 2 (and is summarized below). Other tools are available to support decision makers in more specific analyses (see end of chapter and annex).
- Participatory appraisal techniques, multi-criteria assessments (MCA), →*monetary valuation* and Cost-Benefit Analysis are different approaches to identify the importance and value of a service. **Monetary valuation is a powerful instrument** for communicating the importance of →*biodiversity* for human well-being. However, monetary valuation of eco-system services **needs to be carefully conducted and interpreted**. Although the outcome may seem 'concrete' (in that precise values are determined), precision may disguise the fact that valuation is often based on assumptions and prognoses that are difficult to validate and predict.
- **Approach is guided by purpose.** The purpose for considering ecosystem services determines which approach to take. Are you revising your municipality's spatial plan? Do you require guidance on a public infrastructure project? Do you want to run a public campaign for securing and enlarging your city's green spaces? Does your marine protected area need more political backing? Do you want your farmers' association to raise funds for conservation from international carbon markets? These, and similar, entry points shape which services are being assessed and how. You choose the assessment instrument. This choice determines the degree of detail you aim for, the time horizon considered and the value of future benefits as opposed to present ones.

10.2 A STEPWISE APPROACH TO APPRAISING NATURE'S BENEFITS

Assessment and valuation of ecosystem services may be carried out in more or less explicit ways, with degrees of intervention in markets and regulation that reflect the problem, the opportunity and the circumstances. TEEB recognizes there are three tiers for taking nature's value into account (see Preface and TEEB Synthesis Report).

- **Recognizing nature's values** (spiritual, social and economic). Spiritual values are reflected in sacred places and in art inspired by nature, while social ones are visible in a person's sense of belonging. Economic recognition includes 'cashable' services as well as often ignored services upon which we equally depend. Where there is consensus within

society on the importance of nature's benefits, attempting monetary valuation is often unnecessary,

- Where there is little consensus and benefit visibility, **demonstrating value** is often required to reach balanced decisions that take into account the full implications on services. Valuation in these circumstances facilitates local policy trade-offs between short-term benefits and long-term cost, between financial gains and quality of life; but also between concrete alternative land-use options and the bundles of ecosystem services they provide. In these situations, economic analysis of ecosystem services provides important insights.
- **Capturing value** involves local policy responses that promote desired use-practices by making them (financially) attractive to individuals, business, or communities. The valuation of ecosystem services is often important to the design of effective regulations and incentives.

In Chapter 2 we outlined a flexible, stepwise approach to appraising the value of nature. According to the specifics of local policy situations, your own effort may focus on recognizing, demonstrating or capturing nature's benefits and the steps may carry different weights. You can adapt them according to your needs.

How can these steps be undertaken in various settings? The following hypothetical scenarios illustrate typical opportunities for applying the TEEB stepwise

Box 10.1 The TEEB stepwise approach to appraising nature's benefits

1. **Specify and agree on the problem**
   This is often a worthwhile effort because views can differ substantially. If key stakeholders share a common understanding of the problem, serious misunderstandings during the decision-making process and implementation can be avoided.
2. **Identify which ecosystem services are relevant**
   Ecosystem services are often interconnected. Identifying which ones are most important to your problem focuses the analysis. Going one by one through the list of services (Chapter 1) is a simple approach.
3. **Define the information needs and select appropriate methods**
   The better you can define your information needs beforehand, the easier it is to select the right analytical method and interpret the findings (Chapter 3). Assessments differ in terms of which services are considered, the depth of detail required, timelines, spatial scope, monetization of the results and other factors. The study design determines what kind of information you get.
4. **Assess expected changes in availability and distribution of ecosystem services**
   If possible, use experts. Also, draw on field work and documented experience from analyses in comparable settings. Use common sense and consult with colleagues on possible changes and their consequences, starting with the most obvious ecosystem services.
5. **Identify and appraise policy options**
   Based on the analysis of expected changes in ecosystem services, identify potential responses. Appraise these in terms of their legal and political feasibility as well as their potential in reaching the targeted quality, quantity and combination of ecosystem services produced by your →*natural capital*.
6. **Assess distributional impacts of policy options**
   Changes in availability or distribution of ecosystem services affects people differently. This should be considered in social impact assessment, either as part of the analysis or as part of appraising policy options.

The relative importance of each step is determined by your situation and objectives. Taken together, adapted to your needs, and incorporated into existing decision-making procedures, they offer guidance for considering natural capital in local policy. Other technical, legal, economic and social information also needs to be considered. The steps can also help you design a monitoring system and thereby track the condition of your natural capital (Chapter 4.3).

approach: decisions on infrastructure, construction, development proposals, agricultural extension and conservation management in protected areas. These cases demonstrate that we cannot apply a fix recipe for assessing and considering ecosystem services in local policy. TEEB's approach is flexible. There are instances where certain steps can and should be omitted, repeated or emphasized. Hopefully, the scenarios encourage developing your own version of the process.

Scenario 1:
Wastewater treatment plant no longer meets water quality standards.

A change in national legislation has increased treatment requirements by lowering acceptable bacterial levels. The added designation of new residential areas will also increase volume to a level that can no longer be handled by your city's plant.

As director of the responsible department, you commission a pre-feasibility study for the construction of a modern plant that meets both quality and quantity requirements. The province-level development bank has an attractive credit scheme to help finance converting an agricultural site, but the costs are high and would require a considerable portion of the city's infrastructure budget. The city council agrees that an alternative solution is needed (Step 1).

At a workshop, you learn about the utility of wetlands for wastewater treatment. This helpful coincidence makes you realize what a preliminary ecosystem services appraisal would have shown (Step 2): There is a wetland in your city close to an abandoned railroad track which is neither accessible nor attractive.

You invite the workshop expert who tells you that the location and condition of your wetland are suitable. He recommends you to determine how much rainwater runoff can be redirected to the wetland for rehabilitation, to examine flood control needs for neighboring settlements and to establish whether redirected waters will reduce the volume flowing to the old plant (Step 3). A team of colleagues consults available data for assessing the ecosystem services involved (Step 4).

Subsequent calculations reveal that this plan is considerably less costly than constructing a new treatment plant (Step 5). It has the added benefit of liberating funds for other infrastructure projects and will not increase citizens' water bills. The area is uninhabited and unused, so an impact analysis on current users is unnecessary (Step 6). A local NGO agrees to help plant the reconstructed wetland and you convince the earthworks company to remove the railroad tracks to make space for a cycling and walking path.

The need to replace or construct new infrastructure presents an opportunity to examine ways to invest in **more green**, instead of grey, **infrastructure** or at least redesign projects in order to minimize damages to ecosystem services and biodiversity. There are many such opportunities: in water provisioning (catchment management instead of water treatment plants), flood regulation (flood plains or mangroves rather than dykes) and landslide prevention (maintaining slopes covered with vegetation). Green infrastructure usually provides additional ecosystem services such as recreational value or →*habitat services*.

Scenario 2:
Public consultations: a proposal to develop the city's port area.

An investor has been asked to develop two alternatives: rehabilitating an old port or constructing a new one. The new facility would be less costly and closer to the industrial area. It would, however, be in your city's protected dunes.

Your mayor has been criticized by conservationists, a neighborhood group and the local chamber of commerce. As a municipal planner, you have been entrusted with organizing a public consultation (Step 1). A colleague from the city's environmental office presents which ecosystem services may be affected (Step 2). The 'old-port alternative' would amount to increasing traffic in the city center. The 'beach alternative' would cut through the city's most attractive weekend destination. Participants remain undecided.

Following fierce press coverage, the mayor commissions an expert group from the university to assess each alternative's economic consequences. They propose to estimate the costs and benefits of the port

in terms of jobs and local taxes. Conservation NGOs insist on examining the less obvious impacts on tourism, coastal protection, the local fishing industry and real estate (Step 3).

The expert group estimates future changes in the involved ecosystem services (Step 4). In a second public consultation, you present the estimates. Participants say the fishery estimates are too high, as catches have continuously diminished. Conversely, the importance people attach to beaches has been underestimated.

City council reviews the two port options with a revised set of monetary and non-monetary estimates (Step 5). They decide in favor of the new port. Local NGOs and citizen groups in favor of protecting the original landscape communicate through the press that the dunes effectively protect against flood waves. This is confirmed by the national office for coastal protection and the project is shifted two miles to avoid affecting the core area of the dunes.

Considering **ecosystem services in large construction projects** such as dams, roads or ports, can provide a more complete picture of construction consequences. Because the stakes are high, you can expect controversy, particularly when monetary valuation of ecosystem services is involved (See also Chapters 4 and 6).

Scenario 3:
An NGO proposes innovative agricultural production methods.

As a local authority or rural extension officer, you have an interest in working with an external NGO that wants to use a new plant variety in pilot sites to improve grazing land. This could substantially lower the risk of overgrazing. With the backing of the national agency for promoting rural development, the NGO requests your support.

You examine their proposal and realize that the new varieties need to be checked for drought resistance (Step 3). After a joint appraisal with the NGO and other colleagues (Step 4), it's determined that the new variety is unsuitable to sloped land because it has high water needs and limited water retention capacity.

You compare alternative sites (Step 5) and decide to relocate some to flat areas. You also learn that the new variety's resistance to a local plant disease is uncertain (Step 3). After consulting with the NGO, you decide to investigate the risk of spreading the disease. Two pilot sites will be surrounded by land known to have resistant plant cover.

You also wonder how the new variety will affect the area's small game populations which are important to the region's poor families (Step 6). The NGO agrees to careful monitoring and to keep you informed of interim results which will be useful to you for future decision making.

Investors and NGO proposals may overlook local particularities. An assessment of ecosystem services, expected project impacts and management measures can help make a project locally relevant (Chapter 5).

Scenario 4:
A simmering conflict over protected area regulations.

As the manager of a newly protected wetland, you oversee conservation of an internationally renowned bird habitat. Strict protection rules have been approved in the central office of the national wildlife agency.

At an information session, several neighboring villagers voice opposition to the new restrictions (Step 1). They are no longer permitted to use the wetland's thatch grass, which they use for roofing and basket weaving (Step 2).

After discussing with colleagues, you conclude that a comparative study of tourism-related income and the costs of lost access is necessary (Step 3). After examination of local thatch prices and national park visitor records (Step 4), your impression is that people benefit more from increased tourism than lose from restricted grass harvest. You learn from consulting with villagers, however, that nature tourism income does not flow to them (Step 4). Young people from the city have been trained to guide foreign bird watchers. You also learn that farmers are complaining about lower yields because they can no longer collect wetland bird feces to fertilize their fields (Step 3).

A local biologist tells you that thatch harvesting rejuvenates bird habitat and is therefore to some extent beneficial to the wetland (Step 4). You discuss alternatives for changing the rules with colleagues and local authorities (Step 5). Issuing permits for thatch harvesting is the most promising solution. You propose it to a senior wildlife agency that agrees to annual harvesting permits for villagers.

This solves one problem but many villagers remain discontent. You propose an additional voluntary charge to birdwatchers to compensate the farmers for losses in yield. This works well after its purpose and history are outlined on a flyer distributed at the park entrance.

Taking a close look at winners and losers, and how potential losses can be compensated for, is a powerful strategy for conflict resolution and avoidance (Chapter 7).

The formulation of a new development plan, decline of traditional economic activities, increasing problems in service provisioning and structural change within the local economy all provide further interesting entry points to **identify** where natural capital can contribute more, where it is already overused or **where potentials lie** to redirect economic development to sustainable activities.

10.3 THREE KEY ISSUES FOR MAKING ECO-SYSTEM SERVICES COUNT IN LOCAL POLICY

The above scenarios demonstrate that including ecosystem services works best when following a flexible recipe. There is room for improvisation and for adapting the analysis to your needs. But environmental issues are always cross-cutting. They rarely abide by the sector responsibilities of public administration. For that reason, local authorities and government agencies can almost always achieve better results if they collaborate – amongst themselves, with civil society organizations and with local communities.

Your insights on ecosystem services enter into local policy and management processes which may be marked by many problems: issues such as corruption, party politics in pre-election periods, pressures from the corporate sector, differences between state and customary law, frictions inside the government hierarchy, high staff turnover and associated loss of capacity, are well known around the world. Also, many environmental challenges are created by economic or political influence beyond local scope – consequently, the room for local policy to respond is often small.

Under such conditions, **how can you make your analysis of ecosystem services count in local policy?** Three issues deserve your attention to effectively employ your insights and make your natural capital work for local development: the de facto distribution of rights to nature's benefits; the optimal use of available scientific and experience-based knowledge; and well-informed facilitation of the participatory processes.

RIGHTS TO NATURE: ECOSYSTEM SERVICES AS PUBLIC, COLLECTIVE AND PRIVATE GOODS

In every location, there is a bundle of ecosystem services. It is not always easy to determine ownership. Timber grown on a private patch of land usually belongs to the land owner – yet many countries require permits for cutting trees, even on private land. Do wild bees pollinating neighboring fields belong to the landowner? In some countries, water flowing from a forest spring is considered private, but what of the enjoyment hikers experience when they stop for a rest by the river? What about the ground water recharge capacity further down in the valley? What about regional climate regulation due to the forest's evapotranspiration? These questions are difficult to answer. They depend on the characteristics of the service itself (Can you delimit its borders? Is it quantifiable?). They also depend on those who benefit from the services and the rules which regulate access to them.

We can characterize rights to ecosystem services by classifying them:

- **private goods**, from which others can be excluded (the fruits in my garden).
- ***→public goods***, where all enjoy more or less similar benefits (micro climate regulation by a city's greenbelt).
- **common property**, where a group of people collectively enjoy and manage a limited service (water through a communal irrigation channel system).

Ecosystem services are interconnected. One ecosystem can provide private, public and collective benefits. Intensifying agriculture may enhance private benefits (such as crop production) that may be connected to fertilizer accumulation in surface waters, resulting in a public loss of water quality. Clearing the forest may improve private yields of shade grown coffee, but it may do so at the cost of public services (maintaining genetic diversity, protecting against erosion and regulating water flows). Inversely, the collective benefits of a pristine tourist destination (such as a beach resort) can lead local government to impose restrictions on private land use near the sea.

Local policy makers need to be aware of the mix of public, private and collective benefits from nature. Focusing on ecosystem services presents an opportunity for **clarifying who has what rights to nature**. This framework facilitates giving equal attention to less visible cultural and regulating services, often public goods. It also illuminates who is dependent on which ecosystem services irrespective of whether formal rights to them have been acknowledged. Recognizing customary rights and considering a community's poor citizens is critical here. Loss or privatization of public/collective services can result in the loss of poor people's crucially needed share. Poor people are rarely in a position to claim or successfully defend their rights.

Local policy decisions often influence which services are accessible for whom – both in legal terms – who is allowed to use the well? and in very practical terms – the well dries out if the forest responsible for ground water recharge has been cut. Therefore, rights and dependence on nature's benefits need to be considered during decision making.

Policy decisions also shape the overall availability of ecosystem services. **Where connections between the services are understood, rules for private, public and collective goods can be mutually supportive in enhancing your natural capital.** National laws that regulate good agricultural practice, such as the use of pesticides, can complement spatial planning at watershed level, a municipal payment scheme for watershed services, or voluntary rules for certified organic farming. Likewise, the development of sustainable nature tourism requires public rules – for example regulating access to an attractive coral reef – to be considerate of public interest and of the needs of private users of ecosystem services, such as tourism operators and fisherfolk.

Policy makers can examine rules and policies through the lens of their impact on availability of ecosystem services and on access to them. This reveals not only the social impact of rules, but also where regulations are counterproductive. Harmonizing regulations on ecosystem services in the public and private sphere has enormous economic and environmental potential.

Modifying rights to nature is a key option for local policy makers. Most economic activity is based on private ecosystem services. For this reason, they are often our main focus. Public and collective goods, however, are also indispensable. They contribute to human well-being and society's welfare. Trees in cities improve temperature regulation and reduce air pollution. This benefits everyone. If an ecosystem service is not recognized as a public benefit ('greenbelts', for example), there is a risk that it will deteriorate. In many cases, it depends on local policy makers whether regulations and incentives can tackle pressures and ensure sustained ecosystem services.

Your setting determines whether state-managed or privatized services fare better than collectively managed ones. In Mexico, large parts of the country are under a unique regime of collective ownership and stewardship called 'ejido'. In 1992 a national law was adopted to promote their conversion to private lands. Despite the law, less than 10% of ejido lands have been privatized since then (Registro Agrario Nacional 2007), partly because community forestry enterprises had developed within the ejido structure. These successfully generated high, yet sustainable, flows of income (Antinori and Bray 2005; Barsimantov et al. 2010).

Protected areas have been managed with varying success either privately, publicly and collectively or in combinations of these (Barrett et al. 2001; Borrini-Feyerabend et al. 2006). Collectively owned and managed forest areas seem at least as effective in conserving biodiversity as state-run protected areas because they tend to develop and maintain site specific rules (Hayes and Ostrom 2005).

Internal and external factors determine which combination of rights, rules and management structures appear most appropriate. This can include connection to external markets or higher level policies. It can also include the ways in which communities depend on local natural →*resources* and services. Factors differ in weight according to context. They have been identified for common property regimes, (Agrawal 2001; Ostrom 1990) and, more generally, for the sustainability of local human-environment systems (Ostrom 2007).

KNOWLEDGE ABOUT NATURE: WHAT SCIENTISTS SEE AND WHAT OTHERS SEE

Handling knowledge effectively is another key issue for making ecosystem services count in local policy. Different kinds of knowledge must be brought together. Our approach to what we know should also account for uncertainty – our knowledge is not exhaustive.

We can understand 'knowledge' as a combination of observations and ideas about how things are connected. A forest means different things to different people. To a local inhabitant, it can be a cherished childhood place. To a professional from a city's water company, it is a catchment. A landowner may see it as a source of timber revenue while a biologist recognizes it as habitat for a rare woodpecker.

The framework of ecosystem services captures all of these views. But for stakeholders it may be a difficult exercise. Appreciating other people's knowledge requires recognizing other worldviews. It also involves understanding that different ideas are expressed in different 'languages'. Biologists do not always grasp the meaning of childhood narratives. Foresters may have trouble interpreting hydrology jargon. Sometimes, people use the same words but mean different things. For instance, what exactly is 'nature'? Plants and animals? Wild landscapes? With humans, or without them? 'Nature' has inspired poets, politicians, engineers and ecologists in very different ways (Hinchliffe 2007; Ingold 2000). In local policy, disregarding such difficulties can lead to great misunderstanding.

We have to make decisions when we are not certain. While science generally knows how ecosystems develop under different circumstances, it is often impossible for researchers to precisely anticipate tipping points. Here site-specific knowledge can be crucial: From experience and local observation insights can be drawn which are key to informing ecological science. Experience-based knowledge can specify assumptions and prognoses from research. Ecosystem science and concepts such as 'critical natural capital' (Farley 2008) can alert decision makers, but to avoid irreversible environmental damage decision makers also need to recur to local observation. Nevertheless we cannot put our finger on the exact moment from which a natural system will not recover but turn into a different state. Precaution is therefore essential.

When knowledge is rather limited, focusing on ecosystem services can provide strong guidance for policy. Determining who depends on which services and in which ways, quickly and effectively identifies critical environmental assets and helps prioritize policy attention.

The lens of ecosystem services invites insight from different knowledge backgrounds. The Millennium Ecosystem Assessment (MA 2003) provides a means to classify different benefits from nature – from 'provisioning' to 'regulating' services and from 'supporting' to 'cultural' services. Such classification may conflict with the experience and worldviews of people who feel these things cannot be separated. However, the framework does important work. It structures debate and draws attention to a broad range of benefits. The framework is also not static. There are options for adapting it to other knowledge systems. Stakeholders can agree on locally appropriate ways to classify services in their

Box 10.2 What role for scientists in local environmental policy?

Scientists can support stakeholders to identify and agree on the problem. They can develop a study design together with stakeholders and conduct an ecosystem services assessment. They also help policy makers in interpreting the results.

Often, scientists are privileged knowledge holders and make use of their expertise to formulate concrete policy recommendations: "This is what you should do!". However, such recommendations imply value judgments or policy trade-offs beyond the scientific realm. Values and trade-offs should be subject to local policy debate. Thus, instead of recommending one best decision, scientists describe the consequences of various alternative options and to leave it to policy makers and stakeholders to discuss and decide about values and trade-offs, based on this information (Pielke 2007).

own way based on how much they depend on them. The framework is also open in terms of how relations between services are described and how their values are expressed.

Bringing scientific and experience-based knowledge together is a particular challenge. Experience-based ecological knowledge from local, traditional or indigenous knowledge-holders often fails to be fully recognized as valuable. This knowledge is rarely expressed in the vocabulary of formal science. In many cases, it reflects the best available site-specific understanding of an ecosystem. Apart from the different languages and worldviews upon which knowledge builds, knowledge ownership is a frequent challenge for bringing together local and external experts. In India, for example, a system to record ecological knowledge in people's biodiversity registers was fiercely opposed, as the rights to the local knowledge (for medical uses, for example) could not be protected.

From a policy perspective, **site-specific environmental knowledge is an important asset**. Local resource-use patterns and cultural practices reflect local expertise (Maffi 2001). Rather than seeking to extract secrets, policy makers should seek to engage with local experts in an open and respectful manner. This can bring an enormous diversity of views and expertise to inform the decision-making process (Berghöfer et al. 2010). But such diversity also requires us to take care when appreciating the quality of diverse local knowledge (Atran et al. 2002). One strategy to verify local knowledge claims is to ask peers

Box 10.3 Recognizing different worldviews

The coastline of Lebanon has been massively developed over the past decades. As a result, the coast is under severe pressure. A UNEP taskforce was set up in the 1990's to support conservation efforts. They identified one bright green spot along Lebanon's coast: the forest of Harissa.

The forest landowner, the Maronite Church of Lebanon, was sent a 48-page scientific, economic and legal document demanding that the Church abide by national and international laws to ensure the future protection of the forest, due to its enormous ecological importance. The Church, which had owned the land for centuries, did not reply. It had guarded the forest because it harbored one of its most important cathedrals. The document had made no mention of the forest's spiritual, cultural and historical significance.

In a follow-up attempt, representatives from a local NGO met the head of the Maronite Church. They made the case for protecting the forest and within half an hour, the church committed to protect the forest in perpetuity. This happened because it made sense in Maronite theology, culture and tradition to protect nature, and in particular this forest – irrespective of scientific arguments.

Source: Adapted from: Palmer and Finlay 2003

Box 10.4 Religion in local environmental policy

Most religions promote taking good care of the earth (www.arcworld.org). This can translate into local environmental action when religious leaders assume responsibility for the environment. Religious leaders may lead by example or seek to directly influence policy. The role of religion in influencing environmental policy cannot be underestimated.

Caring for the earth: Views from religious leaders

- "Islam says that human beings should not use what they don't need. And that they should plan their resources for a future use." Sheikh Mohammad Hossein Fadlallah, Beirut
- "An awareness of the relationship between God and humankind brings a fuller sense of the importance of the relationship between human beings and the natural environment, which is God's creation and which God entrusted to us to guard with wisdom and love." Common Declaration by Pope John Paul II and the Ecumenical Patriarch Bartholomew I
- "We have a responsibility to life, to defend it everywhere, not only against our own sins but also against those of others. We are all passengers together in this same fragile and glorious world." Rabbi Arthur Hertzberg, World Jewish Congress
- "Nature is the closest thing to religion, and religion is the closest thing to God." Sheikh Ali Zein Eddine, Druze Foundation, Lebanon
- "Do not use anything belonging to nature such as oil, coal or forest, at a greater rate than you can replenish it. For example, do not destroy birds, fish, earthworms and even bacteria which play vital ecological roles – once they are annihilated you cannot recreate them." Swami Vibudhesha Teertha, hereditary leader of Vedic teaching, India

For guidance on how to connect religious convictions to environmental action, consult ARC/UNDP (www.windsor2009.org/Guidelines-Long-Term-Commitment-09-11-24.pdf)

Source: www.unep.org/ourplanet/imgversn/142/finlay.html

to comment on them or to have local group discussions about them. Local knowledge cannot be judged by the same criteria as academic science. Each type of knowledge builds on its own equally valid worldview.

PARTICIPATION IN DECISION MAKING: WHO SHOULD BE INVOLVED?

How can acknowledging rights to nature and knowledge about nature support mainstreaming ecosystem services in local policy? Participatory decision making is where knowledge and rights converge.

Stakeholder participation in local policy goes beyond people's right to be part of processes that affect them. Participation is an important element of effective local policy. The credibility and legitimacy of policy efforts is enhanced when there are opportunities for stakeholders to become involved. Also, local perspectives often surface through reflection and dialogue. If well done, participation brings stakeholder concerns to the fore. It can bring different knowledge backgrounds into fruitful exchange, preventing conflicts and strengthening the knowledge base out of which decision are made. Participation can strengthen local environmental awareness and create a sense of ownership regarding decisions. In sum, **participation can improve** both the **quality of decisions** and their **chances of being successfully implemented** (NRC 2008).

Participation means different things to different people. To some, participation is about empowering the poor, to others it is about improving the effectiveness of projects. One way to clarify is to distinguish the degree to which participants share power with those convening the process. Are participants merely being informed? Are they being asked their opinion regarding certain measures? Are they part of the planning processes, and if so, how? Are they consulted

on the objectives of the policy/project? Do they have a formal influence on the final decision? Which degree of power sharing is most appropriate depends on your situation, but **transparency on what participants can expect is key** to a successful process.

In policy settings with divergent worldviews, conflicts can be anticipated by elucidating different knowledge and opinions in participatory processes. This is particularly important in situations of high uncertainty (Renn 2008). Step 1 of the TEEB approach (10.2) emphasizes the need for consensus regarding the problem and its parameters. This can involve exchanges of opinion and negotiation.

Well-conducted participatory processes can also play a key role in bringing to light de facto rights to resources and services – important for dealing with conflicting interests.

Several principles have proved useful for organizing participation (Box 10.5):

There is a direct correlation between the accessibility of information and the utility of the participatory process. A focus on ecosystem services provides information in a format that is very relevant to stakeholders. It **helps identify stakeholder-specific dependencies** on certain services. This helps to outline the implications of policy change on the stakeholders and their activities. The first step to recognizing the social impacts of policy change is agreeing on which stakeholders are dependent on which ecosystem services.

Where people are at risk of losing certain services, their rights need to be taken seriously. This may be a basis for rethinking the original decision, or it may help define adequate compensation. Public consultation on ecosystem services means that conflicting interests and disputes over alternative options are grounded in broadly acceptable information. This helps the debate. And it helps the project or policy proponents who can expect concrete feedback.

A focus on ecosystem services also **makes trade-offs between services visible**. This focus can make plain the implications of each choice. Debate is better informed, based on a clear picture of the social and economic implications of different options. It illuminates what people stand to lose and what people stand to gain. Another virtue of discussing environmental implications in this way is that ecosystem services provide a common language. This builds bridges between distant positions. Through this lens, disparate concerns are made equally visible and valid.

Finally, a **note of caution**: when conducting ecosystem service assessments using participatory processes, the method and its underlying assumptions need to be understood by all. People cannot make informed choices or debate results if they do not understand what is being assessed and how.

Box 10.5 Design principles for facilitating participatory processes

How can participation help people peacefully relate to each other and act together in their own best interest? A challenge! Facilitating participation requires caution in both word and deed. The following principles are helpful guides:

- For each participatory process, organizers should specify: Who participates? On which terms? For what purpose? Stakeholders need to have a clear idea of what they can expect from the process.
- Organizers should analyze (politically and in economic terms), interactions and power relations within the local context as well as between a locality and its wider structural setting. Examining the distribution of ecosystem services provides important insights. If power relations are neglected, the process may be used by those with the most power to capture additional benefits.
- Participation should include everyone directly affected by the decision, as well as those relevant to implementation. Different actors will have different concerns. Bilateral meetings, or 'shuttle diplomacy', can support process facilitation.
- The success of a participatory process largely depends on the trust stakeholders place in it. For this reason, the reliability and transparency of the facilitator are key.

Source: adapted from: Berghöfer and Berghöfer 2006

10.4 TEEB'S ANSWERS TO PRACTICAL QUESTIONS

Why and how should an ecosystem service assessment be conducted? How can I make use of an ecosystem service assessment in local development policy? What follows are answers from a TEEB perspective to practical questions about considering ecosystem services in your own regions, districts, or municipalities.

Question 1:
What do I need to know when commissioning an assessment?

- **What do I need it for?** The typical situations described above give you an idea of the different ways an ecosystem services assessment can support local and regional policy. For precise decision-making support, the assessment needs to incorporate the future impact of several decision options. For an initial analysis for example, a snapshot of your city's green infrastructure may be sufficient.
- **What information and expertise do I already have at my disposal?** If you already know, through experience or common sense, what the assessment will investigate, the assessment is of little added value. If water provisioning is a key service in your region because it is arid, the assessment should focus on different scenarios or policy options, rather than merely confirming what is already evident.
- **What are my resources and time constraints?** If data and capacity is limited, and time is tight, a stepwise approach makes sense. After a rough first appraisal, narrow down your scope and concentrate efforts on further examining those services or areas where more insight seems most helpful. Organize the assessment in such a way that preliminary results are repeatedly discussed and used to guide the next steps of examination. Insist that only the obviously necessary information is generated.

Question 2:
Do I need to clarify the design of the assessment study?

Yes. The TEEB Foundations report summarizes best practice for valuation, but most settings require specific adaptations to the study design. To a significant extent, the design of the assessment determines the kind of information you get out of it. You need to agree on the assumptions upon which the assessment is based (see Chapter 3). If you collaborate with the experts conducting the assessment by being involved in the study design, you can make sure that necessary information is actually produced. You will also know how to interpret results.

The following questions can **help you clarify and agree on the study design**:

- Where do I need monetary estimates? When do I want quantitative and when do I want qualitative results?
- Benefits or costs of changes in ecosystem services may occur beyond municipal borders, and sometimes into the future. Which area do I focus on? Can I have different degrees of detail in my analysis for different parts of the assessment area?
- Which services do I focus on? Are there potentially critical ones amongst those I intend to neglect? Where can analysis of one service give me a good proxy for another one? For which services do I have clear information already – even if it is not labelled as an 'ecosystem service'?
- What is the time horizon I want to consider? This may be a decisive design feature for monetary valuations. The value of a forest differs if you estimate the benefits that flow from it over a period of 10 years or 30 years. Here, the →*'discount rate'* at which you calculate future gains in present terms, strongly affects the result. The higher the discount rate, the less important you consider future benefits compared with today. (see Chapter 3; also TEEB 2008 and TEEB Foundations, Chapter 6).

Question 3:
How can I assess ecosystem services without scientific resources and skills?

An exact assessment of ecosystem services requires a sound understanding of the functioning of the ecosystem which provides the services. An ecosystem services perspective already provides valuable orientation where ecosystems have not been studied in depth. The list of services (Chapter 1) tells you what to look out for. It presents guiding questions that help with a first appraisal. Such questions include:

- Which ecosystem services are central to my local/regional society and economy?
- Who depends on which services?
- Which services are at risk?
- What impact will an action/decision/policy have on the services?

Discussing these questions among peers, using common sense, local expertise and available information can begin to generate a clear picture about the characteristics of the problem and the priorities for action. Likewise, participatory appraisal techniques (Chapter 3) and information from other places about linkages between ecosystem services, or between policy action and services, can give you valuable insights. The ecosystem services perspective orients your analysis and prevents you from neglecting key issues.

We do not present monetary reference values for different ecosystem services here because they vary across different settings. The value of a coral reef for tourism can differ from a few dollars to nearly one million dollars per hectare depending on what kind of infrastructure and connections to the tourism market you have. The TEEB Matrix available on www.teebweb.org recompiles exemplary studies of values for ecosystem services in different socio-economic contexts and →*biomes*. Also, for your own appraisal, Chapter 3 gives you an overview of relevant guidelines and handbooks on valuation methods.

Question 4:
Do I need to calculate total economic value (TEV)?

The →*total economic value* can give you an indication of what you risk losing. It points to value dimensions: use, →*non-use*, option and →*existence values*. Identifying these value categories for different services helps to characterize what we are talking about (See Chapter 2 and 3). Existence and option values can never be calculated as precisely as provisioning services for products with a market.

It is often not necessary and sometimes not appropriate to calculate TEV. Sometimes a project impacts only one service. In order to be sure that other services are minimally affected, you should carry out at least Step 2 (10.2) and explicitly go through all ecosystem services to identify which are relevant to your situation. You might then consciously decide to focus on a few services or on one and choose the appropriate assessment approach (see next question). Further along in the process, it is helpful to mention the assumptions made regarding the other services.

Question 5:
When should I use qualitative assessment?

The situation, and the intended use of assessment results determine what kind of assessment you need. You can choose between (i) a qualitative assessment describing why and how a service is important for local well-being, (ii) a quantitative assessment estimating for example how much a service has changed, and (iii) a monetary assessment expressing the value of a service in money terms. You can also combine different approaches for different services.

It is often useful to first conduct a 'quick and dirty' appraisal, mainly in qualitative terms, to prioritize and specify the need for further analysis. This is particularly useful where the relative importance of services and/or the potential impact of a project are still very unclear, or where there is little scientific expertise available.

When the expected impacts are drastic, it may not be necessary to quantify what is already known to be unacceptable. For example, when a certain pesticide is known to contaminate a water supply or where a species is in acute risk of extinction, the decision may not require more elaborate estimates. 'Recognizing value' is sufficient (compare TEEB Foundations, Chapter 4).

Qualitative assessment also is a better choice where it is considered unethical to value services or species in monetary terms. Assessing in qualitative terms ensures that their value is explicitly considered in the decision-making process.

Question 6:
How can I assess cultural services?

Some cultural services can be assessed and monetized quite easily, such as the value for tourism (see Chapter 3) while inspiration, religious importance or sense of place are better captured in a qualitative manner. Even if services are only identified and discussed, decision makers can be made aware of what these services mean for the population and future development potential. Often, the more urbanized and industrialized an area becomes, the higher the potential value of recreation, health, peace of mind, and inspiration. Good quality enquiry could include questions such as:

- Will our children be able to play in the forests as we did?
- Can I be buried where my ancestors lie?
- Will this still feel like home once large parts of the natural surrounding are transformed in order to allow for construction or industrial development?

Question 7:
What if my results are very different from studies in other places?

In this case the first important step is to analyze and understand why this is so:

- Were all pertinent ecosystem services included in the analysis?
- Is important data missing?
- Are only very few people affected?
- Is the income of this people and/or their purchasing power much lower than in comparable biomes?
- Was a very high or very low discount rate used?

Ecology is often very complex, so be aware that values may differ strongly from place to place. It is therefore important to identify crucial or critical areas (compare Box 2.3)

Question 8:
How long do my estimates remain valid?

There is no clear cut answer to this question. It depends on many factors, from ecosystem to beneficiaries. This is precisely why applying the precautionary principle when managing local nature, or at least identifying potential option values for future development, is so important.

It is useful to identify which variables will have a significant effect on the results if they are adjusted. If these (or proxies) can be monitored, it becomes easier to determine when and what type of updates might be required to ensure that the valuation remains valid.

Question 9:
Are there sound monitoring systems for ecosystem services?

As indicated in section 10.2, there are many different occasions where conducting an assessment of ecosystem services can be beneficial. In the medium and longer term it is beneficial to monitor and stay abreast of the state of important natural resources and the services that flow from them (the stock of natural capital). Again, your monitoring system should respond to your information needs and be adapted to your situation. ecoBUDGET (Chapter 4. 4), is an example of a management system for local natural capital. It in-cludes the agreement on needs-oriented indicators for monitoring.

In 2010 a City Biodiversity Index is being developed under CBD auspices, combining indicators on biodiversity, ecosystem services and environmental policy for urban management (www.cbd.int/authorities).

Question 10:
How do ecosystem service assessments relate to other assessments?

While ecosystem service assessments can inform other monitoring and assessment efforts, they should not duplicate or replace them. They can be incorporated into spatial contexts and their respective tools and management systems (maps, GIS). Several tools exist to incorporate ecosystem services explicitly into management systems and GIS databases. The most comprehensive is InVEST (see Box 6.7 and annex).

A focus on ecosystem services can be incorporated into strategic environmental assessments or environmental impact assessments (Chapter 6). Any social

impact assessment of projects or policies would also benefit from such a focus. Including ecosystem services in other assessments can be the most practical and cost-effective means to explicitly take ecosystems and their services into account. How can this be done? The key issue here is to revise and complement the design of these other assessments, checking which services are already covered and which ones would need to be included.

Often, impact assessments are fixed in a legally required format. When local authorities have to commission, comment on or endorse impact assessments this presents a good opportunity to request that assessment teams expand their focus to include ecosystem services.

Question 11:
How can I make the most of ecosystem service assessments?

Some typical opportunities for taking up an ecosystem services perspective have been described above. They include:

1. making visible the trade-offs among different decision alternatives (land use, infrastructure projects);
2. understanding the social impact of certain environmental changes;
3. making a strong case for wider consideration of your natural capital;
4. adopting a systematic approach for doing so (see the steps described above).

Assessments of ecosystem services can be very helpful when devising local and regional policy response. They can improve the design of incentives schemes and compensations, taxes and charges; rules and regulations; spatial planning and environmental monitoring (See Chapters 4-9).

In order to make the best use of assessments, their function and scope in the policy process needs to be clear to you and to others. For this, it is helpful to adapt your study design to the intended use of the assessment. It is also helpful to be transparent about the assumptions in your assessment when you communicate results. Combine the assessment or valuation of services with other information you draw from. It is important not to allow any debate to be narrowed down only to an estimate of the value of selected ecosystem services. A clear plan for how to insert results into a decision-making process is most important.

Question 12:
How do I involve stakeholders in using results of assessments?

Assessing the availability, future changes or the value of ecosystem services is insightful. This is especially true if services are viewed in the context of other available knowledge, such as business knowledge about the local economy, higher policy level experience concerning the political and legal context and your peers' professional experience in different local policy areas.

It is a good idea to use assessments as input in discussion with stakeholders. This may prompt different interpretations of the results and tease out implications. This is best done if there is sufficient time for it, if results are presented at disaggregated levels (for each service or for each area separately) and if assumptions and assessment methods are understood (though not necessarily agreed upon) by all involved.

Focusing on ecosystem services, and their importance for human well-being, can also provide a common language between different parties. This is the case even where there is no agreement on specific values, or on which services are to be prioritized, in your local setting.

In complex or conflict-prone settings, it is advisable to make use of formal decision-support systems such as multi-criteria assessments (MCA). This does not require additional steps in your process, but is a tool for bringing together insights from different realms in a transparent and recognizable way (see Chapter 3). MCA can be very helpful for structuring difficult decisions regarding trade-offs for your community.

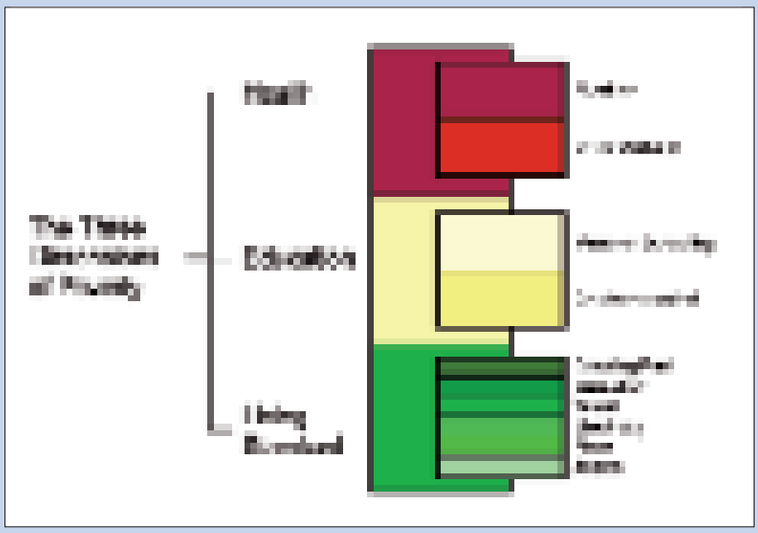
Question 13:
How can I ensure that monetary estimates do not backfire?

In Bulgaria, some years ago, a project estimated the economic value of medicinal plants. This information quickly spread. Eventually, the police had to protect the areas where these wild plants occurred. This shows

Box 10.6 Dimensions and Indicators of Multidimensional Poverty

The Multidimensional Poverty Index focuses on three facets of poverty: health, education and standard of living. The index works with 10 indicators relevant and feasible to study in more than 100 countries (Alkire and Santos 2010). At least 3 of the indicators are directly related to the sustained flow of ecosystem services: (i) malnutrition, (ii) the availability and quality of drinking water; (iii) electricity and other energy sources.

The multidimensional index goes beyond income measure. Policy makers can adapt it to their information needs in twelve steps procedure. They define what aspects of poverty are most relevant, which indicators would be feasible and meaningful to apply. For each indicator a threshold determines from when onwards someone is regarded deprived in regard to the indicator. For example, lack of education may be determined by less then 3, 4 or 5 years of school enrolment. Subsequently, for each indicator the situation of households is assessed and finally, if desired, weighting and aggregation can bring this information into a single score.



In rural subsistence economies, where dependence on ecosystem services is high, their availability and accessibility could function as meaningful indicators.

More details at www.ophi.org.uk/research/multi-dimensional-poverty/how-to-apply-alkire-foster

Source: adapted from Alkire and Santos 2010

there are concrete dangers involved in disclosing or attributing monetary values to ecosystem services.

While monetary estimates are a powerful means of communicating value, the way they are perceived and used in local communities and policy debates cannot be anticipated or controlled. They may take on a life of their own, and persist in the collective memory for a long time while the assumptions and conditions under which the estimates were made are not part of that memory. Numbers can also be used to argue for opposing causes. If calculating future costs of a loss of water catchment capacity and habitat for pollinators gives a very low monetary estimate, even small monetary gains from deforesting land may seem like an attractive choice. It is important to keep in mind that the benefits (from timber, for example) do not replace the losses of the other services if different people are affected or different time periods are considered.

Monetary estimates of ecosystem services can frame the debate about decisions affecting the environment in terms of costs and benefits. While a comprehensive cost-benefit analysis would include existence and option values of all ecosystem services, in most cases we have only partial estimates because only a selection of services have been used to produce the estimate. Omitted services, preferences and arguments need to enter the decision-making process in non-monetary formats. At local policy level, an estimate of a total economic value seems seldom the best choice in face of these difficulties.

Monetary estimates need to be embedded into a chain of arguments or into a multi-criteria analysis if you want to ensure that they do not backfire. Another safeguard is to keep estimates at disaggregate levels. Instead of claiming that green spaces in a town are worth X, you should state that their air quality value is equivalent

to Y and their leisure value is equal to Z. This makes communication more complicated but helps you and your audience in interpreting results.

Question 14:
Why should I examine *WHO* benefits from nature?

Ecosystem services benefit different people or groups in different ways. Making distribution visible is a good precondition for designing policies that contribute to →*equity* and poverty reduction. When designing an ecosystem service assessment, it is important to ask (for each service): 'Who benefits from this service?' and 'Who uses or depends on this service?' For services such as flood control, microclimate regulation or erosion control, a spatially disaggregated analysis can also help identify who are the main beneficiaries and who is at risk of losing a service.

The sustainable livelihoods approach and participatory appraisal techniques (Chapters 2 and 3) provide methods and tools for a more detailed analysis on who depends on ecosystem services. Implications of changes in ecosystem services, especially for the daily life of poorer populations, can often be captured in descriptive terms, such as the time required to access clean water, or the health risks of contaminated water.

To address environmental conflicts, local policy makers benefit from considering the full range of ecosystem services, from obvious to elusive ones. Two things need to be clarified. Firstly: Which services are actually affected? This includes services which are indirectly involved. Secondly: Who has which rights to these services? In combination, responses to these questions can help map conflict lines between different public and private interest holders. This is useful for any conflict resolution strategy.

Question 15:
How can a focus on ecosystem services strengthen the local economy?

Natural capital is an important asset for business. Managing it well can help reduce risks and secure business opportunities. The efficient use of natural resources, and the prevention or limiting of pollution, secures long-term economic growth. Local fisheries are an example of this. There are several options for local policy to improve the use of natural capital – through taxation, specific credit programs and fees or charges. Local policy can also create incentives for citizens and businesses to invest in natural capital.

Local policy can also make rules to guard against very damaging and dangerous practices. A clear understanding of local natural capital provides a good basis for this. Local government, or related organizations such as municipal water companies, can directly invest in ecosystems by buying up land or setting up payment schemes for ecosystem services (Chapter 8).

When restoring nature, it can take a considerable amount of time for services to fully resume. Carefully identify when costs and benefits occur and who will benefit and who will lose. This will help with devising tailored approaches to overcome gaps. Communicating and explaining (to all parties involved) when and how benefits and costs will occur is an important first step. Knowing short-term loss will be compensated by medium-term gain can help mobilize resources and help you to plan accordingly. Many people and firms may not be able to finance the investment using their own resources. Credit lines or easements can help overcome the 'dry spell' before benefits cover costs. Grants or subsidies can cover parts of the initial investment. Other instruments can make an investment accessible to private parties. Make sure support is transitory and compatible with cost and benefit streams.

The same principles apply at the municipal level. Although conserving or restoring nature is often a good investment (TEEB in National Policy, Chapter 9), municipal budgets might not be able to cover costs on their own. State level or development banks might have adequate credit lines. Incentive programs may be set up at the national level. Some foundations set up projects or competitions that can help cover parts of the costs. Selling shares to citizens and involving them in the investment might also be an option.

Transition is not only a financial challenge. Changing how we manage natural resources requires a change in how we relate to nature. It requires a change in how we perceive it and what we value. Investing in wetlands

or degraded forests that have long been considered wastelands is a radical shift from the current ways of doing things. Such changes take time and effort, even when compensation for financial losses occurs. Education and capacity building, which make benefits tangible, can help ease transition. Changes might affect rights (to access or use), knowledge (the definition of nature) and values. Such changes are usually not easy and often involve conflict.

Question 16:
How can I address conflicts over ecosystem services?

Environmental conflicts exist amongst private interest holders and between public and private interests. Current and future interests also play a part. Environmental conflicts occur over resource use rights and the pollution of natural systems. Rights to harvest or pollute are currently being negotiated and renegotiated at an unprecedented speed across many policy levels. Apart from social or political changes at local and regional levels, central government policies and new demands from distant markets can rapidly transform relationships with the natural system. Carbon sequestration values did not exist 15 years ago. Climate change mitigation had not reached the policy sphere.

Addressing conflict takes more than an ecosystem service assessment – but an assessment can help map the conflict lines between different public and private interest holders. It specifies which services are actually affected (including services that are indirectly involved). It also specifies who has which rights to services. Such a map is useful for any conflict resolution strategy. It pinpoints who will be affected by the environmental change (See Further Information).

Question 17:
How does a focus on ecosystem services affect other motivations to protect nature?

A focus on ecosystem services raises awareness about our dependency on a functioning natural environment. Those already concerned about conserving nature because of scientific, aesthetic, cultural or spiritual experiences and rationales, may not need additional insights to convince them of the value of nature. They might even feel pressed when asked to justify their activities with reference to the services they help to secure. This should not be a hurdle if assessment includes cultural and supporting services.

Estimating the monetary value of an area's ecosystem services cannot substitute for other forms of knowledge and appreciation, such as the spiritual importance of a place, its political significance or the emotional attachment people have to it. Instead, a focus on ecosystem services provides arguments and insights which are complementary to other motivations for nature protection. If this is recognized by policy makers, arguments for enhancing and protecting ecosystem services become even more convincing.

In the long-term, we can imagine a rich landscape with diverse protection regimes in different places. Some measures will focus on securing immediately needed services such as water provision through the protection of watersheds (eg funded by water utilities), or climate regulation by protecting forests (eg funded by a REDD+ scheme). Other areas will focus on species conservation (eg funded by conservation organizations).

10.5 CONCLUSION: IT IS BETTER TO ERR ON THE SIDE OF CAUTION

Understanding where, how and why ecosystem services play a role in the local society, economy and culture is essential to prioritizing which services to enhance and how to enhance them. Understanding also makes it possible to consider the implications of imminent local land-use change and of planned projects, programs and policy changes. This is the central claim of our report.

We have offered tools and frameworks for considering ecosystem services in Chapters 2 and 3. We have presented options and experiences with this approach in a range of local/regional policy areas and →*public management* tasks in Chapters 4-9. In this last chapter, we have outlined key governance issues and practical questions for shifting local policy on the basis of stronger environmental arguments.

A focus on ecosystem services makes it clear that a functioning natural system is an indispensable pre-requisite for our well-being. Some of the consequences of degraded services are difficult to quantify even though the connections are well understood. Losing green spaces in cities certainly affects the mental health of city-dwellers – even if calculating the impact of this loss is difficult – and some of the benefits of maintaining ecosystems accrue over many years. We do not know yet, except in a vague sense based on our hypotheses, how important it will be to maintain genetic diversity. Because we do not know what the future has in store, it is prudent for us to err on the side of caution when-ever we are in doubt about the consequences of our actions. Without ecosystem services, life on earth could not be supported. They are essential to our survival. Safeguarding them, quite simply, is common sense.

We simply cannot risk taking nature for granted. Twenty years from now, we may see more clearly the implications of what we are already seeing signs of today. We might understand better how overexploitation affects people and natural systems directly and indirectly. We may also notice that governments, whose strategy is to balance needs with supply, have had a significant positive impact on the environment and quality of life.

Let us consider 'quality of life' as the beacon that orients local policy, recognizing that a healthy environment is our natural life support system. On these terms, visionary leaders of cities and rural communities, working to secure the future of our planet and its people, will ultimately be proven right.

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FOR FURTHER INFORMATION

Identifying Policy Responses

Millennium Ecosystem Assessment 2005. Response Assessment. This volume is a comprehensive collection and analysis of policy options. www.millenniumassessment.org/en/Responses.aspx

Rights to Nature

CAPRI – Collective Action and Property Rights. Online information portal with policy briefs, research papers and training announcements – all on the role of getting rights clarified. www.capri.cgiar.org

R Meinzen-Dick et al. 2010. The role of collective action and property rights in climate change strategies. Policy brief on response strategies to climate change and the importance of collective action and clear property rights in them. www.capri.cgiar.org/pdf/polbrief_07.pdf

P Dasgupta 2006. Common Land – Commercialisation versus Conservation. Policy Brief of SANDEE, examining effects of a shift from collective to private ownership of benefits from nature in rural India. http://idl-bnc.idrc.ca/dspace/bitstream/10625/38935/1/128294.pdf

Kalpavriksh Environment Action Group. Website with reports and analyses of implications of environmental laws on rural residents in India. www.kalpavriksh.org/laws-a-policies/tracking-forest-rights-act-

T Apte 2006. A Simple Guide to Intellectual Property Rights, Biodiversity and Traditional Knowledge. IIED. This handbook introduces the world of Intellectual Property Rights in clear, simple language. www.earthprint.com/productfocus.php?id=14525IIED

Knowledge Management

World Bank: Key Resources for Indigenous Knowledge and Practices. Comprehensive online information portal with studies, links, videos, database on integrating indigenous knowledge in policies and projects. www.worldbank.org/afr/ik/key.htm

D Roux et al. 2006. Bridging the Science–Management Divide: Moving from Unidirectional Knowledge Transfer to Knowledge Interfacing and Sharing. Research article on bringing together knowledge and views from researchers, policy makers and resource managers for better ecosystem management. www.ecologyandsociety.org/vol11/iss1/art4/

Stakeholder Participation

NRC – National Research Council. 2008. Public Participation in Environmental Assessment and Decision Making. An excellent overview report on participation, its practice and principles in environmental policy and management, with focus on US context. www.nap.edu/catalog.php?record_id=12434

C Richards et al. 2004. Policy brief – Practical Approaches to Participation. The Macauley Institute. A hands-on overview to organising stakeholder participation. www.macaulay. ac.uk/socioeconomics/research/SERPpb1.pdf

Portland Development Commission 2008. Public Participation Manual. A detailed stepwise approach to planning and conducting participatory processes in urban contexts. www.pdc.us/public-participation/default.asp

J Seeley et al. 2000. Women's participation in watershed development in India. A review of on the ground experience with national legislation promoting women in watershed management. IIED Gatekeeper Series. www.iied.org/pubs/pdfs/6347IIED.pdf

IBEFISH 2007. Stakeholder Participation towards Ecosystem-Based Approaches to Fisheries Management. A policy brief on tackling challenges with facilitating participation, with focus on EU fishery. www.ymparisto.fi/download.asp?contentid=76426

FISHGOVNET 2005. Interactive Fisheries governance – a guide to better practice. An in-depth guide on participation, rules and policy context in fisheries, based on practical insights from around the world. www.fishgovnet.org/

Public Management

CAPAM – Commonwealth Association for Public Administration & Management. A network for capacity building in the public sector with training programs and an extensive online library on public management. www.capam.org

TOOLS AND DATABASES

DECISION SUPPORT TOOLS

WRI (2008) Ecosystem Services: A guide for decision makers. This easily accessible report frames the link between development and ecosystem service, points out risk and opportunities and provides clear guidance for decision makers (http://www.wri.org/publication/ecosystem-services-a-guide-for-decision-makers).

IUCN WANI toolkit. The IUCN Water and Nature Initiative (WANI) together with 80+ partner organizations have developed a toolkit which includes a guide on the use of valuation. It provides guidance for water management at the local and national level (www.iucn.org/about/work/programmes/water/resources/toolkits).

The Katoomba Group offers PES learning tools for developing agreements for payments for ecosystem services (PES). It outlines important steps for getting started with PES and provides links to further guides (www.katoombagroup.org/learning_tools.php).

Designer Carrots decision support tool. The tool helps decision makers to assess whether market based instruments (MBI) are a suitable tool for solving issues of natural resource management and which type of MBI may be most appropriate. MBI Guide: www.marketbasedinstruments.gov.au/Portals/0/docs/DST_%20final_web.pdf (http://www.marketbased-instruments.gov.au/).

Poverty-Forests Linkages Toolkit. Developed by PROFOR in collaboration with several partners the toolkit includes a set of rapid appraisal methods to gather information on economic as well as other contributions from forests to households, especially the poor (http://www.profor.info/profor/forestry_poverty_toolkit).

CRISTAL (Community-based Risk Screening Tool - Adaptation & Livelihoods) is a tool developed by IISD and IUCN to facilitate the integration of risk reduction and climate adaptation into development strategies of local communities (http://www.iisd.org/pdf/2007/brochure_cristal.pdf).

Ecosystem Services Management: A briefing on relevant public policy development and emerging tools (Fauna & Flora International). The publication provides a brief introduction to markets and assessment tools of ecosystem services (http://www.naturalvalueinitiative.org/download/documents/Publications/Ecosystem_Services_Management.pdf).

BRS (2008) Measuring Corporate Impact on Ecosystems: A Comprehensive Review of New Tools. Overview of some existing tools; presenting their pros and cons to help decision makers in selecting the tool that suits their needs best (www.bsr.org/reports/BSR_EMI_Tools_Application.pdf).

BBOP (Business and Biodiversity Offset Program) Toolkit. Developed by Forest Trends this toolkit provides step-by-step guidance on how to effectively mitigate and avoid an organizations impact on biodiversity (http://bbop.forest-trends.org/guidelines).

ESR (Corporate Ecosystem Services Review). This structured methodology developed by the World Resource Institute helps corporate managers to proactively develop strategies for managing business risks and opportunities arising from their company's dependence and impact on ecosystems (http://www.wri.org/project/ecosystem-services-review).

NVI (Natural Value Initiative) is an assessment approach (toolkit) which enables the finance sector to evaluate how well the food, beverage and tobacco (FBT) sectors are managing biodiversity and ecosystem services risks and opportunities (www.naturalvalueinitiative.org/content/003/303.php).

IBAT (Integrative Biodiversity Assessment Tool) is in development by Conservation International, drawing on rapid ecological assessment methodologies and aims to enable companies to identify potential site specific impacts and risks associated with biodiversity (www.ibatforbusiness.org).

SDRN (2007) Emerging Methods for Sustainability Valuation and Appraisal provides an overview on (valuation) methods (www.sd-research.org.uk/wp-content/uploads/sdrnemsvareview-final.pdf).

Ecosystem-Based Management Tools Network (www.ebmtools.org/) is a database that provides a list of tools for ecosystem-based management in coastal and marine environments (www.smartgrowthtools.org/ebmtools/index.php).

SOFTWARE TOOLS

InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs) is a GIS based tool developed by The Natural Capital Project. It can be used to model and map the delivery, distribution, and economic value of ecosystem services. It helps to visualize the impact of decisions, identify tradeoffs and synergies, and assess possible scenarios including climate change (www.naturalcapitalproject.org/InVEST.html).

CITYgreen by American Forest is a proprietary GIS-based software tool enabling city planners to integrate the benefits of urban forestry in decision making (www.americanforests.org/productsandpubs/citygreen).

MIMES (Multiscale Integrated Models of Ecosystem Services) is available in an early version ("beta plus") from the University of Vermont's Gund Institute for Ecological Economics. www.uvm.edu/giee/mimes

ARIES (Assessment and Research Infrastructure for Ecosystem Services) is under development by the University of Vermont's Ecoinformatics "Collaboratory", Conservation International, Earth Economics, and experts at Wageningen University (esd.uvm.edu).

Marxan is a conservation planning software developed by the University of Queensland, Australia. It supports decision makers with reporting on the performance of existing reserve systems, designing new reserves and developing multiple-use zoning plans (www.uq.edu.au/marxan/index.html).

itree by US DA Forest Service is a toolbox for city planners and urban arborists to integrate tree benefits in landscape architecture and apply urban forest effects model (www.itreetools.org).

Tree benefit calculator is a web-based calculator - base on the itree model - pointing out tree specific benefits in a depictive way, especially to inform and raise awareness about the benefits of neighborhood trees (www.treebenefits.com/calculator).

BGIS (Biodiversity GIS) is a web-based mapping tool providing free information on biodiversity aiming to assists decision makers and spatial planners in South Africa (bgis.sanbi.org).

AGWA The Automated Geospatial Watershed Assessment (AGWA) Tool is a GIS-based watershed management tool that parameterizes and runs two watershed models, KINEROS2 and SWAT. AGWA is designed to provide qualitative estimates of runoff and erosion relative to landscape change (www.tucson.ars.ag.gov/agwa).

Biodiversity Planning Toolkit is developed by the Association of Local Government Ecologists (ALGE) and uses interactive maps to incorporate biodiversity in spatial planning (www.biodiversityplanningtoolkit.com).

DATABASES

Database	Organization	Weblink
Case studies		
Biodiversity Economics	IUCN and WWF	http://biodiversityeconomics.org/library
International Model Forest Network	International Model Forest Network (IMFN)	www.imfn.net/index.php?q=node/4
Database on Ecosystem Services & Sustainable Management	NatureValuation.org	www.fsd.nl/naturevaluation/73764
Natural Capital Database	Natural Capital Project	www.naturalcapitalproject.org/database.html
CCBA Standard	Climate, Community and Biodiversity Alliance	www.climate-standards.org/projects/index.html
Innovation Cases in Forestry	EU, BOKU, EFI	http://cases.boku.ac.at/
Market based instruments		
Species Banking	Ecosystem Market Place Netwok	www.speciesbanking.com/
Ecosystem Service Project	CSIRO	www.ecosystemservicesproject.org/
Networking		
Ecosystem Service Expert Directory	World Resource Institute	http://projects.wri.org/ecosystems/experts
Wiser Earth Network	Wiser Earth	www.wiserearth.org/issues
Indigenous and Community Conserved Areas Registry	UNEP-WCMC	www.iccaregistry.org
Biodiversity and conservation		
World Database on Protected Areas	UNEP-WCMC, IUCN	www.wdpa.org/MultiSelect.aspx
IUCN Red List of Threatened Species	IUCN	www.iucnredlist.org
Biodiversity Hotspots species database	Conservation International	www.biodiversityhotspots.org
BirdLife International data zone	BirdLife International	www.birdlife.org/datazone
Global Biodiversity Information Facility Data Portal	Global Biodiversity Information Facility	http://data.gbif.org
Alliance for Zero Extinction Database	Alliance for Zero Extinction	www.zeroextinction.org/search.cfm
Important Plant Areas (IPA) Database (UK only)	PlantLife International	www.plantlife.org.uk/nature_reserves
General information & research		
Research Ecosystem Services	Stockholm Resilience Center	www.stockholmresilience.org/research/researchthemes.4.aeea46911a312742798 0006208.html
SANDEE research database	SANDEE	www.sandeeonline.org/research_db.php
EcoLex Environmental Law Database	FAO, IUCN, UNEP	www.ecolex.org
EarthTrends Database	World Resource Institute	http://earthtrends.wri.org/searchable_db/index.php?theme=1

GLOSSARY AND ABBREVIATIONS

Altruistic value: The importance which individuals attach to a good or service out of selfless concern for the welfare of others.

Asset: economic resources

Auctions: mechanism for exchange of goods and services by offering bids, receiving bids and then selling the item to the highest bidder

Bequest value: The importance individuals attach to a resource that can be passed on to future generations.

Biodiversity (a contraction of biological diversity): The variability among living organisms, including terrestrial, marine, and other aquatic ecosystems. Biodiversity includes diversity within species, between species, and between ecosystems.

Biological diversity: see Biodiversity

Biome: A large geographic region, characterized by life forms that develop in response to relatively uniform climatic conditions. Examples are tropical rain forest, savanna, desert, tundra.

Certification: A procedure by which a third party gives written assurance that a product, process or service is in conformity with certain standards. (Box 9.1)

Conservation easement: permanent restriction placed on a property to protect some of its associated resources like water quality. The easement is either voluntarily donated or sold by the landowner and constitutes a legally binding agreement.

Cost-effectiveness: referring to the least cost option that meets a particular goal.

Discount rate: A rate used to determine the present value of future benefits. (Box 3.8)

Direct use value (of ecosystems): The benefits derived from the services provided by an ecosystem that are used directly by an economic agent. These include consumptive uses (eg harvesting goods) and nonconsumptive uses (eg enjoyment of scenic beauty). (Chapter 2.2 under TEV)

Driver (direct or indirect): Any natural or human-induced factor that directly or indirectly causes a change in an ecosystem.

Ecological stability or Ecosystem health: A description of the dynamic properties of an ecosystem. An ecosystem is considered stable or healthy if it returns to its original state after a disturbance, exhibits low temporal variability, or does not change dramatically in the face of a disturbance.

Ecological value: Non-monetary assessment of ecosystem integrity, health, or resilience, all of which are important indicators to determine critical thresholds and minimum requirements for ecosystem service provision.

Economic incentives (disincentives): a material reward (or punishment) in return for acting in a particular way which is beneficial (or harmful) to a set goal.

Economic valuation: The process of estimating a value for a particular good or service in a certain context in monetary terms. (Chapter 3.2)

Ecosystem: A dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.

Ecosystem function: A subset of the interactions between ecosystem structure and processes that underpin the capacity of an ecosystem to provide goods and services.

Ecosystem health: see Ecological stability

Ecosystem process: Any change or reaction which occurs within ecosystems, either physical, chemical or biological. Ecosystem processes include decomposition, production, nutrient cycling, and fluxes of nutrients and energy.

Ecosystem services: The direct and indirect contributions of ecosystems to human well-being. The concept 'ecosystem goods and services' is synonymous with ecosystem services.

Ecotourism: Travel undertaken to visit natural sites or regions without harming them.

Equity: Fairness in the distribution of rights and of access to resources, services, or power.

Existence value: The value that individuals place on knowing that a resource exists, even if they never use that resource (also sometimes known as conservation value or passive use value).

Externality: A consequence of an action that affects someone other than the agent undertaking that action and for which the agent is neither compensated nor penalized through the markets. Externalities can be positive or negative.

Governance (of ecosystems): The process of regulating human behavior in accordance with shared ecosystem objectives. The term includes both governmental and nongovernmental mechanisms.

Habitat service: The importance of ecosystems to provide living space for resident and migratory species (thus maintaining the gene pool and nursery service).

Human well-being: A context- and situation-dependent state, comprising basic material for a good life, freedom and choice, health and bodily well-being, good social relations, security, peace of mind, and spiritual experience.

Indicator: Information based on measured data used to represent a particular attribute, characteristic, or property of a system.

Indirect use value: The benefits derived from the goods and services provided by an ecosystem that are used indirectly by an economic agent. For example, drinking water that has been purified as it passed through the ecosystem. (Chapter 2.2 under TEV)

Institutions: The rules that guide how people within societies live, work, and interact with each other. Formal institutions are written or codified rules, such as the constitution, the judiciary laws, the organized market, and property rights. Informal institutions are rules governed by social and behavioral norms of the society, family, or community.

Intrinsic value: The value of someone or something in and for itself, irrespective of its utility for someone else. (Chapter 2.2 under TEV)

Kyoto Protocol: international agreement linked to the United Nations Framework Convention on Climate Change, which sets binding targets for industrialized and developed countries to reduced greenhouse gas emissions

Label: A label or symbol indicating that compliance with specific standards has been verified (Box 9.1)

Market failure: situation in which markets fail to allocate the resources efficiently and effectively due to incomplete information, existence of a dominant firm or externalities

Natural capital: An economic metaphor for the limited stocks of physical and biological resources found on earth. Also referring to the capacity of ecosystems to provide ecosystem services.

Non-use or passive use: Benefits which do not arise from direct or indirect use.(Chapter 2.2 under TEV)

Open access: Accessible to all

Opportunity costs: foregone benefits of not using land/ecosystems in a different way.

Over-exploitation: Use in excess of a sustainable use level

Potential use or Option value: The use(s) to which ecosystem services may be put in the future.

Public goods: A good or service in which the benefit received by any one party does not diminish the availability of the benefits to others, and where access to the good cannot be restricted.

Resilience (of ecosystem): capacity of an ecosystem to tolerate disturbance without collapsing

Revealed preference techniques: Techniques based on observations of consumer behavior.

Services and benefits of ecosystems: see Ecosystem services

Stakeholder: A person, group or organization that has a stake in or is affected by the outcome of a particular activity.

Standard: Documented agreements containing technical specifications to be used consistently as rules, guidelines or definitions, to ensure that materials, products, processes and services are fit for their purpose (Box 9.1)

Substitutability: The degree to which elements can replace each other, e.g. human-made capital vs. natural capital (or vice versa).

Supporting services: Ecosystem services that are necessary for the maintenance of all other ecosystem services. Some examples include biomass production, production of atmospheric oxygen, soil formation and retention, nutrient cycling, water cycling, and provisioning of habitat.

Total economic value (TEV): The value obtained from the various constituents of utilitarian value, including direct use value, indirect use value, option value, quasi-option value, and existence value.

Trade-offs: Management choices that intentionally or otherwise change the type, magnitude, and relative mix of services provided by ecosystems.

Vulnerability: Exposure to contingencies and stress, and the difficulty in coping with them.

LIST OF ABBREVIATIONS

CBA	Cost-Benefit Analysis
CBD	Convention on Biological Diversity
CDM	Clean Development Mechanism
CNC	Critical Natural Capital
EIA	Environmental Impact Assessment
ICCA	Indigenous or Community Conserved Area
KBA	Key Biodiversity Area
LBSAP	Local Biodiversity Strategy and Action Plan
MA	Millennium Ecosystem Assessment
MCA	Multi-Criteria Analysis
PA	Protected Area
PES	Payment for Ecosystem Services
PGS	Participatory Guarantee Systems
REDD	Reducing Emissions from Deforestation and Forest Degradation
SEA	Strategic Environmental Assessment
SLA	Sustainable Livelihoods Approach
TEV	Total Economic Value

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