Integrating Ecosystem Services into Development Planning

A stepwise approach for practitioners based on the TEEB approach

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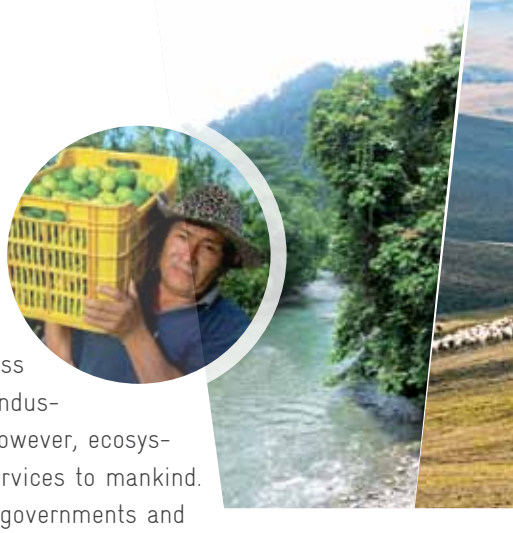
Contents



Preface

People all over the world obtain numerous benefits from nature, such as – for instance – fresh water, nutrition, or a great variety of raw materials. Without these ecosystem services social and economic development, and ultimately human progress and survival, would not be possible. Most individuals, households, businesses and industries depend in some way on nature for their well-being and economic growth. If, however, ecosystems are overused and destroyed, they often cease to provide these fundamental services to mankind. Consequently, there is the risk that development strategies fail and that eventually governments and societies will not be able to bear the long-term economic and social costs and damage associated with the degradation of ecosystems and the loss of biodiversity.

Until now, the true socio-economic and cultural values of the so-called "natural capital" have been frequently overlooked and have only been poorly factored into political and economic decision-making in development planning. Degradation of ecosystems and loss of biodiversity are often the result. The damage to natural ecosystems is subsequently reducing their ability to provide vital goods and services, undermining development and often drastically limiting social and economic opportunities. Factors like climate change and a growing number of natural disasters are worsening the scenario. Furthermore, the increased demand for costly high-end technologies and expensive efforts to restore degraded landscapes have in many cases demonstrated the economic advantages of natural solutions. Making full use of ecosystems services and biodiversity values to address global challenges such as climate change not only makes ecological but also economic sense. It is therefore of critical importance to ensure that ecosystem services are fully incorporated into development planning and measures throughout all sectors.

This guide on Integrating Ecosystem Services into Development Planning (IES) aims to assist advisors, project staff and development planners in partner countries in recognising the links between nature and development. It considers the environmental and economic trade-offs associated with development measures and helps to systematically incorporate ecosystem service-related opportunities and risks into the planning and development of strategies. This step-by-step approach aims to support GIZ programmes and partners to integrate ecosystem services into the design and review of development plans, sector-specific and spatial planning, environmental and climate assessments, as well as into project development and proposal formulation.

The work of GIZ is guided by the principles of sustainability, which builds the core of our corporate values. This guide contributes to the understanding of how these principles can be achieved through capturing the value of ecosystem services and biodiversity for human development in the context of our daily work.

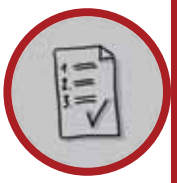
Stephan Paulus
Director, Environment and Climate Change

Summary of the 6-step approach to integrating ecosystem services into development planning

How does the development plan depend and impact on ecosystem services?

Step 1 Defining the scope of assessment and setting the stage

- *What are the main issues that need to be addressed, and to what ends?*
- *Who are the relevant stakeholders, and how should they participate in the process?*
- *What are the process milestones and expected outcomes?*
- *What are the requirements for staff, funds and other inputs?*
- *How are you going to communicate key messages to target groups?*



Step 2 Screening and prioritising ecosystem services

- *How does the development plan depend and impact on ecosystem services?*
- *Who are the main stakeholders that are affected by ecosystem services?*
- *How are the benefits and costs distributed between different groups?*
- *Do potential areas of conflict, competition or synergy emerge?*
- *Which are the priority ecosystem services for the development plan, and why?*

What risks and opportunities do ecosystem services pose to the development plan?

Step 3 Identifying ecosystem service conditions, trends and trade-**offs**

- *What kind of information and evidence related to the condition and trends of ecosystem services exists and what are information gaps?*
- *What are the current conditions and likely future trends in the supply of and demand for the identified ecosystem services?*
- *What and who are the main drivers of change?*
- *What trade-offs might arise between development goals and the ecosystem services, or between stakeholdergroups?*

Step 4 Appraising the institutional and cultural framework

- *Which institutions govern ecosystems and their services? Who participates in these, and in the decisions they make?*
- *Which policies, regulations and other positive or negative incentives influence people's use and management of ecosystems and their services? Who or what do they target, and how are they enforced?*
- *Are there conflicts or inconsistencies between institutional, policy, legal and cultural frameworks, and the incentives they give rise to?*
- *Which other kind of needs, interests and rights drive management choices regarding ecosystems?*

Step 5 Preparing better decisionmaking

- *What ecosystem service-related risks and opportunities to the development plan emerge as a result of the foregoing assessment?*
- *Could economic valuation be useful, and if so what should it cover?*
- *Which are the most feasible policy options and entry points to use to capture ecosystem service opportunities, and reduce or avoid risks?*
- *What kind of experiences (positive and negative) related to the implementation of particular instruments and mechanism already exist in the region, and can be built on?*

Which policy measures can help us to avoid these costs and capture these benefits?

Step 6 Implementing change

- *Are the prioritised policy options realistic, feasible and acceptable and coherent with the development plan?*
- *Are the necessary financial, technical, human resource and institutional capacities in place to deliver the selected policy options?*
- *Who is going to be involved in implementing the policy measures, and in what role?*
- *How will the impacts of the policy measures be monitored?*
- *How will learning be generated, shared and communicated?*

List of Boxes

List of Figures

List of Tables

List of Acronyms

CBD	Convention on Biological Diversity
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
IES	Integrating Ecosystem Services Into Development Planning
MDG	Millennium Development Goal
MEA	Millennium Ecosystem Assessment
NGO	Non-Governmental Organisation
PES	Payments for ecosystem services
TEEB	The Economics of Ecosystems and Biodiversity

PART 1
Introduction and orientation

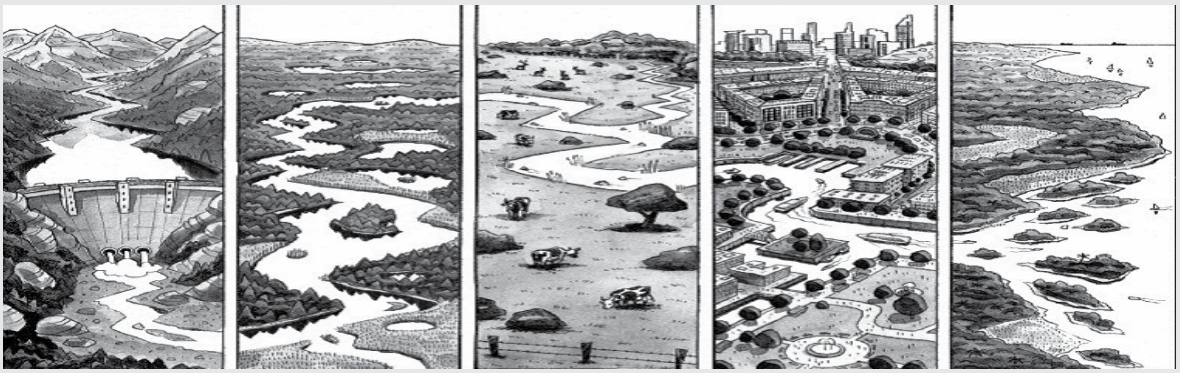
Background to the guide

Why are ecosystem services important to development planning?

Ecosystem degradation is threatening human development. On the one hand, it is clear that transformation of the environmental resource base has contributed to substantial net gains in human well-being and economic development – at least over the short-term, and for some people. On the other hand, this has incurred substantial economic losses, some of which are far reaching in their impacts. Damage to natural ecosystems is undermining their ability to provide vital goods and services, with considerable economic and social consequences. Many of the costs associated with ecosystem degradation are only now becoming apparent.

Ecosystem services can be defined as "the benefits people obtain from ecosystems" (MEA 2005). All natural ecosystems yield economically valuable services (Box 1). Examples include production of food and medicines, regulation of climate and diseases, provision of productive soils and clean water, protection against natural disasters, opportunities for recreation, maintenance of cultural heritage and spiritual benefits, among many others.

Box 1 Ecosystems and their services



Mountains | Lakes & rivers | Grassland | Cities | Coasts

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.
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.
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.
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.
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.

Source: TEEB for Local and Regional Policy Makers (2010). Illustration by Jan Sasse for TEEB

Ecosystem services are central to human survival, and to social and economic development (a topic that we will investigate in more detail below). There are few groups or sectors that do not depend in some way on them. Individuals, households, businesses and industries all rely on ecosystem services for their well-being and growth – and stand to incur significant costs and losses if they are degraded. These harmful effects tend to be borne disproportionately by the poor, who are less able to access or afford alternatives when ecosystem services are lost. Ecosystem degradation is contributing to growing inequities and disparities between groups, and is sometimes the principal factor causing poverty and social conflict (MEA 2005).

It is therefore of critical importance to ensure that ecosystem services are incorporated into development planning, because they are essential to equitable and sustainable growth and development. At the same time, most people and governments cannot afford to bear the long-term economic and social costs associated with ecosystem degradation and loss.

One major challenge is that ecosystem services have long been under-valued in decision-making. The benefits and costs associated with their conservation and degradation have been largely excluded from the economic policies, markets and prices that shape people's production and consumption, investment choices, land use and resource management practices. As a result, economic opportunities have been missed and significant risks to achieving and sustaining positive development outcomes have arisen. This underestimation of the value of ecosystem services in economic terms means that many decisions have been made on the basis of only partial information, thus threatening sustainable and equitable development goals.

What is the objective of the guide?

This guide on Integrating Ecosystem Services Into Development Planning (IES) **aims to assist GIZ project staff and other development planners to recognise the links between nature and development, consider the trade-offs associated with development plans, and incorporate ecosystem service-related opportunities and risks into their development strategies.**

It advocates a stepwise approach to the integration of ecosystem services into development planning. This helps to identify priority services for further consideration, and shows how integration can be achieved in practice. Basically, the assessment process will

(a) d**emonstrate the dependence and impacts of development goals and measures on ecosystem services**,
(b) **generate information on how to reduce the negative impacts and/or increase the supply of ecosystem services that the development plan depends on or affects**, and
(c) **provide concrete options on how to maximise positive linkages** (Box 2).

Box 2 Summary of the IES guide

The IES guide provides guidance to development planners on how to:

- Understand people's dependence and impact on ecosystem services.
- Identify ecosystem services and related ecosystems that are crucial for the success of a development process.
- Assess the conditions and trends of ecosystem services and the resulting risks and opportunities for the development plan.
- Develop strategies and measures to manage the identified risks and opportunities.
- Develop a working plan to implement the selected strategies and measures.

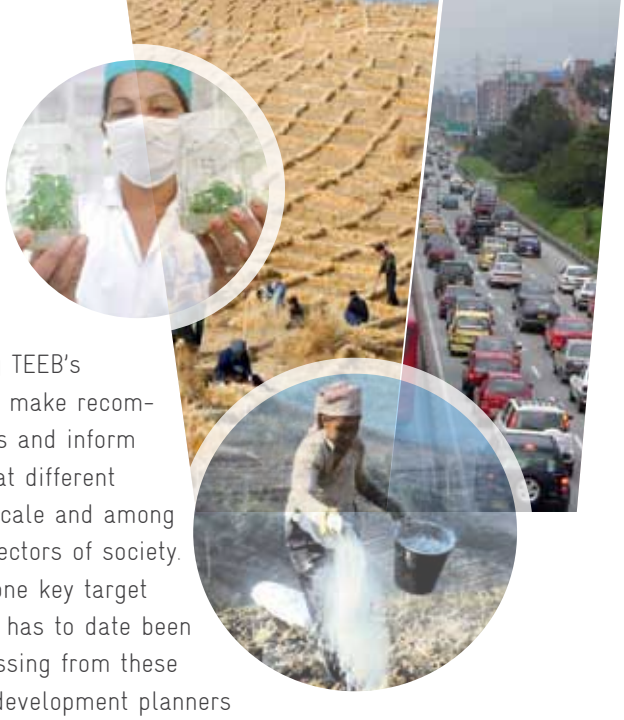
Key sources

The guide is based on **The Economics of Ecosystems and Biodiversity (TEEB)** initiative. It aims to operationalise TEEB's approach and findings in a development planning context.

TEEB was launched in response to a proposal by the G8+5 Environment Ministers in 2007 to develop a global study on the economics of biodiversity loss. It agreed to "initiate the process of analysing the global economic benefit of biological diversity, the costs of

the loss of biodiversity and the failure to take protective measures versus the costs of effective conservation" (TEEB 2010).

The initiative was undertaken as a collaborative effort by more than 500 experts across the globe, compiling in a meta-analysis a huge amount of information, knowledge, good practices and lessons from various scales and policy fields. TEEB showed how economic concepts and tools can help equip society with the means to incorporate the values of nature into decision making at all levels (**Box 3**). It produced a series of reports, each providing tailor-made recommendations and solutions to policymakers, administrators, businesses and individuals on how to incorporate the value of ecosystem services into their decisions.



Across the world, organisations have been using TEEB's findings to make recommendations and inform decisions at different levels of scale and among different sectors of society. However, one key target group that has to date been largely missing from these efforts is development planners working in the field of international co-operation. The guide aims to fill this gap.

Box 3 TEEB's three-tiered approach and stepwise assessment method

TEEB shows how economic concepts and tools can help equip society with the means to incorporate the values of nature into decision making at all levels. TEEB suggests a three-tiered approach to analysing problems and ascertaining suitable policy responses:

- Recognising the value of biodiversity and ecosystems: embedding the knowledge that they are both important and significant.
- Demonstrating the value of biodiversity and ecosystems through integrating information about their benefits and costs into the calculations and indicators that inform and influence decisions.
- Capturing biodiversity and ecosystem values, by using markets, prices and incentives to influence people's economic behaviour.

A stepwise assessment method is proposed to guide local and regional 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.

Source: The Economics of Ecosystems and Biodiversity: Mainstreaming the Economics of Nature: A synthesis of the approach, conclusions and recommendations of TEEB. (TEEB 2010), TEEB for Local and Regional Policy Makers (2010)

Much of the groundwork for TEEB, and for this guide, was laid by the Millennium Ecosystem Assessment (MEA 2005), which provides what has now become the most widely-used framework for understanding ecosystem services and their links to human wellbeing. Initiated in 2001, the MEA was a four-year assessment conducted under the auspices of the United Nations, which involved approximately 1,360 experts from 95 countries. Its objective was to assess the consequences of ecosystem change for human well-being and to establish the scientific basis for actions needed to enhance the conservation and sustainable use of ecosystems and their contributions to human well-being (**Box 4**).

Box 4 The four main findings of the Millennium Ecosystem Assessment

- Over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fibre, and fuel. This has resulted in a substantial and largely irreversible loss in the diversity of life on Earth.
- The changes that have been made to ecosystems have contributed to substantial net gains in human well-being and economic development, but these gains have been achieved at growing costs in the form of the degradation of many ecosystem services, increased risks of nonlinear changes, and the exacerbation of poverty for some groups of people. These problems, unless addressed, will substantially diminish the benefits that future generations obtain from ecosystems.
- The degradation of ecosystem services could grow significantly worse during the first half of this century and is a barrier to achieving the Millennium Development Goals.
- The challenge of reversing the degradation of ecosystems while meeting increasing demands for their services can be partially met under some scenarios that the MEA has considered, but these involve significant changes in policies, institutions, and practices that are not currently under way. Many options exist to conserve or enhance specific ecosystem services in ways that reduce negative trade-offs or that provide positive synergies with other ecosystem services.

Source: Ecosystems and Human Well-being: Synthesis. MEA (2005)

The guide has also been developed based on the Ecosystem Approach of the Convention on Biological Diversity (CBD). The Ecosystem Approach is a comprehensive planning, decision-making and management concept which describes a "strategy for the integrated management of land, water and living resources that promotes conservation and sustainable, equitable use" (SCBD 2004). It recognises that humans, with their cultural diversity, are an integral component of ecosystems. The ecosystem approach also builds on the premise that it is not possible to draw clear lines between different ecosystems, since no ecosystem in the world is entirely separate from the others and none can function as an entirely closed system (**Box 5**).

Box 5 Guiding principles of the ecosystem approach

The CBD has adopted twelve guiding principles of the ecosystem approach as its operational framework, condensed into five main points in order to provide operational guidance:

- Focus on the functional relationships and processes within ecosystems.
- Enhance benefit-sharing.
- Use adaptive management practices.
- Carry out management actions at the appropriate scale for each issue, with decentralisation to the lowest level, as appropriate.
- Ensure inter-sectoral cooperation.

Source: The Ecosystem Approach, (CBD Guidelines). SCBD (2004)

How to use the guide

Content of the guide

The guide is divided into four sections:

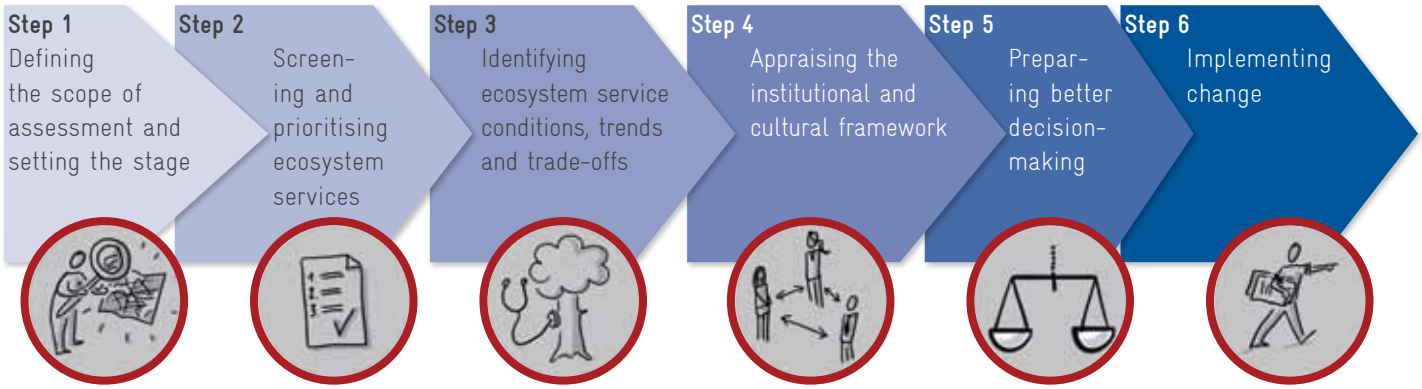
Part 1, introduction and orientation (this section), summarises the rationale for, and the content of, the guide. It also presents a brief overview of its theoretical and conceptual basis. This section discusses the role of ecosystem services in development planning, and provides a number of real-world examples of their links to human well-being. It is particularly important for those who are not yet familiar with ecosystem services. To help the reader, key terms and concepts are further elaborated in red boxes.

Part 2, applying a stepwise approach to integrating ecosystem services into development planning, elaborates the 6-step approach for integrating ecosystem services into development planning processes (**Figure 1**). It starts by giving a general overview of the approach in its entirety, and then goes on to present each step in detail. For every step of the process, the guide explains "what to do", "how to do it" and what the "expected outputs" are. A set of guiding questions are highlighted at the beginning of each section. The questions will steer you through the process of identifying the risks and opportunities resulting from the dependence or impact of your development plan on ecosystem services. Useful hints are given in boxes, which offer additional suggestions to help in the assessment. A worked example of the fictitious Indare Provincial Development Plan is used to illustrate how the approach can be applied.

Part 3, glossary and references, contains a list of useful literature, and explains key terms and concepts that have been used in the guide.

Part 4, information, tools and more, provides additional resources that may prove useful in carrying out an IES assessment. These materials are organised according to topic, and linked to each step of the process. Where the annex contains information that may further elaborate or assist in a particular part of the assessment, this is indicated by a pink box in the main text.

Figure 1 The 6-step approach to IES



When and how to use this guide?

The IES approach offers a structured methodology to help development planners to take into account the risks and opportunities which arise from the dependence and impact of their development plan on ecosystems. It is a flexible and process-oriented approach that is mainly tailored to the needs of projects in the field of international cooperation. The systematic assessment that is embodied in the IES approach

will be an important starting point for implementing policies which are sound in ecosystem terms, and will enhance sustainable development. The resulting information will help identify and prioritise the kinds of responses that need to be integrated into project and programme design.

The guide can be introduced to development planners in several ways. One is, for example, to pilot its use in a new planning process that is just getting underway, to show how it can be of help. Another is to offer training modules on its use to development planners and practitioners, or to support dialogue platforms, information-sharing networks or learning communities on ecosystem services. Routine GIZ programme and project processes offer several opportunities to mainstream an IES approach into development planning (**Box 6**).

Box 6 Opportunities to mainstream an IES approach into GIZ programme and project planning processes

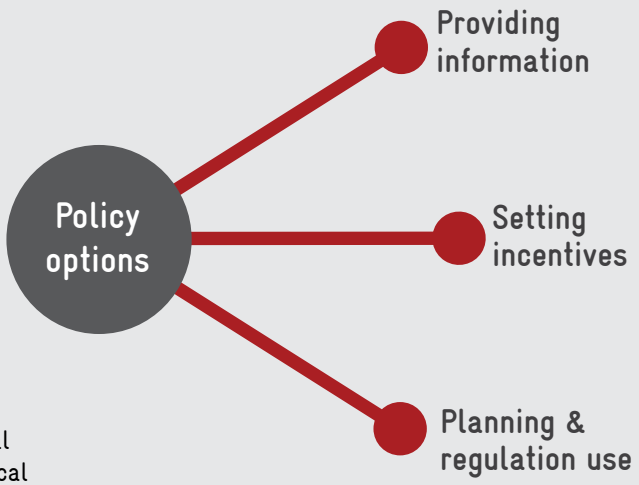
- Formulation and review of (national) development goals.
- Sector specific and/or spatial planning processes.
- Project development and proposal formulation.
- GIZ-Environmental and Climate Assessments.
- Sector networks and working groups.

In principle, the IES approach can be applied at any scale – country-wide, sector specific, or village, company or business scale. Its results are, however, most practical and action-orientated at local and sub-national levels. This is because the assessment process requires specific data, which tends to be more generalised when it is aggregated at a larger scale. The approach is therefore most easily applied, and its results tend to be most robust, when it is used at smaller scales. It can also be applied to any sector. Projects and programmes that have obvious impacts or dependencies on the natural resource base or environment can, in particular, benefit.

In terms of responses, the approach identifies multiple "entry points" for integrating ecosystem services into the implementation of development plans. Various policy options and instruments can be used to provide information, set incentives and plan and regulate ecosystem use (**Box 7**). All of these instruments and measures can easily be mainstreamed into most development plans.

Box 7 Entry points for integrating ecosystem services into development plans

- Information: e.g. indicators and green accounting systems, integrating values of ecosystem services into policy assessment.
- Incentives: e.g. fiscal and market based such as payments for ecosystem services, certification and labelling, reducing harmful subsidies, biodiversity offsets, emissions charges, environmental taxes, etc.
- Planning and regulation: e.g. guiding land use decisions through spatial planning and environmental assessment, protected areas, investments in ecological infrastructure.



Source: adapted from TEEB for Local and Regional Policy Makers (2010)

What is required to implement the IES approach?

The IES approach requires certain technical knowhow and data as inputs. It is also based on a participatory approach to planning, which consults and engages key stakeholders. **Figure 2** provides an overview on the resources required to apply the 6-step approach, and the methods that can be used to obtain appropriate data and information.

Figure 2 Resource requirements and suggested methods for applying the IES approach

	Technical know-how/skills	Data and information	Stakeholder workshop	Expert workshop	Study	Approx. no. weeks required to carry out*
Step 1 	• Process design & facilitation • Development planning • Ecosystem services (general knowledge)	• Development plan and particular measures (existing or new) • Stakeholder overview	✓			1
Step 2 	• Ecosystem services (general knowledge) • Socio-economics	• Economic activities within the scope/ livelihoods	✓	✓		1-2
Step 3 	• Ecosystem services (forestry, ecology, geography, e.g.) • Assessment methods for ecosystems (possibly GIS and ecological models) • Social economics (especially trade-offs and possibly economic models)	• Biophysical data • Land-use systems • Socio-economic data	✓	✓	✓	2-12
Step 4 	• Social/cultural science (e.g. stakeholder analysis, governance)	• Stakeholder characteristics • Incentive structures	✓	✓	✓	2-4
Step 5 	• Development planning • Resource economics • Political science	• Policy options • Best practice	✓	✓	✓	2-4
Step 6 	• Process design & facilitation • Development planning		✓			1

* Depends on the information availability and type and intensity of studies to be conducted.

✓ necessary

✓ optional

The length and cost of the IES assessment will vary, depending on the level of scale being addressed, the number of stakeholders involved, the complexity of the issues at hand, and the amount of detail required. It should however be emphasised that integrating an ecosystem services perspective into development planning need not, and should not, be a costly or difficult exercise. In most situations, we recommend using existing capacities and skills, and building upon existing data and information and filling the gaps where necessary. It is usually not necessary to employ a large number of external consultants or to initiate major new studies.

Nevertheless, in most cases, new perspectives will be required, if ecosystem services are to be fully integrated into the development planning process. It is worth noting that, in order to fully utilise the guide, it will be necessary to prepare the participants in the assessment, especially if the concepts and terminology surrounding ecosystem services are new to them. Some form of training or awareness-building will usually be required.

Understanding ecosystem services in a development context

Seeing the links between ecosystem services and human well-being

It is frequently necessary to justify why an IES approach is required – to your colleagues or within the organisation you are working for, to government counterparts, and to other stakeholders and participants in the development planning process. Although there is a growing body of evidence that **ecosystems** provide services that form core building blocks for pro-poor economic growth (which is elaborated further below), this message does not always seem to have reached development planners.

Biodiversity and ecosystem services are not yet fully **mainstreamed** in development thinking. In all too many cases "environmental sustainability" goals are seen as being distinct from – and sometimes even as conflicting with – "development" goals. In the face of pressing needs for economic growth and poverty reduction, and given the scarcity of public and donor funding, the environment tends to remain a low priority in development planning and policy formulation. A key concern is to effect a shift from the view that ecosystem services are a luxury that development planners cannot afford, to one where they are seen as a necessity that they cannot afford not to invest in (UNDP and UNEP 2008).

Very simply, natural ecosystems are a core part of development infrastructure: the stock of facilities, services and equipment that is needed for the economy and society to function properly and to grow (Emerton 2008). This is because they provide a valuable, and cost-effective, way of delivering on development goals and supporting development processes, especially to the poor. It is frequently far cheaper to maintain ecosystem services than to invest in more expensive – and often less effective – man-made alternatives. Failing to invest in ecosystems is not only short-sighted in economic terms, but the costs, losses and foregone values that result may ultimately undermine many of the gains from efforts at development and poverty reduction. Recognising the correlation between development goals, human well-being and ecosystem services can make the difference between a successful development strategy and one that fails because of unexamined consequences or changes in the flow of ecosystem services and thus on the stated development goals themselves (WRI 2008).

This chapter aims to equip the reader with some of the core arguments and understanding to make the case for integrating ecosystem services into development planning.

KeyTerm/ Concept

The Convention on Biological Diversity defines an ecosystem as "a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit". If one part is damaged it can have an impact on the whole system, and on others. Humans are an integral part of ecosystems. Ecosystems can be terrestrial or marine, inland or coastal, rural or urban. They can also vary in scale from global to local. Examples of ecosystems include deserts, coral reefs, wetlands, forests, grasslands, urban parks and cultivated farmlands.

KeyTerm/ Concept

The systematic integration of biodiversity in development processes is called "biodiversity mainstreaming". The overall goal of biodiversity mainstreaming is to have biodiversity principles included at every stage of the policies, plans, programmes and project cycles, regardless whether international organisations, businesses or governments lead the process.

Another objective of mainstreaming biodiversity is to help reduce the negative impacts that productive sectors exert on biodiversity, particularly outside protected areas, and highlight the contribution of biodiversity to economic development and human well-being, through enhanced collaboration with development sectors and actors.

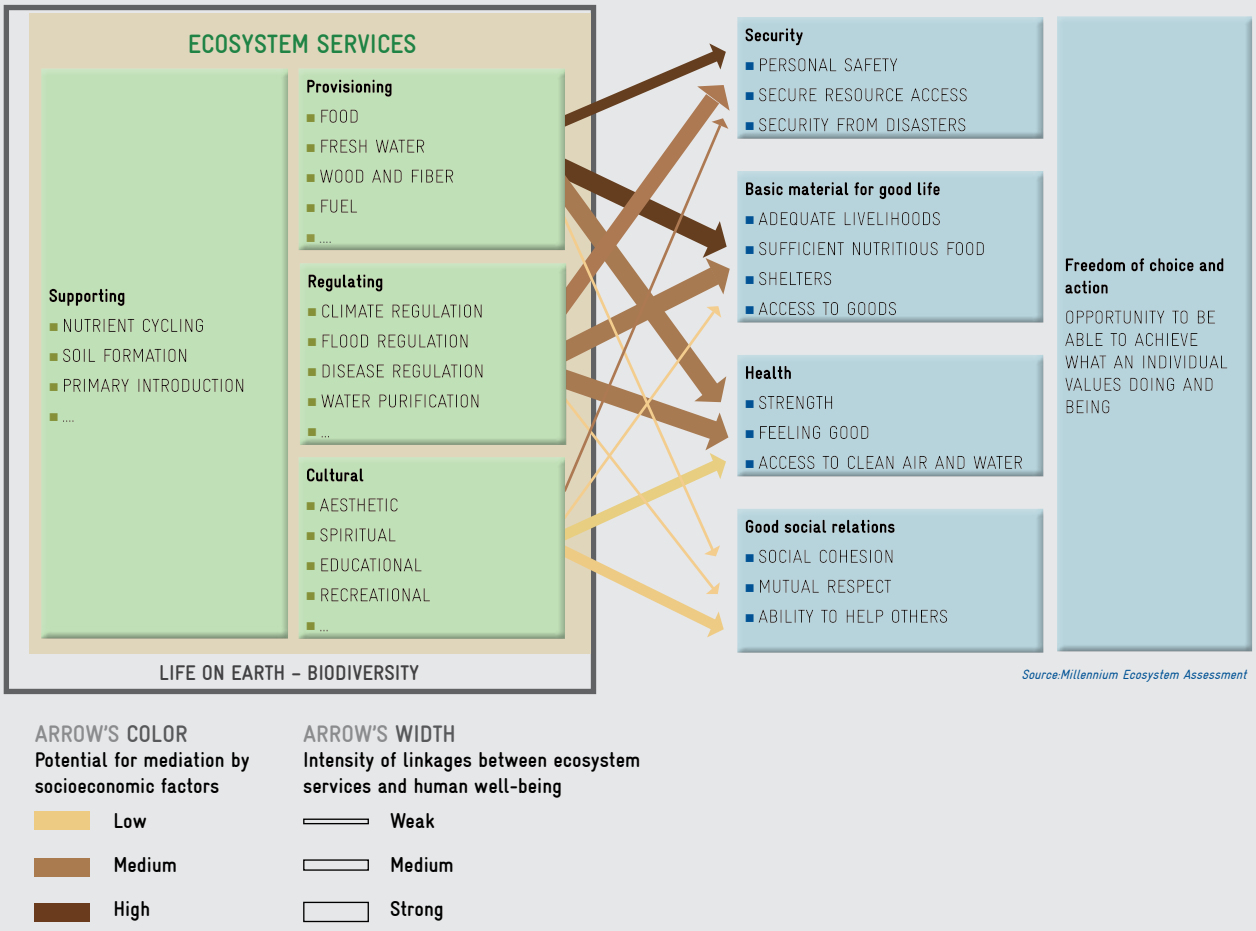
Source: CBD 2010

Understanding ecosystem services

We have already explained in the introduction how ecosystem services **are crucial to human survival, as well as to social and economic development – especially for the poorest and most vulnerable sectors of society.** The IES approach outlined in this guide revolves around identifying and acting on the dependencies and impacts of development processes on ecosystem services, and on the risks and opportunities that ecosystem services pose to development goals.

First, it is necessary to understand just what ecosystem services are. The Millennium Ecosystem Assessment defines four basic categories of ecosystem services ("benefits people obtain from ecosystems"), each of which contributes to and sustains various elements of human and economic wellbeing (**Box 8**). These include **provisioning services** such as food, water, timber, fibre, and genetic resources; **regulating services** such as the regulation of climate, floods, disease, and water quality as well as waste treatment; **supporting services** such as soil formation, pollination, and nutrient cycling; and **cultural services** such as recreation, aesthetic enjoyment, and spiritual fulfilment (MEA 2005). Throughout this guide, this standard categorisation of ecosystem services will be used.

Box 8 Ecosystem services and human well-being



This figure depicts the strength of linkages between categories of ecosystem services and components of human well-being that are commonly encountered, and includes indications of the extent to which it is possible for socioeconomic factors to mediate the linkage. The strength of the linkages and the potential for mediation differ in different ecosystems and regions. In addition to the influence of ecosystem services on human well-being depicted here, other factors – including other environmental factors as well as economic, social, technological, and cultural factor – influence human well-being, and ecosystems are in turn affected by changes in human well-being.

Source: Ecosystems and Human Well-being: Synthesis. MEA (2005)

How ecosystem services underpin sustainable development, poverty alleviation, sectoral output and business performance

It is now useful to consider how and why ecosystem services are of particular relevance to the "bigger picture" goals that are typically targeted by development processes. In this section we give a brief overview of the linkages between ecosystem services and four key development goals: sustainable development, poverty alleviation, sectoral output and business performance. These provide the over-arching context within which the IES approach will, in most cases, be applied. **Box 12**, **Box 13** and **Box 14** provide specific examples of the ways in which ecosystem services generate values, avoid costs and matter to the poor in different countries and locations.

Sustainable development requires that societies only use nature's resources at the rate at which they can be replenished naturally. Maintaining an adequate quantity and quality of ecosystem services obviously plays a critical role in these processes. The sustainable use and management of ecosystems is also key to **poverty alleviation efforts.** While ecosystem services tend to be particularly important to the livelihoods of the poor, their degradation and loss can have devastating impacts on both the well-being of the poor and on efforts to reduce the incidence of poverty (**Box 9**).

The Millennium Development Goals (MDGs) aim to reduce poverty and improve human well-being by 2015, and were agreed to by all 193 United Nations members states following their adoption at the New York Millennium Summit in 2000. They represent a powerful commitment on the part of the global community to address poverty issues. Many development processes aim to contribute towards the MDGs, or have goals which are explicitly phrased in terms of them. It is clear that ecosystem services provide important support to many of the MDGs, while ecosystem degradation and loss pose a major barrier to achieving their agreed targets (**Table 1**).

Almost all **sectoral output** depends in some way on ecosystem services, either directly or indirectly. While these linkages are obvious for the natural resource-based sectors that are based directly on provisioning services (such as forestry, fisheries or agriculture), they are often equally important for other industrial and service sectors (for example health, water and sanitation, energy or urban development). This is largely due to the important role that supporting and regulating services play in enabling, maintaining and protecting production, consumption and infrastructure. Ecosystem services support and underpin sectoral output; they also typically help to minimise costs and expenditures. **Box 10** uses the example of the water and sanitation sector to illustrate the importance of ecosystem services.

Box 9 Why are biodiversity and ecosystem services important for development and poverty alleviation?

The impacts of biodiversity and ecosystem degradation is most severe among people living in poverty, since they have few livelihood options. Therefore, the access to and sustainable use of biodiversity and ecosystem services by the poor are of direct relevance to efforts at poverty alleviation efforts.

- 70% of the world's poor live in rural areas and depend directly on biological diversity for their livelihoods. Biodiversity serves as an important source of food and income for rural households.
- More than 3 billion people depend on marine and coastal biodiversity for their livelihoods, while over 1.6 billion people, including 1 billion living in poverty, rely on forests and non-timber forest products.
- Forests are home to 80% of the remaining terrestrial biodiversity and also provide protection for water resources and reduce the risk of disasters and erosion.

Source: Biodiversity for Development and Poverty Alleviation. CBD (2009)

Table 1 The Millennium Development Goals 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. 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: TEEB for Local and Regional Policy Makers (2010)

Box 10 The value of ecosystem services to the water and sanitation sector

One key example which highlights the economic value of ecosystem services, and the economic costs of their degradation and loss, is our dependence on water. Natural ecosystems, and the services they provide, form a critical – and economic – part of water infrastructure. For example wetlands play an appreciable role in surface, sub-surface and ground water storage, as well as maintaining dry season river flows and attenuating downstream flooding. Many types of wetland also absorb, filter, process and dilute nutrients, pollutants and wastes. Upland vegetation such as grasslands and forests provide land cover which helps to slow the rate of runoff, guard against erosion, even out seasonal peaks and lows in waterflow, and minimise the silt and sediment loads carried downstream.

These services typically yield extremely high economic values for downstream water users, because they underpin water supply and quality, and prolong the lifetime and productivity of infrastructure. At the same time, managing ecosystems for their water services is frequently a far more cost-effective option than employing artificial technologies or taking mitigative measures when these essential functions are lost through environmental degradation (Emerton 2007). Maintaining wetlands for flood control, for instance, is usually substantially cheaper than rebuilding the roads, bridges and buildings that get washed away. Conserving an upstream forest typically costs far less than investing in new water filtration and treatment plants downstream, or undertaking expensive de-siltation activities.

Examples of the economic value of ecosystem services:

- In **Mongolia**, it has been found that every US$1 invested in upper catchment ecosystem conservation generates at least US$15 a year in water benefits for downstream Ulaanbaatar (Emerton et al 2009).
- One wetland area close to **Colombo**, Sri Lanka's capital, has been calculated to be worth several thousand dollars per hectare per year in terms of receiving and treating the major proportion of urban wastewaters and protecting nearby settlements and industries from flooding (Emerton and Kekandula 2003).
- **Wetlands in the Zambezi Basin in Southern Africa** show a net present value of more than US$3 million in flood-related damage reduction, a worth of some US$16 million for groundwater recharge, and water purification and treatment services to an estimated US$45 million (Turpie et al 1999).

Examples of the returns to investing in ecosystems services:

- In **Portland Oregon, Portland Maine and Seattle Washington** it has been found that every US$1 invested in watershed protection can save anywhere from US$7.50 to nearly US$200 in costs for new water treatment and filtration facilities (Reid 2001).
- In **Vientiane, the capital of Lao PDR**, wetlands offer flood attenuation and wastewater treatment services to city-dwellers which save public expenditures to a value of around US$2 million per year (Gerrard 2004).
- Through conserving upstream forests in the **Catskills range, New York City** hopes to have avoided investing an extra US$4-6 billion on infrastructure to maintain the quality of urban water supplies (Isakson 2002).
- In the **Lajeado São José micro-watershed in Brazil**, environmentally sustainable upland management practices save almost US$2,500 per month in downstream domestic water treatment costs (Bassi 2002).

Many development planning processes target, or involve, the private sector. It is therefore important to consider how and why ecosystem services are key to **business performance**, as well as to the broader public interest goals implied by efforts at sustainable development and poverty alleviation. Ecosystem degradation affects business risks and opportunities, and impacts on corporate profits, production and market opportunities (**Box 11**). Companies and industries are now increasingly recognising that considering ecosystem services in decision-making can help them to address a wide range of issues and topics more effectively, helping to optimise and sustain profits, access new markets and investment possibilities, meet consumer and shareholder demands, and comply with regulatory and legal requirements (**Figure 3**).

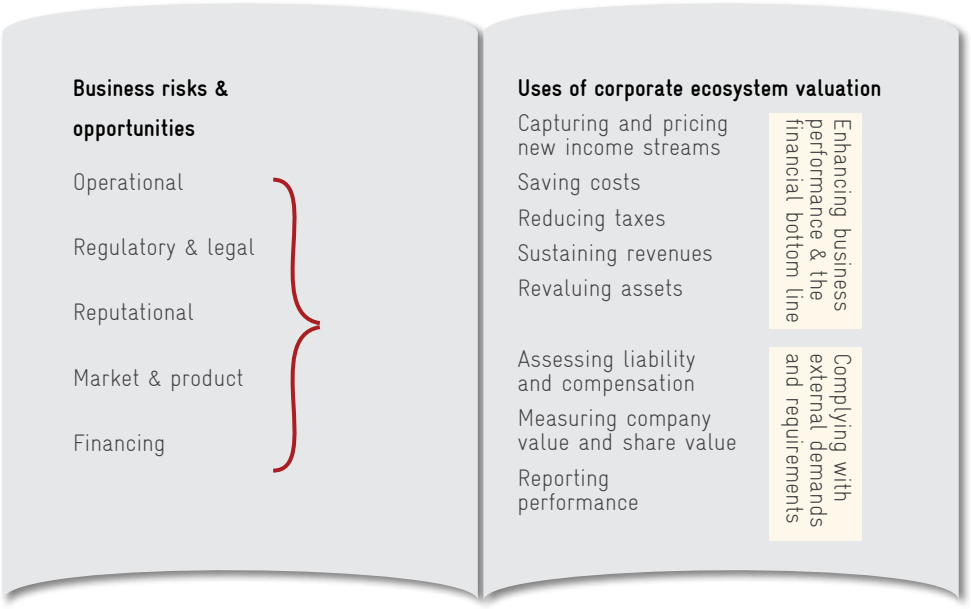
Box 11 Why do ecosystem services matter to business?

Ecosystem degradation presents a real, and increasingly pressing, risk to business operations. Meanwhile, ecosystem services are providing a growing number of opportunities to build and strengthen businesses. The international market in biodiversity offsets is, for example, now worth a few billion dollars, while global trade in carbon is worth over a hundred billion dollars a year, and sustainable natural resource-based business opportunities are counted in trillions of dollars.

- The global carbon market grew from virtually nothing in 2004 to over US$ 140 billion in 2009.
- The current global biodiversity offset market is worth a minimum US$ 3 billion and is expected to grow rapidly.
- Sustainability-related global business opportunities in natural resources may be in the order of US$ 2-6 trillion by 2050.
- The cost of global environmental externalities was nearly US$ 7 trillion (11% of the value of the global economy) in 2008, with the largest 3,000 companies causing around 35% of them.
- 55% of corporate executives believe biodiversity should be among the top ten items on the corporate agenda, and 59% believe biodiversity is more of an opportunity than a risk for their companies.

Source: Guide to Corporate Ecosystem Valuation – A framework for improving corporate decision-making. WBCSD (2011)

Figure 3 The business benefits of factoring ecosystem service values into decision-making



Source: Corporate Ecosystem Valuation – Building the business case. WBCSD (2009b)

Box 12 How ecosystem services generate values

- Forestry accounts for more than 10 % of GDP in many of the world's poorest countries. In all developing countries taken together, the forestry sector provides formal employment for 10 million people and informal employment for another 30 to 50 million people. In Cameroon, the Central African Republic and Liberia, forests make up from just under 30 % to more than 40 % of national exports (OECD 2008). In the Seychelles, environmental goods and services contribute up to a quarter of all employment opportunities, one-third of government revenues and two-thirds of foreign exchange earnings (Emerton 1997).
- Across many parts of the developing world, fuelwood is the primary source of household energy, although this is rarely reflected fully in energy sector estimates. In Zambia, 70 % of national energy requirements are met by fuelwood obtained from forests and trees on farm; in Mozambique, 80 %; in Malawi, about 90 %; and in Tanzania, 97 % (Ecoforum 2001).
- In parts of Indonesia, the traditional use of mangrove products has been valued at over US$3,000/ha/year, contributing up to a half of the income of the poorest households (Ruitenbeek 1992). On the Baluchistan coast of Pakistan, mangroves directly contribute around US$1,300/ha/year to in-shore fisheries, and are responsible for providing the nursery and breeding habitat upon which up to half of off-shore commercial fish stocks depend (Baig and Iftikhar 2007).
- Healthy coral reefs in the Caribbean provide shoreline protection services estimated to be worth between US$2,000 per square kilometre in virtually unpopulated areas and US$1 million per square kilometre in densely settled and developed areas (Burke and Maidens 2004).
- The present value of sustainable upland forest management to the Paute hydroelectric scheme in the Andean Highlands of Ecuador – as reflected in increased power revenues, lower dredging costs and an extension of the dam's lifespan – were calculated to range between US$15 million and US$40 million, demonstrating that upper watershed management is in the direct economic interest of the power sector (Southgate and Macke 1989).
- In times of severe drought, Djibouti's pastoral population relies on emergency foods collected from woodlands. Since these food supplies can be worth up to US$2 million, this makes for large tangible savings on the part of the government and donors in terms of food relief expenditures (Emerton 1999).
- In the Democratic Republic of the Congo, wild foods comprise around one-third of household production. Wild meat, fish and plants contribute 3 %, 6 % and 10 %, respectively, of the total value of the food consumed in the household, corresponding to 0.04, 0.06 and 0.11 kilograms per day, respectively. They also make an important contribution to household income – thus indirectly increasing food security – generating twice as much for household sales as crops (De Merode, Homewood and Cowlishaw 2003).
- About three-quarters of all flowering plants rely on birds, bees and other pollinators to help them reproduce. Bee pollination is thought to be responsible for about US$15 billion annually in crop value in the United States (Sumner and Boriss 2006). On a global scale, many fruits, vegetables and stimulant crops (e.g. tobacco, coffee and tea) are highly or totally dependent on insects for pollination. A recent study found that the total economic value of pollination worldwide amounted to €153 billion, representing 9.4 % of the value of world agricultural production used for human food (Gallai et al 2007).

Source: UNDP and UNEP (2008) Making the Economic Case: A Primer on the Economic Arguments for Mainstreaming Poverty-Environment Linkages into Development Planning. UNDP-UNEP Poverty-Environment Initiative,Nairobi.

Box 13 How ecosystem services help to avoid costs

- **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 mil-

lion 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 neighbouring 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. TEEBcase, see TEEBweb.org).

Source: TEEB for Local and Regional Policy Makers 2010

Box 14 The importance of ecosystem services to the poor

- Work carried out in **rural Zimbabwe** demonstrates that environmental resources make a significant contribution to the income of most households. For the poorest quintile, however, their relative role is by far the greatest: around 40% of total income (Cavendish 1999).
- In an **urban area of northern Bolivia**, it was found that more than half the residents participated in one way or another in the Brazil nut and palm heart industries; members of the poorest income group were most dependent on this source of livelihood, obtaining almost half their income from it (Stoian 2003).
- A study of **villages in the Indian Himalayas** found that the poor relied on natural resources for about 25% of their income, as compared to less than 5% for the rich (Reddy and Chakravarty 1999).
- **Nam Et and Phou Loei Protected Areas in Lao PDR** are located in the north of the country in an area where three quarters of the population are classified as poor, with a per capita GDP of just half of the national average. Unsurprisingly, the economic value of Nam Et and Phou Loei is significant. On average wild plants and animals contribute over a quarter of cash income and 40% of total production and consumption for local households. This cash income alone is more than double the entire annual development budget of central government and donors working in the Province. For the poorest households these figures rise considerably, to almost half of cash earnings and more than 60% of overall consumption. (Emerton et al 2002).
- In **Mtanza-Msona Village in eastern Tanzania** (where more than a third of the population live below the poverty line) the local value of woodland and wetland resources is equivalent to just over US$107 or 37% of GDP, and their relative importance grows as household poverty increases. They are worth almost eight times as much as all other sources of farm and off-farm production for the poorest households in the village. The value of plant-based medicines is almost 15 times as high as purchased drugs and 'modern' treatment, and the wide range of wild foods harvested is worth more than 14 times as much as households' annual expenditures on food from the market. (Kasthala et al 2008).
- In a **highland community in Mexico's Sierra de Manantlán Biosphere Reserve**, it was found that the collection and sale of non-timber forest products was almost exclusively undertaken by women. Sales of such products ranked as the most important source of cash income for 30% of the women interviewed, and either the second or third most important for the remainder (Marshall and Newton 2003).
- In **central Kampala**, more than a million urban dwellers rely on Nakivubo swamp for wastewater retention and purification services. These ecosystem services have been calculated to be worth several thousand dollars per hectare per year. Nakivubo fills a critical gap between the level of basic sanitation and clean water services that a poor urban population requires for an adequate standard of living, and that which the government is currently able to provide through existing infrastructure (Emerton et al 1999).

Source: Emerton 2008, UNDP and UNEP 2009

Making the case for integrating ecosystem services

Unfortunately, **ecosystem service values have not, traditionally, been considered when the costs and benefits of different development options, activities and investments are weighed up.** With few exceptions, the official figures used by governments and donors to track economic performance massively underestimate their contribution. Conventional techniques for project and programme appraisal have also largely failed to consider ecosystem service costs and benefits. At best, development planning has traditionally focused on provisioning services such as food, fibre and fresh water, which already have a value in the market place (WRI 2009). These are the services that are most directly associated with urgent and obvious development goals such as food security, income generation, employment, health and nutrition. But, while it has long been recognised that all these goals are closely linked to provisioning services, the less obvious contribution of supporting, regulating and cultural services has usually not been taken into account. In many cases this has led to unintended negative economic costs or losses, and has failed to capture potentially beneficial opportunities to generate income, employment and other development benefits.

Numerous examples of the high economic benefits that ecosystem services yield for human well-being and development processes, and of the expenditures and losses they help to avoid now exist, across different countries and development sectors (**Box 12, Box 13, Box 14**). These kinds of economic evidence and arguments can provide an extremely powerful tool for persuading development planners and decision-makers of the wisdom of acknowledging the contribution of ecosystem services to pro-poor growth, to buy into policies that encourage their sustainable use and management, and to ensure that adequate resources are invested in ecosystems. It is however worth underlining that, however good your data and evidence, they will have little impact or influence over decision-makers unless they are packaged carefully and communicated effectively so as to make a credible and persuasive economic case for mainstreaming ecosystem services into development planning (UNDP and UNEP 2008). Communication therefore is an integral part of the IES approach outlined in this guide.

Presenting the evidence of ecosystem service degradation

The world's ecosystems are under threat. Most types of natural habitats are showing signs of severe degradation, wild populations of fauna and flora are declining, and land, air and water are all becoming more and more polluted (WBCSD 2009b). A complex series of **drivers** underlie these trends.

The Millennium Ecosystem Assessment, perhaps the most comprehensive audit ever of the condition of the world's ecosystems, revealed that all of the earth's ecosystems have been transformed in some way through human actions in the past 50 years (MEA 2005). The interim report of TEEB further elaborates that forests have shrunk by about 40% in the past 300 years, the world has lost about half of its wetlands since the beginning of the 20th century, and a third of coral reefs have been seriously damaged through fishing, pollution, disease and coral bleaching (TEEB 2008).

This has severely compromised the ability of ecosystems to deliver the provisioning, regulating, supporting and cultural services that are of such importance to human well-being. The MEA concluded that more than 60% of the world's ecosystems, on which human well-being depend, are being degraded or used in an unsustainable way. Almost all of these changes have occurred due to anthropogenic influences, mostly as the result of economic and development pressures (**Box 15**).

A driver of biodiversity and ecosystem loss is any natural or human-induced factor that directly or indirectly causes biodiversity loss (IUCN 2010).

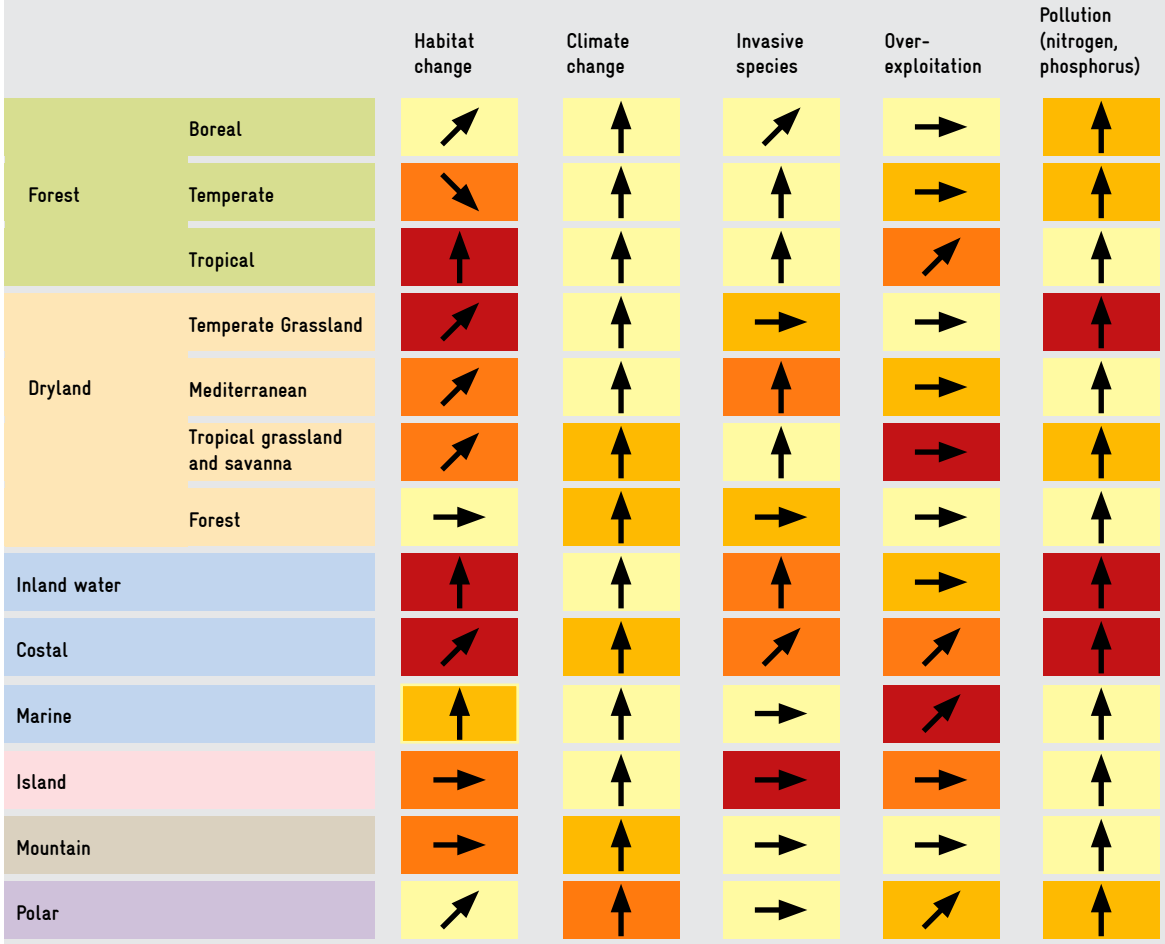
Some of the most important direct drivers are:

- *Habitat loss and degradation*
- *Excessive nutrient load and other forms of pollution*
- *Over-exploitation and unsustainable use*
- *Invasive alien species; and*
- *Climate change*

Indirect drivers are factors that contribute to changes in the direct drivers of ecosystem services. They are often the underlying causes for the direct drivers. Important indirect drivers include changes in population, economic activity, and technology, as well as socio-political and cultural factors.

Box 15 **Direct drivers of ecosystem and biodiversity change**

Most of the direct drivers of change in ecosystems and biodiversity currently remain constant or are growing in intensity in most ecosystems. The most important direct drivers of change in ecosystems are habitat change (land use change and physical modification of rivers or water withdrawal from rivers), overexploitation, invasive alien species, pollution, and climate change. The cell colour indicates the impact of each driver on biodiversity in each type of ecosystem over the past 50–100 years. High impact means that over the last century the particular driver has significantly altered biodiversity in that biome; low impact indicates that it has had little influence on biodiversity in the biome. The arrows indicate the trend in the driver. Horizontal arrows indicate a continuation of the current level of impact; diagonal and vertical arrows indicate progressively increasing trends in impact. Thus for example, if an ecosystem had experienced a very high impact of a particular driver in the past century (such as the impact of invasive species on islands), a horizontal arrow indicates that this very high impact is likely to continue. The figure presents global impacts and trends that may be different from those in specific regions.



Source: Millennium Ecosystem Assessment

Source: Ecosystems and Human Well-being: Synthesis. MEA (2005)

Factoring in ecosystem service trade-offs and synergies

Integrating ecosystem services into development planning almost inevitably necessitates some form of **trade-off**. These arise from the land and resource management choices made by humans, which change the type, magnitude, and relative mix of services provided by ecosystems (Rodrîguez et al 2005).

Trade-offs involve achieving a balance between different, usually competing and sometimes conflicting, development and ecosystem goals (**Box 16**). Some ecosystem services are mutually exclusive. It is not possible, for instance, to manage the same forest area for both intensive timber production and habitat protection. Changes in the quantity or quality of one ecosystem service frequently affect the supply of other ecosystem services or economic benefits. This is particularly the case when decisions need to be made which involve balancing an increase in provisioning services against the maintenance of supporting, regulating and cultural services. The expansion or intensification of agriculture can, for example, increase food security, but it can also give rise to the loss of wildlife habitat, nutrient runoff, sedimentation of waterways, greenhouse gas emissions, and agrochemical pollution. While an increased supply of electricity, irrigation water and fisheries production may be benefits of dam construction, this might affect other ecosystem services such as downstream waterflow, flood protection, and the supporting services of riparian and wetland habitats. The trade-offs reached may be reversible or irreversible; in the latter case, the long-term outcome is a permanent change in the level and mix of ecosystem services which are generated by a certain site or for a particular group of stakeholders.

Trade-offs are a balance or compromise achieved between two competing, conflicting or incompatible features. They arise from management choices or actions that intentionally or otherwise alter the quantity or quality of an ecosystem service in order to achieve a goal. For example, the extraction of timber for economic reasons affects the provision of other ecosystem services (e.g. carbon sequestration, water quality, landscape beauty) over time. Many decisions and choices affecting ecosystems result in trade-offs and technology, as well as socio-political and cultural factors.

Box 16 Examples of ecosystem service trade-offs

- **Vulture decline in India:** The recent sudden decline of Gyps vultures in eastern India provides a compelling example of how species declines can cause declines in provision of many ecosystem services, illuminating unexpected synergies among species and socio-ecological processes. Vultures play an important role as natural garbage collectors in many parts of India. In the last few years, vulture numbers suddenly declined (linked to the use of the veterinary drug diclofenac), with consequences that cascaded throughout the region in terms of health and other impacts associated with solid waste management.
- **Lakeshore Development in the northern United States:** Property values surrounding lakes in northern Wisconsin in the United States are strongly linked to the development patterns around the lake. During the last 30 years, there has been a substantial increase in the development and building on lake shores. The initial conversion of these lakes from undeveloped to developed shorelines resulted in an increase in property values around these waters. Although development was accompanied by an initial increase in cultural ecosystem services, changes in shoreline vegetation resulted in increased sedimentation, reduction of the amount of habitat available for fishes and a decrease in fish growth rates.
- **Fisheries and Tourism in the Caribbean:** Jamaica and Bonaire. Many ecosystem services are provided by the Caribbean Sea. Two of the most prized are fisheries and recreation. Then, in the early 1980s, two extreme events hit Jamaican coral reefs, causing their collapse: Hurricane Allen, and an unidentified disease that killed 99% of black-spined sea urchins. Without the ecosystem services provided by grazing fish or sea urchins, fleshy macroalgae came to dominate coral reefs. The lucrative dive tourism industry in Jamaica declined.
- **Fertiliser Use in the United States:** Intensive agriculture within the United States has resulted in massive soil loss throughout the Mississippi drainage region. The initial conversion of land in this area from prairie and grassland to agriculture was motivated by an interest in increasing food production. To maintain high levels of crop output

in spite of topsoil erosion, farmers have maintained soil fertility through the addition of either natural (manure) or chemical fertilizers. The effects of the high level of artificial fertilization have also resulted in massive changes in downstream areas: many small-scale changes by individual farmers on their own fields have resulted in the creation of a hypoxic zone (a "dead zone") in the Gulf of Mexico, affecting the shrimp fishery as well as in other local fisheries.

- **Mine Effluent Remediation by Natural Wetlands on the Kafue River, Zambia:** An example from Zambia demonstrates a trade-off in which protection of an extensive, unique ecosystem is achieved through the degradation of smaller, upstream wetland systems. The Kafue River originates along the watershed between Zambia and the Democratic Republic of the Congo 100 kilometres northeast of the industrialised Copperbelt mining region. It is the dominant source of water and food for various urban and rural settlements and enterprises. Mining-related contamination of the Copperbelt's water resources has been a matter of great concern over the past decades. Although wetlands throughout the Copperbelt have been affected and degraded as a result of the discharge of mine effluent, these systems have given a considerable level of protection to the downstream ecosystem through the filtration, retention, and remediation of effluent contaminants within the wetland sediment and flora.
- **No-take Zones in St. Lucia:** The Soufrière Marine Management Area, created in 1995 along 11 kilometres of the coast of St. Lucia in the Caribbean, includes five small marine reserves alternating with areas where fishing is allowed. The initial cost of restricting access to fishers in about a third of the available area (a decline in a provisioning ecosystem service) has been easily compensated for by the benefits. As may be expected, fish biomass inside the reserves tripled in just four years, but, more important, biomass in the fished areas doubled during the same period and remained stable thereafter.
- **Lobster Fishing in Maine:** The lobster fishery provides important provisioning services such as food and economic well-being for communities. The development of harbour cooperatives for social enforcement of regulations also provides members and communities with a sense of identity, which is important for social reinforcement of informal regulations on the fishery. The cultural services provided by the lobster cooperatives may have also had synergistic effects, because one of the contributing factors to the current lobster boom is an increased conservation attitude among lobster fishers. This "win-win" outcome in a fairly small-scale system was a product of synergistic interactions among ecosystem services and it helped play a part in the lobster boom and maintain the cultural identity of the lobster communities.
- **Water Quality and Biological Invaders in the U.S. Laurentian Great Lakes:** Beginning about 1870, a set of connected canals was opened in Chicago, Illinois, that reversed the flow of the Chicago River. The purpose of the engineering project was to flush waste from the burgeoning number of human households and slaughterhouses away from Lake Michigan, the drinking water supply for the growing city. Over time these became important conduits for commercial and recreational navigation, as well as a huge open sewer. Because the canal was filled largely with untreated sewage and animal waste, dissolved oxygen concentrations were too low for most organisms to survive for many miles downstream in the Des Plaines and Illinois rivers. This caused a complete loss of riverine fisheries until the 1970s, when Clean Water Act regulations made the waterway habitable again for fish and other organisms. Paradoxically, the consequence of improved water quality in the last three decades has been a surge in invasive species moving in both directions in the canal. The best documented example is the rapid spread of zebra mussels. The consequence of zebra mussel spread within the Great Lakes has been $100 million in annual costs to the power industry and other users, extirpation of native clams in Lake St. Clair, and large changes in energy flow and ecosystem function.
- **Flood Control by the Three Gorges Dam in China:** The construction of the Three Gorges Dam in China is an effort to provide a technological substitution for the ecosystem services of flood control while also producing electricity through hydropower. Flood control is important for the well-being of the millions of people, mostly rice farmers, who live on the floodplain of the Yangtze. Construction of the dam will have other effects as well, however: Once the dam is full, levels of schistosomiasis near Chongqing, at the north end of the impoundment, are predicted to rise dramatically as a consequence of the decreased water speed. The capacity of the Yangtze to remove wastes, including industrial effluent and sewage, will also be significantly reduced. Water quality within the long, narrow impounded area is likely to decline. The reservoir that resulted from the construction of the Three Gorges Dam has necessitated the relocation of around 2 million people and caused flooding of numerous villages and historical monuments.
- **Dryland Salinisation in Australia:** Dryland salinisation has been a major issue facing farmers in Australia since the 1930s. It was not until the late 1980s and early 1990s, however, that the problem moved from being individual to collective. To increase agricultural production, many farmers cleared the original woody vegetation and replaced it with pastures and crops. The natural tree landscape of Australia had provided an important but undervalued regulating service by maintaining the groundwater at low enough levels that salts were not carried upwards through the soil. Once the woody vegetation was removed, the groundwater table moved toward the surface, bringing salt into the surface soils. As the salt content in soils increases, lands become unusable for traditional agriculture.

Source: Rodrìguez et al 2005

Such sources of competition or conflict are often unintended, and do not necessarily arise as the consequence of an explicit choice by decision-makers to prioritise one ecosystem service or development alternative (or its beneficiary group) over others. They are sometimes difficult to discern, as changes in ecosystem services are frequently separated from the development actions that triggered them – either **temporally** (e.g. a short-term focus on agricultural production may lead to the longer-term loss of soil quality), spatially (e.g. the construction of a hydropower scheme has an effect on those living lower down the watershed), **sectorally** (e.g. the conversion of forest habitat for settlement and construction may also impact on local food security, health status and enterprise development) or **socially** (e.g. downstream pastoralists may be affected by the loss of floodplain grazing that arises due to water diversion for urban use). Of course these changes may also be positive, when a development action in one place or time generates unexpected ecosystem service benefits for others (for example when new hydrological works on a river lead to the restoration of downstream wetlands, or when small business development reduces commercial exploitation pressures on a nearby forest). The fact however remains that the groups that are affected by changes in the supply of ecosystem services are often not the same as those who benefit from the changes to ecosystems.

Applying an IES approach implies that the elements of these trade-offs, and the groups they impact, are made explicit and factored into the development planning and decision-making process. Both the opportunity costs and the externalities associated with choosing to pursue a particular land or resource use option, investment choice or development activity are considered. Consideration of these effects (and of the groups they impact) is often omitted from more conventional approaches to development planning and appraisal. **The IES approach attempts to avoid the negative trade-offs that arise as a result of the loss of ecosystem services, and maximise the positive trade-offs between development actions and ecosystem service benefits.** The intention of integrating ecosystem services into development planning is to level the playing field: to enable decisions to be made on the basis of the best possible information, and to identify where unavoidable consequences may require some form of remediation or mitigation.

KeyTerm/ Concept

*An **externality** can be defined as the positive or negative consequence of an economic activity that is experienced by unrelated third parties, that is not reflected in the price of the goods or services being produced and for which no compensation is paid or received. These costs or losses are felt by others, by the wider economy, or even as trans-boundary effects or by future generations. An example of a positive environmental externality is when one landholder's investment in upper catchment conservation benefits other downstream users. An example of a negative externality is when the abstraction of water upstream leaves insufficient flow or quality for human and natural systems downstream.*

***Opportunity costs** are the value to the economy of a good, service or resource in its next best alternative use. They are the benefits that are foregone or diminished by choosing to use land, resources or ecosystem services in a particular way.*

Source: Emerton and Howard 2008

PART 2

Applying a stepwise approach to integrating ecosystem services into development planning

Overview of the steps

The stepwise IES approach aims to provide practitioners with a practical and policy-relevant framework for integrating ecosystem services into development planning. **Figure 4** summarises these steps, which are then described in detail in the following chapters.

Figure 4 Overview of steps in the IES approach

Step	Short description
Step 1 Defining the scope	 • The first step is all about establishing the objectives and process design: defining the objective(s), the scope, and main stakeholders to be involved.
Step 2 Screening and prioritising	 • The second step will help you prioritise the ecosystem services which are most relevant to the development plan and its key intended beneficiaries/target groups. Try to focus on 3-6 ecosystem services considered to be sources of risk or opportunity to your development plan in order to produce concrete results. This step will also help you identify users of the ecosystem services that may affect or be affected by the development plan.
Step 3 Identifying conditions, trends and trade-offs	 • In this step the current status and main trends in the supply and demand for the selected ecosystem services are analysed. A draft situation analysis will be conducted to assess the present state of the ecosystem services and an analysis will be made of likely future changes in demand and supply. Subsequently, you will assess key drivers affecting the ecosystem services in the scope and possible future trends resulting from changes in the drivers. This step will illustrate the cause-and-effect relationships within your scope.
Step 4 Appraising the institutional and cultural framework	 • This step will give you an overview of the institutional and cultural framework. It will include analysis of the policies, regulations and informal rules that directly or indirectly affect your key ecosystem services, as well as the key institutions and traditional authorities that influence ecosystem management. This information will help you understand the underlying causes of the existing drivers affecting the ecosystem services. The results will be important for identifying and weighing possible measures in the next step.
Step 5 Preparing better decision-making	 • First summarize the main risks and opportunities for your development plan using the information gathered before. Based on the identified risks and opportunities you will appraise different policy options and instruments in order to maintain or increase the flow of the selected ecosystem services related to your development plan, and to reduce or avoid any negative effects on ecosystem services and their users arising from the development plan. Build on the information generated during the previous steps to identify entry points to key decision-making processes. Determine if an economic valuation of your priority ecosystem services could be a useful tool for enhancing the incorporation of those values into the development plan.
Step 6 Implementing change	 • In this step you will define your implementation strategy and a concrete working plan including policies and instruments, stakeholder involvement, responsibilities and actions, as well as financial resources.

Guiding questions

- What are the main development/management issues that need to be addressed, and to what ends?
- Who are the relevant stakeholders, and how should they participate in the process?
- What are the process milestones and expected outcomes?
- What are the requirements for staff, funds and other inputs?
- How are you going to communicate key messages to target groups?

- How does the development plan depend and impact on ecosystem services?
- Which are the main stakeholders that are affected by ecosystem services?
- How are the benefits and costs distributed between different groups?
- Do potential areas of conflict, competition or synergy emerge?
- Which are the priority ecosystem services for the development plan, and why?

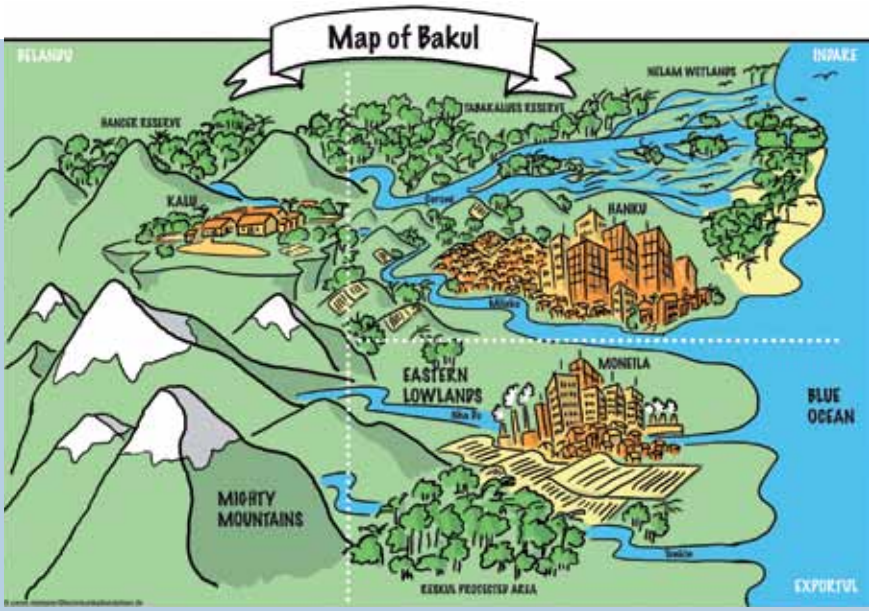
- What kind of information and evidence related to the condition and trends of ecosystem services exists and what are information gaps?
- What are the current conditions and likely future trends in the supply of and demand for the identified ecosystem services?
- What and who are the main drivers of change?
- What trade-offs might arise between development goals and the ecosystem services, or between stakeholder groups?

- Which institutions govern ecosystems and their services? Who participates in these, and in the decisions they make?
- Which policies, regulations and other positive or negative incentives influence people's use and management of ecosystems and their services? Who or what do they target, and how are they enforced?
- Are there conflicts or inconsistencies between institutional, policy, legal and cultural frameworks, and the incentives they give rise to?
- Which other kind of needs, interests and rights drive management choices regarding ecosystems?

- What ecosystem service-related risks and opportunities to the development plan emerge as a result of the foregoing assessment?
- Could economic valuation be useful, and if so what should it cover?
- Which are the most feasible policy options and entry points to use to capture ecosystem service opportunities, and reduce or avoid risks?
- What kind of experiences (positive and negative) related to the implementation of particular instruments and mechanisms already exist in the region, and can be built on?

- Are the prioritised policy options realistic, feasible, acceptable and coherent with the development plan?
- Are there the necessary financial, technical, human resource and institutional capacities to deliver on the selected policy options?
- Who is going to be involved in implementing the policy measures, and in what role?
- How will the impacts of the policy measures be monitored?
- How will learning be generated, shared and communicated?

Indare Provincial Development Plan, Bakul



The country of Bakul has been "created" for the purpose of illustrating how an IES approach can be applied. Although it is a fictitious place, the conditions that are described draw heavily on experiences gained from the real world.

Bakul is an upper middle-income country (as defined by the World Bank), with a market-oriented economy. Its per capita income is estimated at US$5,000 and it has a relatively high Human Development Index score of 0.72.

Historically, the country's economic performance has depended heavily on exports, which provide hard currency to finance imports and external debt payments. Although these exports have provided substantial revenue, income is unequally distributed. According to the latest national poverty assessment, 30 % of the population is classified as poor, including 10 % that is extremely poor. The incidence of poverty is particularly marked among the indigenous, forest-dwelling population who occupy highland areas, while income gaps have also been growing among smallholder farmers in rural areas. The agricultural sector generates more than half of the national GDP.

Bakul is a small and beautiful country with great natural and cultural diversity. The Mighty Mountains split the country into two main geographical regions: the western highlands and the eastern lowlands. Hanku, the largest city and capital of the country is located on the eastern coast in the province of Indare. The coastal city of Moneila in the south-eastern province of Exportul is however considered the economic centre of Bakul. Around the country there are other commercial centres, the most important of which is Kalu, in the western highlands province of Belandu. Economic activity in Belandu is dominated by dairy farming in the highland pastures of of the Milaku River watershed.

Recent months have been especially hard for the province of Indare. The dry season lasted longer than usual, and the Milaku River almost dried out. Now the wet season has been unusually rainy. Over the last month a large part of the Milaku River catchment area and even the capital Hanku have seen the worst flooding in living memory, forcing the evacuation of some settlements and a shutdown of the water purification plant.

During the last meeting of the Indare Provincial Development Committee, several members expressed their concern about recent events. This resulted from their growing awareness of the ways in which environmental degradation has exacerbated – and in some cases even caused – the Province's vulnerability to disasters. The current Provincial Development Plan was thought to need revision, to try and avoid such events in the future.

- Promote biofuels by encouraging private sector participation in crop production and the construction of a biofuel plant.
- Improve the water quality and supply, through the construction of a larger water purification plant for Hanku.
- Enhance timber export.
- Develop ecological and community-based tourism.
- Improve the quality and productivity of cacao for export.
- Enhance food security.

Step 1 Defining the scope of assessment and setting the stage

Guiding Questions

- *What are the main development/management issues that need to be addressed, and to what ends?*
- *Who are the relevant stakeholders, and how should they participate in the process?*
- *What are the process milestones and expected outcomes?*
- *What are the requirements for staff, funds and other inputs?*
- *How are you going to communicate key messages to target groups?*

What to do?

The first step of the IES approach is a preparatory one. **It defines the objectives and the scope of the assessment.** This includes considering the sectoral and geographical focus, the main issues or management challenges to be addressed, and the key ecosystem services and main stakeholders to be involved. It also involves organising logistical and scheduling aspects such as the staffing, funding and tasks that are required to carry out the assessment, and its timeline. Its purpose is also to demarcate clearly the boundaries of the assessment. By the end of step 1, there should be a clear plan for how the assessment will proceed, which has been discussed and agreed with key stakeholders.

The objectives and scope of the assessment will depend on the specific development plan that is being considered. Remember that where and how to start the assessment, as well as what and who it will include, will be determined by the ways in which development process you are looking at interacts with ecosystem services. The intended outcome of the IES process should also be kept in mind at the design stage, as the assessment should be geared towards these overarching objectives:

- To understand the dependence and impact of development goals and measures on ecosystem services.
- To provide information about how to avoid negative trade-offs and achieve beneficial ones.
- To identify concrete options to maximise positive linkages and synergies between ecosystem services and development goals.

Useful Hints

- *Be prepared to refine the scope as the assessment proceeds. Over time, it may prove useful to reduce or expand the focus, or to engage new stakeholders.*
- *Consider adjusting the timing of your assessment to coincide with data availability, or to coincide with other studies which will yield relevant information.*
- *Keep in mind that the broader the approach is, the more resources you will need! Try to keep the assessment as clear and targeted as possible.*
- *Do not forget that the involvement of key stakeholders is essential, from the start – both to identify the full range of ecosystem dependencies and impacts, and to successfully address them.*

How to do it?

The initial decision about the scope and boundaries of the assessment will usually be made by the main decision-makers in the particular development planning process that is being scrutinised, with the assistance of technical experts. They will broadly define the key development and ecosystem service issues that need to be examined in more detail. As mentioned above, important elements to consider include the focus, process and inputs of the assessment, as well as its intended outputs. Several tools can assist in deciding on these parameters, such as internal meetings and brainstorming sessions, and the collation and synthesis of relevant literature and data.

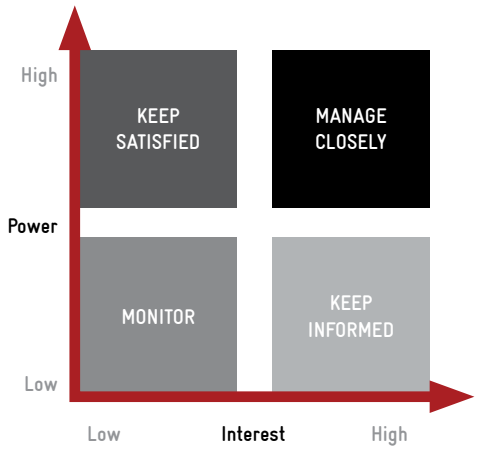
Identifying the stakeholders who are impacted by or who affect ecosystem services is a fundamental part of this preliminary planning. It is necessary to clarify, very early on in the process, which groups, individuals and agencies should be involved in the assessment. These may include, for example, community members, local administrators and leaders, businesses, producer or consumer groups, government line agencies, NGOs and scientific experts. Possible criteria for prioritising stakeholders include thinking about who manages, regulates, depends and impacts on ecosystem services in the context of the development plan that is being considered. While some of these groups may

be obvious (for example the farmers that are involved in an agricultural improvement project, or the industries that pollute a particular river), others may exert a less obvious – but equally important – influence. Examples include off-site producers and consumers, the Ministry of Finance, or local opinion-leaders. It is important to trace through the chains of cause and effect as regards development activities, including the way in which decisions are made and enforced.

The essence of the IES approach is that it is participatory. Once they have been identified, the main stakeholders should be brought into the planning process as soon as possible. This will be an important factor in the subsequent quality of the assessment: stakeholder consultation will help to refine and focus the objectives and scope so as to reflect the realities of the on-the-ground situation, and will enable new perspectives and knowledge to be built into the design of the assessment. It is also a critical step in leveraging buy-in and acceptance from those involved, including the groups who may ultimately be responsible for implementing the recommendations that come out of the assessment. A common understanding of the management challenges among stakeholders can contribute towards creating alliances and fostering solutions.

There are various tools that can be used to help in identifying and engaging stakeholders. Having scoped out the initial boundaries and scope of the assessment, stakeholder mapping is always a useful exercise. Face-to-face meetings with core stakeholders can also help to identify additional groups that need to be brought into the process. You could for example start with organising a small workshop to present the IES approach, to which you could invite representatives of different organisations. Forming a new task force or working group to guide the process, or mandating an existing one, is a good option.

Figure 5 Power/Interest grid for stakeholder prioritisation



Source: www.mindtools.com

At this stage, a stakeholder engagement and communication plan should be formulated, covering every stage of the assessment process from the design stage to the implementation of its recommendations. In addition to who should be involved in the assessment, one thing to think carefully about is how they should be engaged. Different groups and individuals have different levels of influence and stake in the development processes and ecosystem services being considered, and need to be involved at different levels and in different ways. A key question to ask is: who should be kept informed, consulted, share in decisions and actively participate in activities? **Figure 5** provides a useful framework for organising and planning for stakeholder participation. **Communication is also a fundamental – and continuous – element of the whole IES process:** you should identify target groups and key messages as soon as the basic scope and stakeholders for the assessment have been determined.

Expected outputs of step 1:

- *Clear definition of management challenge or issues to be addressed by the assessment.*
- *Documented and agreed objective, scope and expected outcome of the assessment.*
- *Documented and agreed workplan for the assessment.*
- *Stakeholder map and engagement plan.*
- *Communications plan.*

Indare Provincial Development Plan, Bakul

The initial decision to undertake an IES assessment was made by members of the Indare Provincial Development Committee. They prioritised six aspects of the development plan (promote biofuels, improve water quality and supply, enhance timber export, develop ecological and community-based tourism, improve cacao for export and enhance food security), and were particularly concerned about ensuring that these goals would be robust to the possibility of natural and manmade disasters and stresses in the future. The Committee were, initially, particularly concerned about the effects of watershed forest and wetland loss, and the decline in indigenous crop and livestock breeds and associated land management practices.

Having identified these needs, the Committee convened a larger meeting which involved decision-makers, planners and technical experts from the parent ministries of Committee members. Researchers from Hanku University were also invited to attend, as were representatives from key national development NGOs and major international donors working in the forestry, water, agriculture and tourism sectors in Bakul. At this stage, little or no consultation was however carried out with land and resource users in Indare Province or elsewhere, although invitations were extended to nation-wide industrial associations and urban consumer groups.

This meeting came up with a preliminary overview of how ecosystem services might be linked to the Provincial Development Plan goals, prepared a stakeholder map, and formulated a shared vision of how environmental sustainability and development goals should be linked. As a result of the meeting, an Ecosystem Services and Development Taskforce was convened, bringing together individuals from the organisations and agencies mentioned above. The taskforce was mandated to oversee and guide the IES process, and manage communications with the institutions that the members represented. One staff member from each of the Environment Unit, Agricultural Development Unit, Hanku University and the Provincial Development Committee (the chair of the taskforce), were seconded to work on the IES assessment over the next 3 months. Subsequently, a preliminary communications and stakeholder engagement plan was prepared by a sub-group of the taskforce.

Over the course of several meetings, the taskforce developed a workplan for the IES assessment. This was submitted to the Provincial Committee, who approved it with minor modifications and agreed to allocate sufficient budget resources to implement it. A shortlist of required technical expertise was prepared. Some of the staffing was offered as in-kind contributions by the taskforce members. In addition, terms of reference were prepared for key tasks and technical inputs, and put out for tender by consultancy companies.

Step 2 Screening and prioritising ecosystem services

- *How does the development plan depend and impact on ecosystem services?*
- *Which are the main stakeholders that are affected by ecosystem services?*
- *How are the benefits and costs distributed between different groups?*
- *Do potential areas of conflict, competition or synergy emerge?*
- *Which are the priority ecosystem services for the development plan, and why?*

What to do?

Having defined the scope and boundaries of the assessment, and having agreed on the process that it will follow, the second step **identifies the most ways in which the development plan depends on and impacts ecosystem services**. Throughout, there is a strong focus on the stakeholders that are affected, and on the distribution of costs and benefits between different groups.

By the end of step 2, there should be a clear understanding of the ways in which the development plan depends on impacts ecosystem services. A list of priority ecosystem services that are most relevant to the assessment will also have been identified. Prioritisation is necessary as it helps to reduce the complexity, time and cost of the assessment. In most cases it will be impossible (and not necessary) to consider each and every ecosystem service.

- *Try to minimise complexity, especially if resources are limited: it is just a screening exercise. Remember that you can come back to this step if new information come to light.*
- *If the dependence and impact assessment becomes too difficult, revisit step 1 to narrow or refocus the scope.*
- *Consider applying additional criteria if the first attempt at prioritising ecosystem services fails to narrow the list to five.*
- *Consider at least one ecosystem service that might play an important role by the most vulnerable social groups.*

How to do it?

In order to establish which ecosystem services are linked to your development plan, a basic screening exercise should be carried out. First, a list of all the ecosystem services that are associated with the development plan should be compiled. The annex (**Table 7**) provides a comprehensive checklist of ecosystem services, which can assist in this.

Then, key dependencies and impacts of the development plan should be identified, using the following definitions (adapted from OECD 2008):

- The development plan **depends** on an ecosystem service if the service is an input or it enables, enhances or regulates the conditions necessary for a successful outcome. For example, a coastal development plan may depend on the storm protection services provided by wetlands or mangroves. In other words, if the level of dependency is high and the ecosystem service becomes scarce or degrade, the development plan (or at least part of it) may fail or become more costly.
- The development plan **impacts** an ecosystem service if actions associated with it alter the quantity or quality of a service. For example, the coastal development plan may also affect the storm protection services provided by wetlands or mangroves. Impacts can be positive (enhance the quality or quantity of an ecosystem service) or negative (decrease the quantity or quality of an ecosystem service).

A simple matrix can assist in screening (**Table 2**). Each row corresponds to an ecosystem service, while each column relates to a key development goal or activity. Assigning a score to each of the cells according to dependence/impact (0 = neutral, 1= minor relevance, 2= moderate to major relevance) provides a way of prioritising the most important ecosystem services. Those with the highest aggregate score are the ecosystem services which display the highest dependencies or impacts in relation to the development plan, and should be prioritised in further steps of the assessment.

Table 2 Matrix for identifying development plan impacts and dependencies on ecosystem services

Ecosystem services	Development goals or activities								Sum of scores
	A		B		C		... etc. ...		
	Depends	Impacts	Depends	Impacts	Depends	Impacts	Depends	Impacts	
Provisioning Services									
Food									
Raw materials									
Fresh water									
Medicinal resources									
Regulating Services									
Local climate and air quality regulation									
Carbon sequestration and storage									
Moderation of extreme events									
Waste-water treatment									
Erosion prevention and maintenance of soil fertility									
Pollination									
Biological control									
Supporting Services									
Habitats for species									
Maintenance of genetic diversity									
Cultural Services									
Recreation and mental and physical health									
Tourism									
Aesthetic appreciation and inspiration for culture, art and design									
Spiritual experience and sense of place									
Sum of scores									

Most of the information required to identify and score ecosystem service dependencies and impacts can be gathered through a combination of literature review, data analysis, and expert/stakeholder consultation. Even though, at this stage, only very rapid screening of ecosystem services is taking place (a detailed review will be carried out in step 3), it should be noted that a large body of information and opinions typically lies "behind" the matrix. It is important to keep notes on why particular scores were assigned, recording the nature and magnitude of the ecosystem dependencies and impacts, who is affected by them, and what kinds of knock-on effects and implications they might have. This information will prove vital in carrying out further steps of the assessment, which look at the prioritised ecosystem services in more detail.

It is also useful to bear in mind that the ranking and scoring of ecosystem service dependencies and impacts is not a "scientific" one, in the sense that it will be determined largely by the people who have participated in the screening exercise. For this reason, it is desirable to be as inclusive as possible in your consultations, and to make sure that the opinions and perceptions of different stakeholders are well-balanced. There is also likely to be a high level of uncertainty in some areas, due to a lack of data and knowledge about ecosystem processes, interactions and causality. While every effort should be made to gather the most accurate and up-to-date data (within the time and resources available to the study), it should be recognised that there will inevitably be many gaps and imperfections in the evidential base for the matrix.

When carrying out the scoring, distributional concerns should always be considered. You should take into account the fact that some parts of society depend heavily on ecosystem services, and may have few or other options or sources of fallback if they are degraded or lost. There may in addition be other, political, social or developmental reasons why special attention should be paid to particular groups. Where impacts and dependencies disproportionately affect women, indigenous peoples or the rural poor, for example, they may accorded a relatively higher weight. Conversely, where dependencies are associated with illegal or unsustainable practices, or if alternatives are readily available and affordable to the affected stakeholders, a relatively lower weight may be allocated.

Based on the screening, a priority list of ecosystem services should emerge in terms of the dependencies and impacts of the development plan on ecosystem services. The scoring will also highlight potential areas of conflict, competition or synergy, which may result in trade-offs (these will be looked at in detail in the next step of the assessment). While the number of ecosystem services that are of key importance to a given development plan will of course depend on the specific context, as well as on the scope and the complexity of the plan itself, it is desirable to come up with a "shortlist" of no more than five or six ecosystem services for more detailed review and assessment. A larger number of priority ecosystem services will add to the complexity, time and resource demands of the subsequent assessment, and may run the risk of generating results which are neither concrete nor specific.

Expected outputs of step 2:

- *Matrix showing ecosystem service dependencies and impacts in relation to the development plan.*
- *Notes explaining the scoring of ecosystem services, and elaborating on the nature, magnitude, distribution and evidential basis to ecosystem service/development plan linkages.*
- *Agreed list of priority ecosystem services for further assessment.*

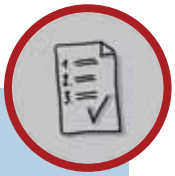
Indare Provincial Development Plan, Bakul

Based on a preliminary screening carried out by the members of the Indare Provincial Development Committee, ten ecosystem services were identified as being of particular importance to the development plan. Three workshops were subsequently held in order to assess these dependencies and impacts in more detail. One (convened in Hanku) for staff from the Ministries of Forestry, Agriculture, Water and Tourism, a second (hosted by the University of Hanku) drew in key biodiversity and scientific experts, while the third was attended by representatives of local authorities, fishing cooperatives and farming communities.

The workshops resulted in a series of refinements to the list of ecosystem services, and conducted a scoring exercise to determine their importance. After this process was given some coverage in the local press, representatives from indigenous forest-dwelling people approached the Indare Provincial Development Committee to protest their exclusion from the process. A roundtable dialogue was hurriedly held, bringing together community members with the other stakeholders, which added seven more ecosystem services to the list, and highlighted a number of sources of potential conflict and trade-off which had not before been considered.

This process made it clear that the priority ecosystem services for the Indare Provincial Development Plan were food, raw materials, fresh water, moderation of extreme events, erosion prevention and maintenance of soil fertility. Furthermore, it became apparent that:

- The goals of the Indare Provincial Development Plan depend strongly on several ecosystem services. For example, the development of ecotourism and community-based tourism revolve around the conservation of rural coastal and forest habitats, while food security depends on the maintenance of agro-ecosystems, including indigenous crop and livestock breeds and wild pollinator species.
- The development goals also have significant impacts on ecosystem services. Both biofuel and cacao production are, for example, leading to the clearance of grasslands, the pollution and drainage of wetlands, and the replacement of endemic breeds with fuel crops, while timber export promotion is impacting heavily on the integrity of natural forest areas and compromising their ability to deliver essential water-



shed and erosion control functions.

- There are trade-offs between different development goals. For example, the promotion of biofuels has the potential to undermine both food security and improved water supplies and quality.
- There is competition among development goals regarding ecosystem services. For example, both tourism development and timber production place competing demands on forest lands, conflicts are arising over the use of productive lands for biofuel production and smallholder farming, while wetland drainage and pollution is having devastating effects on the local artisanal fishery.

While most, industrial and livelihood-level, development activities in Indare Province depend in some way on ecosystem services, stakeholders are being unequally impacted by ecosystem degradation and the resultant loss of key services. The most affected groups were identified as being smallholder farmers, fisherfolk and indigenous forest-dwelling communities. The production and consumption activities of these groups are, however, having only low to medium impacts on the provision of ecosystem services.

The illustrative matrix shows the ways in which the Indare Provincial Development Plan depends and impacts on ecosystem services.

	Indare Provincial Development Plan main goals												Sum of scores
	Promote biofuel production		Improve water quality and supply		Enhance timber export		Develop eco/ community tourism		Improve cacao for export		Enhance food security		
	Depends	Impacts	Depends	Impacts	Depends	Impacts	Depends	Impacts	Depends	Impacts	Depends	Impacts	
Provisioning Services													
Food	1	2	0	1	0	1	2	1	2	1	2	2	15
Raw materials	2	2	0	0	2	2	2	1	1	1	1	1	15
Fresh water	2	2	2	2	2	2	2	1	2	2	2	2	23
Medicinal resources	0	1	0	0	0	1	1	1	0	1	1	1	7
Regulating Services													
Local climate and air quality regulation	1	2	1	1	1	1	2	0	2	1	2	1	15
Carbon sequestration & storage	1	2	0	0	1	2	0	0	0	2	0	1	9
Moderation of extreme events	2	2	2	1	1	1	2	1	1	2	2	1	18
Waste-water treatment	0	2	2	2	0	1	1	1	0	0	1	1	11
Erosion prevention and maintenance of soil fertility	2	2	2	0	1	1	1	0	2	2	2	2	17
Pollination	1	2	0	0	1	1	1	0	2	2	2	2	14
Biological control	2	2	0	0	1	1	0	0	2	1	2	2	13
Supporting Services													
Habitats for species	1	2	1	1	1	1	2	1	1	1	1	2	13
Maintenance of genetic diversity	0	2	0	0	0	1	2	0	0	1	2	2	9
Cultural Services													
Recreation and mental and physical health	0	2	0	0	0	2	2	1	0	1	0	1	8
Tourism	0	2	0	0	0	2	2	0	0	1	0	1	7
Aesthetic appreciation and inspiration for culture, art and design	0	1	0	0	0	1	2	1	0	1	0	1	6
Spiritual experience and sense of place	0	1	0	0	0	1	2	1	0	1	0	1	6
Sum of scores:	**15**	**31**	**10**	**8**	**11**	**22**	**26**	**10**	**15**	**21**	**20**	**24**	

Step 3 Identifying ecosystem service conditions, trends and trade-offs

- *What kind of information and evidence related to the condition and trends of ecosystem services exists and what are information gaps?*
- *What are the current conditions and likely future trends in the supply of and demand for the identified ecosystem services?*
- *What and who are the main drivers of change?*
- *What trade-offs might arise between development goals and the ecosystem services, or between stake-holder groups?*

What to do?

Step 2 has broadly identified the ways in which the development plan (and its key stakeholders) depends and impacts on ecosystem services, and has prioritised the most important ecosystem services for further assessment. Now we will start to investigate the dynamics of these linkages, for the selected ecosystem services. By the end of step 3, we should have a clear idea of how ecosystem services are being managed and used, and have highlighted the factors that may be leading to their degradation – or may, with intervention, be harnessed to maintain and improve them.

The **status and main trends in the supply and demand for ecosystem services** will be analysed, in terms of both the causes and effects. The key stakeholders involved will be reviewed in detail. Aspects such as the quantity, quality, and timing of the supply and demand for ecosystem services will be considered, paying particular attention to the spatial relationships between production and consumption. Analysis of the **drivers of ecosystem change** is an important aspect of this step. A particular concern is to **identify where there may be trade-offs**: measures to balance between the provision of different ecosystem services, between ecosystem services and development objectives or activities, or between stakeholder groups.

- *Interview at least one expert per priority service.*
- *Consider hosting a meeting in which a number of experts and stakeholders share information and react to each other's perspectives.*
- *It is important to be explicit about the assumptions made about the links between ecosystem status, changes in the provision of ecosystem services, and wellbeing outcomes. Every effort should be made to build a good evidence base as regards causality, sustainability, thresholds and uncertainty.*
- *However, always remember that the IES approach is not intended to be a detailed academic or research exercise. It is a planning tool, geared to generating practical and policy-relevant decision-support information.*

This step focuses on the development and other activities that directly depend and impact on ecosystem goods and services. Step 4 then looks at the underlying policy, institutional, regulatory and cultural conditions which shape these actions. Together, the information from steps 3 and 4 will help us to identify concrete policy options to improve development decisions and actions (in steps 5 and 6). In addition, the information generated will provide a useful baseline against which future changes in development and ecosystem service indicators can be measured during the course of the implementation of the development plan and associated policy measures.

How to do it?

What the assessment covers, and what information it should generate

First, it is necessary to establish and describe the **present condition of the ecosystem services** that have been prioritised during step 2. This will of course be linked to the status of the ecosystem that is generating them. A basic description of the natural and human-modified ecosystems that lie within the boundaries of the development plan should be given – their area, type, management and status. These natural areas are then linked to the prioritised ecosystem services. This involves presenting the scientific and other evidence to explain the biophysical relationships that result in the

provision of ecosystem services from a given ecosystem: that a particular forest, for example, is serving to protect against erosion or maintain downstream waterflow, or that a specific habitat is hosting important pollinator species. The annex (**Table 8**) gives some suggestions for appropriate measures of biodiversity and ecosystem services.

A clear statement needs to be made about the current status of the supply of ecosystem services: what quality and quantity of benefits are being generated. A second aspect is to look at the demand (or dependency) side: who is benefiting from the ecosystem service, and in what ways. How many urban dwellers, for example, rely on water sources which are protected by a natural forest, or what kinds of crops are being fertilised by natural pollinators. A third aspect is to look at impacts: how are development activities impacting on the supply of ecosystem services. How does a hydropower dam affect downstream wetland services, for example, or what are the impacts of forest products utilisation on watershed protection and carbon sequestration.

After collecting this baseline information, it is necessary to review **trends in the demand and supply of ecosystem services**. This would usually consider both past trends and likely future developments. It may, for example, track changes in forest cover, document the spread of agriculture and abstraction of water for irrigation, and show how changing demographic trends and consumption patterns have affected the demand for land and natural resources.

One element is to gauge how the human population that depends on ecosystem services is changing – both in terms of the quantity and type of beneficiaries, and in the ways in which ecosystem services are used. Will growing urbanisation, for example, likely lead to an increased dependence on water quality and waterflow services, and at the same time lead to a sharp rise in demand for food crops and timber? Trend analysis also involves assessing how ecosystems, and the services they generate, are being impacted by human activities and other forces: how changes in management and uses may affect their ability to generate services. Is the expansion of tree-planting and sustainable farming improving the ability of a key watershed forest to deliver services, for example, or are there signs that increasing urban settlement and infrastructure development may encroach into a wetland area that is important for flood attenuation?

This leads into an analysis of the drivers of ecosystem service change. Conclusions will be drawn on why changes in ecosystem status and service provision have occurred or will arise in the future (for instance growing urban demands for timber, changes in hydrology resulting from dam construction, or creeping encroachment of farms into previously pristine wetlands and forests), who is responsible for these changes, and who has been impacted or will be affected by them. This will highlight the groups and activities that are responsible for maintaining (or degrading) ecosystem services, and the motivations or underlying forces that cause them to behave in a certain way.

It is now necessary to synthesise this information in a form that you will be able to use in further steps of the assessment process. table 3 provides a format for doing this. Each row refers to an ecosystem service, which is in turn linked to the specific site or ecosystem that generates it. The columns then record the current condition of the ecosystem service and likely future trends in demand and supply, and summarise what the direct and indirect drivers of change are, and who or what is responsible for them.

Table 3 Matrix for recording ecosystem service conditions and trends, drivers and stakeholders

Ecosystem services	Site or habitat that generates the service	Current condition of ecosystem service (++ very good, + good, – bad, –– very bad)	Likely future trends (↑ increasing, → stable, ↘ decreasing)		Drivers of change	Stakeholders and actions related to the driver
			Supply	Demand		
A						
B						
C						
… etc. …						

Based on the information on ecosystem service conditions, trends and drivers, it will be possible to identify where trade-offs may be required. A wide range of examples of ecosystem service trade-offs are provided in the annex (**Table 10**), which may help to guide you in this process. A trade-off is a balance or compromise achieved between two competing, conflicting or somehow incompatible outcomes. It may arise in the context of balancing the provision of different ecosystem services (for example the use of forest land to generate watershed protection versus food crops), generating ecosystem services and development objectives (such as diverting a river for irrigation or maintaining downstream flows to wetlands and floodplains), or the needs of various stakeholder groups (for instance between large-scale commercial trawlers and small-scale artisanal fishers). Assessing trade-offs will help you identify those stakeholders that will likely win or lose as a result of ecosystem service changes in the short and long-term.

Information sources and analytical tools that can be used to assist in the assessment

There are various **options for conducting and presenting your assessment and analysis.** The annex (**Figure 9**) provides some further guidance on this. These range from a purely descriptive, qualitative study through to assessments which incorporate a great deal of quantified data, maps, figures and statistics. Which is the most suitable in a given situation will depend largely on the availability of data, time, money and expertise with which to carry out the assessment, and on the magnitude of the development plan under consideration. It is however worth underlining that the IES approach is not intended to be a detailed academic or research exercise. It is a planning tool, geared to generating practical and policy-relevant decision-support information. The most important thing is that the information used is credible and realistic, and that the results generated are useful for planning and decision-making.

A variety of **information sources** can be used to assist in documenting and analysing ecosystem service dependencies, impacts and trade-offs. The annex (**Table 9**) summarises some of the most commonly-used methods. These include expert opinion, traditional knowledge, innovations and practices.

Information can be drawn from literature, including published and un-published studies, scientific and semi-scientific works, as well as databases held by government departments, research institutes and non-government organisations. It is worth emphasising that expert opinion and stakeholder consultation is likely to be a particularly important source of information, especially where published studies and data are scarce (as is often the case for ecosystem services). For this reason, you should think carefully about how best to engage different people's views and knowledge. This could start with organising a workshop with key institutions and experts that work on the area, and have a good knowledge of ecosystem service conditions and trends.

Various software and computer-based tools can be used can be used to generate, manage, analyse, model and present data on both socio-economic and biophysical aspects of ecosystems and ecosystem services. These range from conventional tools such as GIS, remote sensing, land-use, hydrological and ecological models, through to a suite of new applications that have been developed specifically to deal with ecosystem services. The World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI) have for example recently released toolkits for "Corporate Ecosystem Service Review" and "Corporate Ecosystem Valuation". A series of quite sophisticated and innovative web-based tools and software models are currently being developed by US universities and conservation NGOs for incorporating ecosystem values into spatial planning and decision-making: for instance Assessment and Research Infrastructure for Ecosystem Services (ARIES), EcoValue, Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) and Multiscale Integrated Models of Ecosystem Services (MIMES). A detailed list of available tools and applications, and suggestions for their use in relation to ecosystem services in development planning, is provided in the annex.

Key challenges and points to consider in carrying out the assessment

There are a number of challenges in assessing ecosystem services. These are elaborated further in the annex (**Figure 7**). Some of the most important points to consider concern the quality of information used, and the assumptions that are made about causality, sustainability, thresholds and uncertainty.

Although the IES approach is essentially a rapid assessment process, which minimises the need for complex and costly data collection, analysis and skillsets, it is worth underlining that **good information is required** to identify the conditions and trends of ecosystem services. Some level of primary data collection is usually required for all but the simplest assessments: it is not normally possible to rely entirely on secondary sources or expert opinion.

It is often particularly challenging to obtain reliable, credible data on the **causal links** between a particular ecosystem, the generation of a given set of ecosystem services, and particular human well-being outcomes. This requires detailed biophysical and socio-economic data, and must be founded on sound (ecological, hydrological, etc.) "science" and evidence, if estimates are to be both credible and realistic. It is a persistent failing of many studies that they merely impute these linkages and the effects of changes in ecosystem status, without investigating their scientific underpinnings or elaborating their factual basis. Although some grounding in "known facts" is required, the reality is however that it will usually be necessary to make a number of assumptions about causality and linkages. For instance, how a particular land use or management regime influences ecosystem status, how a change in ecosystem status results in differing levels of ecosystem services, and how changes in the quality and quantity of ecosystem services affects possibilities for economic output and consumption.

A related point is the importance of considering the rate at which environmental and socio-economic parameters will change over time, as ecosystem status and conditions change. Typically, neither ecosystem nor human change (or the links between them) follows a "straight line" path. This requires some understanding of the **sustainability** of land and resource uses, and of the other development activities that impact on ecosystem integrity and status. Secondly, it also requires some understanding of ecosystem and socio-economic **thresholds**: at what point certain ecosystem services will be affected to the point that they will start to decline/increase (and what trajectory this decrease/increase will subsequently follow), as well as the point at which production or consumption will be affected (and how it will decline/increase over time).

The high levels of uncertainty surrounding both natural and human processes, and the interactions between them, can also sometimes make assessment and analysis difficult. Uncertainty describes a situation where little is known about future trends or impacts and where no possibilities can be assigned to certain outcomes, or where even the outcomes are so novel that they cannot be anticipated. Some level of (both human and scientific) uncertainty is unavoidable, and it is inevitable that certain assumptions will have to be made (and should be made explicit) during the course of the assessment. In most cases, the best (and most commonly-accepted) way of dealing with uncertainty in relation to ecosystem services is to employ a general policy of caution and precaution (TEEB 2009, 2010).

The Rio Declaration on Environment and Development defines the precautionary approach as "where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation", stating that "in order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities". In some legal systems, such as European Union law, the application of the precautionary principle has been made a statutory requirement.

In summary, the critical factor is to acknowledge that many of the assumptions about causality, sustainability, thresholds and uncertainty that are made in the assessment are based on imperfect knowledge and data (and, in most cases, will rely heavily on expert opinion). They will however be generated from the best possible information available at the time of the study, and can be updated as new or improved data become available. The challenge here is to achieve a good understanding of your site's context and to make sure that your assumptions have a sound scientific and evidential basis - without spending too much time and resources trying to develop a perfect model of reality.

Expected outputs of step 3:

- *Information on conditions and trends of ecosystem services.*
- *Overview of the main drivers related to identified conditions and trends (cause-effect relationships).*
- *Identification of stakeholders behind those drivers.*
- *Analysis of ecosystem service trade-offs which may arise in the context of the development plan.*

Indare Provincial Development Plan, Bakul

The team that undertook the condition and trends analysis for the Indare Provincial Development Plan brought in members of Moneila University and several independent consultants, who worked with government counterparts. Field verification, including consultation with local farming, fishing and indigenous groups as well as with industry and businesses, was a key part of the assessment. A wide range of rapid ecological assessment and participatory rural appraisal techniques were used, and the results mapped using GIS software. It was fortunate that the water resources development faculty of the University had recently carried out an hydrological modelling exercise in the Moneila River Basin, and a conservation NGO had just completed biodiversity surveys in key protected areas in the country. The results of both these studies proved vital to the analysis.

In order to overlay the drivers of change and associated stakeholders, a 2-day brainstorming session was held, led by the study team but also involving members of relevant line agencies, land and resource users in upstream and downstream areas, and the private sector. In order not to repeat earlier mistakes, special efforts were made to include representatives of indigenous peoples' groups. It was only at this stage that it was recognised that it would be important to also involve land and resource users from upstream Belandu Province, and so the brainstorming was held in a local community-run eco-lodge located beside a protected area in the upper watershed of the Milaku River.

The results of the assessment are shown below. In most cases, it was found that the supply of ecosystem services in the study area was declining or staying constant – it is only livestock and crop production (including biofuels) that are showing any sign of increase. Meanwhile, demands for all ecosystem services except one were agreed to be set to increase still further in the future. Only the demand for forest habitat was considered likely to remain stable. Many of the drivers of change – and associated stakeholders – were common to different ecosystems and ecosystem services. It was found that the conversion of natural habitats for urban settlement and agriculture (including commercial biofuel plantations as well as smallholder crops and livestock), combined with rising problems associated with agrochemical and industrial pollution, as well as large-scale timber extraction constituted the main direct drivers. Important underlying causes of ecosystem degradation and loss related to poor law enforcement, changing population demographics (especially those related to immigration and urbanisation) and weak or unclear property rights. Exogenous factors, mainly related to international market demand, were also agreed to exert a strong influence over the growth of commercial land and resource uses in key ecosystems, especially timber and biofuels.

Eco-system services	Site or habitat	Current condi-tion	Likely future trends		Main drivers of change	Major stakeholders and actions related to the driver
			Supply	Demand		
Fresh water (quan-tity and quality	Milaku watershed	–	↘	↗	• Forest conversion to agriculture • Pollution caused by fertilizers and pesticides • Pollution, overgrazing, soil erosion from livestock • Demographic change/immigration • Weak law enforcement • Timber extraction • Biofuel production	• Upstream farmers and livestock owners • City dwellers • Downstream smallholders • Belandu regional government institutions (agriculture, environment, economic development) • Timber companies • Biofuel companies
Erosion preven-tion and main-tenance of soil fertility	Milaku watershed	–	↘	↗	• Forest conversion to agriculture • Pollution, overgrazing, soil erosion from livestock • Demographic change/immigration • Weak law enforcement • Timber extraction • Missing/unclear property rights	• Upstream farmers and livestock owners • Smallholders downstream • Biofuel investors • Timber companies • Belandu regional government institutions (agriculture, environment, economic development)
Raw materi-als	Forests	+	↘	↗	• Forest conversion to agriculture • Timber extraction • Demographic change • International markets	• Smallholders and indigenous communities • Biofuel investors • Timber companies
	Wetlands	++	→	?	• Wetland conversion to agriculture and houses/com-mercial property	• Smallholders and indigenous communities • Housing sector • Tourism sector
	Mountains	+	↘	?	• Land conversion to agriculture	• Smallholders and indigenous communities
	Agro-ecosys-tems	++	↗	↗	• National and international demand • Technology and management practices • Missing/unclear property rights • Biofuel production will increase supply and demand and cause trade-offs with other ecosystem services	• Smallholders and indigenous communities • Province Agricultural Development Unit
Moder-ation of extreme events	Milaku watershed	–	↘	↗	• Land use upstream • Infrastructure construction	• Livestock owners
Natural habitat	Forests	+	↘	→	• Forest conversion to agriculture • Timber extraction • Demographic change • Infrastructure construction • International markets	• Smallholders and indigenous communities • Timber companies • Biofuel companies
	Wetlands	++	↘	↗	• Wetland conversion to agriculture and houses/com-mercial property • Demand for tourism and related infrastructure • Pollution of groundwater and rivers by fertilizers and pesticides • Urban and industrial pollution	• Smallholders and indigenous communities • Housing sector • Tourism sector
	Mountains	+	↘	↗	• Land conversion to agriculture • Overgrazing and pollution caused by livestock • Infrastructure construction • demographic change • weak law enforcement	• Livestock owners • Smallholders and indigenous communities
	Agro-eco-systems	+	↘	↗	• National and international demand • Technology and management practices • Missing/unclear property rights • Biofuel production will decrease supply and increase demand and cause trade-offs with other ecosystem services	• Province Agricultural Development Unit
Food	Forests	+	↗	↗	• Forest conversion to agriculture: increasing supply of food, but trade-offs with other ecosystem services	• Smallholders and indigenous communities • Timber companies
	Wetlands	+	↘	↗	• Pollution of groundwater and rivers by fertilizers and pesticides • Urban and industrial pollution • Wetland conversion to agriculture and houses/com-mercial property	• Smallholders and indigenous communities • Fishery sector • Housing sector • Tourism sector
	Mountains	+	→	↗	• Land conversion to agriculture: Increasing supply of food, but trade-offs with other ecosystem services • Pollution of groundwater and rivers by fertilizers and pesticides	• Pollution of groundwater and rivers by fertilizers and pesticides
	Agro-eco-systems	+	→	↗	• National and international demand • Technology and management practices • Missing/unclear property rights • Biofuel production will decrease supply	• Smallholders and indigenous communities • Biofuel companies • Province Agricultural Development Unit

Step 4 Appraising the institutional and cultural framework

- *Which institutions govern ecosystems and their services? Who participates in these, and in the decisions they make?*
- *Which policies, regulations and other positive or negative incentives influence people's use and management of ecosystems and their services? Who or what do they target, and how are they enforced?*
- *Are there conflicts or inconsistencies between institutional, policy, legal and cultural frameworks, and the incentives they give rise to?*
- *Which other kind of needs, interests and rights drive management choices regarding ecosystems?*

What to do?

Step 4 complements the information that has been gathered in step 3 about ecosystem demand, supply, drivers and trade-offs. It **appraises institutional, policy, legal and cultural frameworks**, and the resulting incentive structures. These factors and arrangements mediate and influence how people manage, use and impact on ecosystems and their services. They may act as drivers of either ecosystem degradation or ecosystem conservation, and are also key to negotiating any trade-offs that occur. By the end of step 4, we should have a clear idea of what underlies people's behaviour as regards ecosystems and their services, and have identified where potential areas of conflict or co-operation exist.

Institutional, policy, legal and cultural frameworks include both customary and government authorities and laws, as well as formal and informal institutions, rules, practices and belief systems. A wide range of incentives should be considered, including de facto and de jure rights, markets, prices, taxes and subsidies that relate to ecosystem services, and the lands and resources that generate them.

The aim of this step is to understand how different stakeholders' interests, rights and values determine the way in which they depend or impact on ecosystem services, and identify the influences that shape how people act. The extent to which institutional, policy, legal and cultural frameworks encourage or discourage ecosystem service dependencies and impacts is of particular concern, as is the way in which people's interests, rights and values may either stimulate conflict or cooperation in their use and management.

- *Your analysis should encompass how institutions, policies, regulations, and cultural norms function in practice - in governance and equity terms.*
- *Try to work out the difference between what's on paper, and what's actually going on.*
- *This is also the time to think about things like elite capture, inequities, control of decision-making by particular groups, and even corruption etc. In other words, the real-world factors those modify and influence how decision-making really works.*
- *This needs to be incorporated in a realistic way. Even if the assessment process cannot go into too much detail- it needs to identify and highlight key factors.*

It is important to recognise that the governance structures related to ecosystems and ecosystem services are complex. Ecosystems are rarely subject to one form of management or regulation that is clearly enforced and understood by all. A range of formal and informal, "modern" and traditional, private and collective systems may coexist simultaneously (**Box 17**). Many ecosystem services also have at least some of the characteristics of "public goods", meaning that people cannot necessarily assert unambiguous ownership rights over them, or be excluded from using or benefiting from them.

Box 17 Who manages and regulates ecosystem services?

You should be aware that ecosystem services are interconnected and that most of the time they are a mix of private, public and collective benefits. 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 neighbouring 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?).

Check Annex

…us on ecosystem services permits to clarify who has what right to nature. It is also important to … …s dependent on which ecosystem services and who have formal and informal rights. Supporting, re… cultural services are less visible and tangible and therefore have mainly the character of public or com… and de facto occur mostly an open access situation, where is difficult to control the way people access, u… impact them. However, public and collective services play a significant role by contributing 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 privatised services fare better than collectively managed ones. Loss or privatisation of public/collective services can have impacts on the availability of these services to poor people.

Source: TEEB for Local and Regional Policy Makers (2010)

How to do it?

Institutional, policy, legal and cultural frameworks

A review of existing literature, including official records (such as laws, regulations, policies etc.) as well as technical documentation, is a good starting point when **evaluating the institutional, policy, legal and cultural framework**. These sources will, however, usually only present limited information about ecosystem **governance** arrangements.

Equally, if not more, important, will be the perceptions and insights of ecosystem managers and users themselves, including traditional knowledge and oral history. Obtaining this kind of information which will require face-to-face interviews and discussions, and often involves some kind of stakeholder analysis. Such methods are an important means of obtaining information about the real situation on the ground, in terms of the principles and rules that actually govern ecosystem access, ownership, management and use, as well as the extent to which "official" institutions, laws and policies are effective.

Much of the most valuable information in step 4 will therefore be based on qualitative aspects of institutions, organisations and actors, and will consider stakeholders' relative power, positions, interests and needs. This will assist in learning more about distributional issues. It should be possible to identify major sources of inequity, and the stakeholder groups that are most affected in the process of making decisions. At the same time, multiple stakeholders – each with varying influence, power, needs and preferences, influence ecosystem services. The annex (**Figure 10**, **Figure 13**) shows how stakeholder maps and other visual tools can be useful for assessing the main groups that need to be considered in the assessment. It is also important to identify those stakeholders which are excluded from institutional, policy and regulatory arrangements. Failing to identify these groups could mean marginalising some of the poorest and most vulnerable sectors of society. The annex (**Figure 11** and **Figure 12**) provides further information on characteristics of ecosystem services, stakeholders and rules.

KeyTerm/ Concept

Governance is about social interactions, about who takes the decisions, but also how these decisions are taken and how they are enforced, thus affecting the way people access and use natural resources. Addressing governance issues therefore requires understanding and changing formal and informal rules, enforcement and coordination mechanisms. These interactions are mediated through the particular context and timeframe within which governance decisions are taken. Additionally, beliefs, values and ideals influence people's thinking about nature, society, government and individual responsibilities.

A more targeted approach consists in the analysis of governance issues surrounding a specific area or ecosystem and ecosystem services in order to improve cooperation among actors, build consensus and transform incentives that have a negative impact on biodiversity. Based on this analysis, interventions should seek to improve social interaction between people and institutions, in order to secure fair arrangements that conserve ecosystem services, minimize conflict and lead to more equitable access and use.

Source: GIZ (2010)

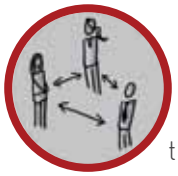


Table 4 provides a matrix for recording and presenting stakeholder information. Each row contains information about a particular stakeholder, while columns provide space to record the positions, interests and needs of different stakeholders, their level of power/influence and the relationships between them.

Table 4 Matrix for recording stakeholder analysis results

Stakeholder	Why do they act the way they do?		Level of power	Level of influence	Relationships among stakeholders	
	position	Interests/ needs	High (H), medium (M) or low (L)	High (H), medium (M) or low (L)	Possible alliances	Possible conflicts
A						
B						
... etc. ...						

Incentives

The Convention on Biological diversity defines an incentive as "a specific inducement designed and implemented to influence government bodies, business, non-governmental organisations, or local people to conserve biological diversity or to use its components in a sustainable manner. Incentive measures usually take the form of a new policy, law or economic or social programme." An overview of the different kind of incentives can help you to identify the most relevant ones in the context of a given set of ecosystem services and development goals. The following incentives tend to exert the most important influences on ecosystem management and use (adapted from Emerton 2000 and GTZ 2004):

- **Market-based incentives** are measures that have an impact on market actions and opportunities – generally transferred by way of prices and markets. Examples are user charges, eco-labelling and payments for ecosystem services.
- **Fiscal incentives** are measures that manipulate the prices that people pay or receive for goods and services, or raise public revenues. They operate through public budget transfers. Examples are taxes, subsidies and low-interest credit.
- **Regulatory incentives** are measures that regulate and stipulate legal conditions, codes of social interaction (who may do what under which conditions). Examples are laws, environmental standards and access restriction.
- **Property rights** are a special category of regulatory instruments, which allocate rights to own, use or manage biodiversity, ecosystems, land, resources or other assets and services. Examples are ownership, management, access, ususfruct and sale rights, or arrangement such as leases, concessions, licences, permits and franchises.
- **Cultural and social norms** operate through setting and sanctioning generally-accepted standards or codes of behaviour and conduct, and are generally enforced through social and peer control rather than through formal regulations. Examples include religious edicts, patterns of "acceptable" behaviour, taboos and restrictions.
- **Cooperation** includes measures that motivate changes in resource management by involving interest groups in the decision-making and governance process. Examples are roundtables or alliances.
- **Information-related incentives** are measures such as those that make external effects visible and in so doing, provide information about the actual benefits and costs of certain management techniques. Examples are audits, labelling and certification and information and measuring systems.

Keep in mind that incentives depend on:

- The characteristics of the **ecosystem services:** Is it possible to control access to an ecosystem service and exclude others, and is there any rivalry in consumption?
- The characteristics of the **stakeholders:** What are their positions, rights, interests, values and needs?
- The characteristics of the **rules** (characteristics of social coordination among stakeholders): Do these rules work, how are they enforced, and what kind of incentives do they create?

In the annex you'll find more information on these characteristics. Please also consult the manual "Natural Resources and Governance: Incentives for Sustainable Resource Use" (GTZ 2004).

Table 5 provides a matrix for recording information about incentives. Each row refers to a category of incentives (these may be sub-divided or added to as required), while the columns allow notes to be added about which measures are used, who they target, and how they operate and are enforced in relation to ecosystems and ecosystem services.

Table 5 Matrix for recording incentives influencing ecosystem management and use

Types of incentives	List of relevant measures	Observations on their operation, enforcement and target group
Market-based		
Fiscal		
Regulatory		
Cooperation		
Information		
Cultural and social		

Expected outputs of step 4:

- *List of the key institutional, policy, legal and cultural frameworks and the resulting incentive structures that influence how people manage, use and impact on ecosystems and their services*
- *Systematic overview of stakeholder's positions, rights, interests, values and needs.*
- *Information on existing and possible areas of conflict or cooperation between stakeholders, institutional, policy, legal and cultural frameworks or incentives.*

Indare Provincial Development Plan, Bakul

The main method used to assess institutional, policy, legal and cultural frameworks was a stakeholder analysis. This relied heavily on participatory methods, and involved several anthropologists working in close collaboration with land and resource-using communities as well as a more formal institutional assessment of government and non-governmental agencies operating in the area.

The ecosystems governance framework in Indare and Belandu Provinces was found to be a fairly complex one. While a plethora of institutions – including traditional authorities as well as government line agencies, NGOs and the private sector – lay some claim over ecosystem use and management, their jurisdictions and rights are by no means clear.

This has led to several conflicts already being manifested (differences of opinion between government protected area authorities, biofuel and timber businesses and indigenous peoples have for example already arisen, in some cases in quite extreme forms), and is clear further disputes are beginning to make themselves apparent. Most concern competing claims over particular sites. These problems have been exacerbated by unclear land and resource property rights, and weak enforcement of regulations. Meanwhile, often poor governance – characterised by widespread corruption, and an undue influence of the relatively richer and elite members of society – have led to an often uneven distribution of benefits, and have persistently marginalised more vulnerable groups. Indigenous peoples and poor or landless rural smallholders, in particular, have tended to lose out, and have largely lacked a "voice" in decision-making. This information was captured via the stakeholder analysis, and is summarised in the matrix below.

Stakeholder	Why do they act the way they do?		Level of power	Level of influence	Relationships among stakeholders	
	position	Interests/needs			Possible alliances	Possible conflicts
• Unit for development	• Progress and economic growth	• Political incidence • Taxes	• M	• M	• Unit for agricultural development • Indigenous peoples	• Unit for environment • Environmental NGO • Biofuel and timber businesses
• Unit for environment	• Ecosystem conservation is priority	• Political incidence • Enhance environmental legislation and enforcement • Represent interest groups	• M	• L	• City dwellers • Environmental NGO • Indigenous peoples	• Unit for development • Unit for agricultural development • Biofuel and timber businesses
• Unit for Agricultural Development	• Agriculture is key to development	• Maintain/strengthen political power • Satisfy lobby	• M	• M	• Unit for development • Rural smallholders • Biofuel and timber businesses	• Unit for environment • Indigenous peoples
• City dwellers	• Progress and better public services	• Low food prices • Good water quality • Recreation opportunities • Quality of life • Good governance	• L	• M	• Environmental NGO	
• Rural smallholders	• Government fails to assist the rural sectors	• Fair food prices • Market infrastructure • Low input prices • Technical assistance	• L	• L	• Unit for agricultural development • Biofuel and timber businesses	• Unit for Environment • Environmental NGO • Biofuel and timber businesses • Indigenous peoples
• Indigenous peoples	• Maintenance of traditional livelihoods and protection of spiritual sites	• Recognised forest land and resource rights • Secure livelihoods • Protection of cultural heritage and practices	• L	• L	• Environmental NGO	• Unit for development • Unit for agricultural development • Rural smallholders
• Biofuel and timber businesses	• Maintenance of profits and minimisation of costs	• Use rights over key lands and resources • Profit maximisation and business growth • Access to new domestic and international markets	• M	• H	• Unit for development • Unit for agricultural development • Rural smallholders	• Indigenous peoples • Rural smallholders
• Environmental NGO	• Government has to enforce environmental sector	• Lobby and funding • Strengthen a weak sector and public interests	• L-M	• L-H	• Unit for environment • Biofuel and timber businesses	• Unit for development • Unit for agricultural development • Rural smallholders • Indigenous peoples

The assessment found that a number of incentives – and disincentives – to sustainable and equitable ecosystem management exist in Bakul. These largely reinforced the findings of the stakeholder analysis. As shown in the matrix below, the bulk of market and government policy instruments serve to encourage and prioritise the commercial exploitation of lands and resources, and their conversion to other uses. Meanwhile the needs, interests and rights of rural smallholders and indigenous peoples have, for the most part, attracted little attention.

Types of incentives	List of relevant measures	Observations on their operation, enforcement and target group
Policies	• Forest and Wildlife Policy from 2005 • National Biodiversity Strategy with minimal political impact	• Lack of law enforcement and monitoring
Market or fiscal	• Rising prices for biofuels • Increasing demand for land	• Land is sold to biofuel investors
Regulations	• Land use act 1982: Crops belong to farmers but land belongs to landowners • Traditional land rights in indigenous territories	• Land tenure system does not comprise management of natural resources • Land rights (especially from smallholders) are not clarified
Informal rules	• Informal mechanisms for administration and utilization of land (corruption) • Multiple leasing	• Difficult registration process leads to informal mechanisms • Land is unofficially leased to migrants
Cooperation	• Similar interests among timber industry and biofuel investors	• A future alliance between timber industry and biofuel investors could increase deforestation and intensify conflicts with smallholders and indigenous communities
Information	• Absence of well documented demarcated and permanent boundaries (boundary conflicts)	• Promotion of income generation activities through NGOs.
Cultural patterns	• Indigenous forest dwelling cultures: dependence of livelihoods and believes	

Step 5 Preparing better decision-making

- *What ecosystem service-related risks and opportunities to the development plan emerge as a result of the foregoing assessment?*
- *Could economic valuation be useful, and if so what should it cover?*
- *Which are the most feasible policy options and entry points to use to capture ecosystem service opportunities, and reduce or avoid risks?*
- *What kind of experiences (positive and negative) related to the implementation of particular instruments and mechanism already exist in the region, and can be built on?*

Guiding Questions

What to do?

Steps 1–4 of the assessment process will have provided information about the linkages between the development plan and ecosystem services, and identified in detail both the main stakeholder groups who stand to gain or lose out from ecosystem changes. They will also have described the main causes or drivers of ecosystem degradation and loss, and the frameworks and incentives that govern how ecosystems are used and managed. This gives us a foundation for formulating a response to these linkages between ecosystem services and the development plan.

Step 5 **appraises the policy options and instruments** that can be used to improve the way in which ecosystem services are used in support of development goals, and to ensure that development activities in turn provide a solid basis for sustainable and equitable ecosystem management and use. It involves identifying the main risks and opportunities that ecosystem services pose to the development plan. By the end of step 5, we should have identified entry points into the decision-making processes surrounding the development plan, and selected suitable policy options and instruments to avoid development risks and capture development opportunities (**Box 18**).

This may involve identifying new policy tools and instruments, so as to fill key gaps in existing frameworks. There may be needs and possibilities to, for example, develop novel ecosystem-oriented markets, incentives or governance structures. In many cases, however, making relatively small changes to existing policies (including overcoming existing distortions and failures) can leverage substantial improvements in the way in which markets, laws and institutions work in relation to ecosystem services. In almost all cases, however, a mix of policy instruments is required, which target different issues and stakeholder groups and work together to achieve a given set of objectives or desired outcomes. Detailed information on policy options and instruments is provided in the annex.

Useful Hints

- *Identify and remove policies and incentive mechanisms that degrade ecosystem services, e.g. economic and fiscal incentives that inadvertently create incentives to degrade ecosystems services, or perverse subsidies.*
- *Consider already-existing policy instruments. Improving what is already there might be more effective than introducing new policy options. This includes law enforcement!*
- *A mix of policy instruments may be required. Keep in mind that each priority ecosystem service may be tackled by different policy options. In many cases more than one solution has to be considered for policy adoption.*
- *Consider adopting new policy tools such as tax incentives, public or private funds for maintenance of ecosystem services, clarification or strengthening of local community rights to use and manage ecosystem services, or establishing protected areas.*
- *Take the legal framework into account. Official statutes and informal rules both provide frameworks for adopting and applying policies to sustain ecosystem services.*

Box 18 Entry points and policy options for integrating ecosystem services into development plans

Entry points	Ministry/Agency/Organisation	Examples of decision processes
National and sub-national policies and plans	Development & planning	• Poverty reduction strategies, land-use planning, water supply, and sanitation
	Environment	• Protected area creation, climate adaptation strategies
	Treasury	• National budgets, public expenditure reviews, audits
	Physical planning, emergency planning, and response	• Integrated ecosystem management of coasts, river basins, forest landscapes, and watersheds
Economic and fiscal incentives	Finance	• Subsidies, tax credits, payments for ecosystem services, import duties, and tariffs
	Budget office	• Tax policies to support easements or promote alternative energy technology, pricing regulations for water
Sector policies and plans	Commerce and industry	• Corporate codes of conduct/standards, assessment of new technologies
	Science and technology	• Applied research, technology transfer, business capacity building
	Agriculture	• Extension services, best management practices
	Forestry	• Forest sector action programs, mapping initiatives, concession management
	Environment/Natural resources	• State of the environment reports, strategic environmental assessments, environmental impact assessments, information/tools, legal instruments
Governance	Prime minister's or mayor's office, justice ministries, legislature, local government bodies	• Decentralisation policies, free press, civil society, accountability of government through elections, access to information and decisions, judicial review, performance indicators

The examples provided for each entry point are not intended to be exhaustive, but rather illustrate the variety of ways ecosystem service considerations can be incorporated into development decision processes.

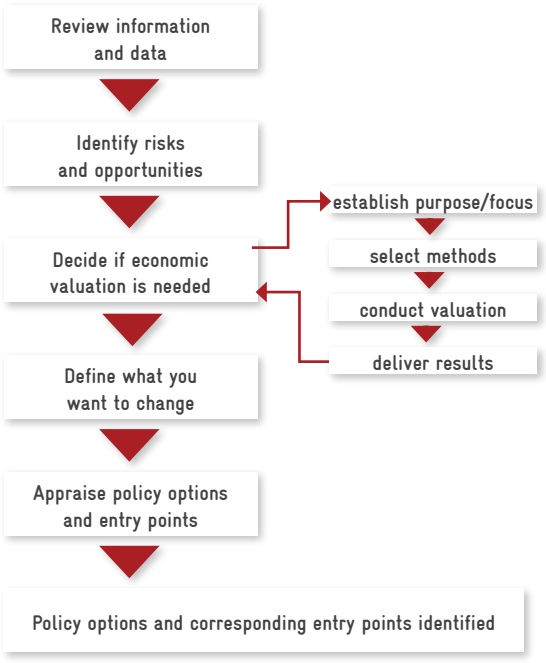
Source: WRI (2008)

How to do it?

First, **bring together all the information that has been collected in steps 1-4.** Start by reviewing the impacts and dependencies of the development plan on ecosystem services, take a look again at trade-offs, and reconsider the institutional, policy, legal and cultural frameworks and incentives. Make sure that you have a clear chain of logic which links together information on these different topics into a coherent "story" about the development plan and the ecosystem services you are concerned with. At this point, some gap-filling may be required, if data is missing or incomplete, or of you realise that key opinions or stakeholders have not had a chance to input properly into the process.

Next, use this information to **identify the risks and opportunities that ecosystem services pose to the development plan.** While doing this, also think about any positive or negative trade-offs that may result from the effect of the development plan on ecosystem services. Remember that trade-offs may involve economic gains or losses (such as physical expenditures or an increase in profits) and other costs (for example a decline in health or an improvement in nutrition), as well as changes in people's non-material circumstances (for instance alienation of cultural heritage or inclusion into decision-making processes). Decide if the development plan needs to be revised, so as to minimise, avoid or mitigate these risks or in order to capture these opportunities.

Figure 6 Workflow of step 5



At this stage, you may want to **consider whether there is a need to carry out economic valuation.** This will provide information on the monetary costs and benefits associated with particular impacts or effects of the

Information on economic costs and benefits can exert a powerful influence on decision-makers. Valuation techniques can be helpful, nonetheless they have to be used "intelligently". Valuation is not an end in itself, but a means to an end – better and more informed decision-making (Emerton and Bos 2004).

Useful Hints

development plan and ecosystem services. The main reasons for using valuation are to provide additional evidence and arguments to convince decision-makers of the need to modify the development plan or to utilise policy instruments, and to generate any additional quantified data that may be needed for designing, planning or evaluating policy instruments. It should, however, be emphasised that valuation is not required, or necessarily useful, in all cases. If you do decide that some kind of economic valuation exercise is needed, its purpose, target group and focus should be clearly elaborated. A great deal of guidance already exists on how to conduct ecosystem valuation, and should be referred to if you choose to carry out a valuation exercise. The annex gives further details of these (**Table 11 and 12**), and also points the reader towards online databases of ecosystem valuation references that may yield useful information (**Table 13**).

Check Annex

On the basis of the risks and opportunities identified and – if a valuation exercise has been carried out – the economic benefits and costs involved, it will now be possible to **define what needs to be changed** in order to reduce the negative ecosystem impacts of the development plan and maximise positive synergies. Revisit the main stakeholder groups which are affected by or drive changes in ecosystem services, and go back to the main causes and drivers of ecosystem degradation. Try to figure out how it might be necessary to change stakeholders' behaviour and actions so as to maintain the flow of ecosystem services, or better capture the opportunities associated with them.

The process of preparing better decision-making culminates in appraising policy options and entry points into decision-making processes. Analyse which instruments or policy changes could be developed and used to minimise, avoid or mitigate risks, and capture opportunities. Review the range of policy options, and choose those that will most effectively sustain the capacity of ecosystem services to meet people's needs. Wherever possible, choose measures and instruments that have already been proved to be effective in relation to ecosystem services and development impacts (**Box 19**), and make use of any windows of opportunity that are associated with public opinion, political and social conditions or market developments in the country or region in which you are working. Last, but not least, pay particular attention to distributional and equity issues: take into account the needs of the poor and vulnerable groups when you identify and select potential policy options and instruments. A detailed list of policy options for integrating ecosystem services, with real-world examples of their application, is provided in the annex (**Table 14**).

Check Annex

Box 19 Policies that show promise for biodiversity and ecosystem services

TEEB reviewed policies that are working, around the world, to promote the integration of biodiversity and ecosystem services into decision-making. The examples come from many different fields, but they convey some common messages for scaling up and replication elsewhere:

- Rethink today's subsidies to reflect tomorrow's priorities.
- Reward currently unrecognised ecosystem services and make sure that the costs of ecosystem damage are accounted for, by creating new markets and promoting appropriate policy instruments.
- Share the benefits of conservation.
- Measure the costs and benefits of ecosystem services.

Source: (TEEB 2008)

The following table shows an example of how you may systematise and visualise the results. The information presented here is based on the fictitious case. In the left column, three current development goals are enlisted. In the next columns ecosystem services related risks and opportunities identified during the previous steps are mentioned and consequently the new/different policy options are derived, considering the drivers and underlying causes as the basis for identifying alternatives. Additionally, entry points for decision-making are pointed out.

Table 6 Matrix for identifying policy options and entry points into decision-making processes

Development goal (actual plan)	Related risks and opportunities	What do we want to change? Drivers to influence and causes to reverse	New/different policy option(s)	Entry points
A				
B				
C				
... etc. ...				

Once a list of possible policy options and entry points has been developed, it is possible to assess their likely viability, feasibility, and "fit" with the development plan. They can be prioritised into a shortlist for further operationalisation in step 6. Although the exact criteria for prioritisation will vary according to the development plan that is being assessed, and the context and conditions under which it will be implemented, filters may include:

- Political viability: to what extent will the measures be supported by high-level decision-makers and politicians. Are they consistent with, and do they support, key development goals and political agendas?
- Public acceptability: have the people who will be affected by the measures indicated their support, and are they in harmony with broader social and cultural norms?
- Legal authority: are the measures enabled, and supported, by law? Do they contravene any informal or customary arrangements?
- Economic viability: is there a net benefit to deploying the measures for society at large or for the groups involved? If there remain uncaptured benefits or uncompensated costs, can transfer mechanisms be deployed to balance these?
- Equity: will any group be made disproportionately better or worse off by the measures, particularly poorer or more vulnerable sectors of the community? If so, can redistributive mechanisms built in where needed?
- Financial viability, sustainability and cost-effectiveness: will there be sufficient funds committed, or to be generated, to cover the costs of the measures over the long-term? Are they the most cost-effective means of reaching a particular outcome?
- Effectiveness and reach: do the measures have a high chance of success, and of reaching the largest possible number of target participants/beneficiaries?
- Urgency: which measures address the highest priority needs and desired outcomes?
- Institutional capacity and sustainability: is there the organisational set-up and institutional capacity to deliver the measures, and to monitor and enforce them over the long-term?
- Ease of implementation: are the measures realistic to implement in the given time frame, resource budget and skill-set?

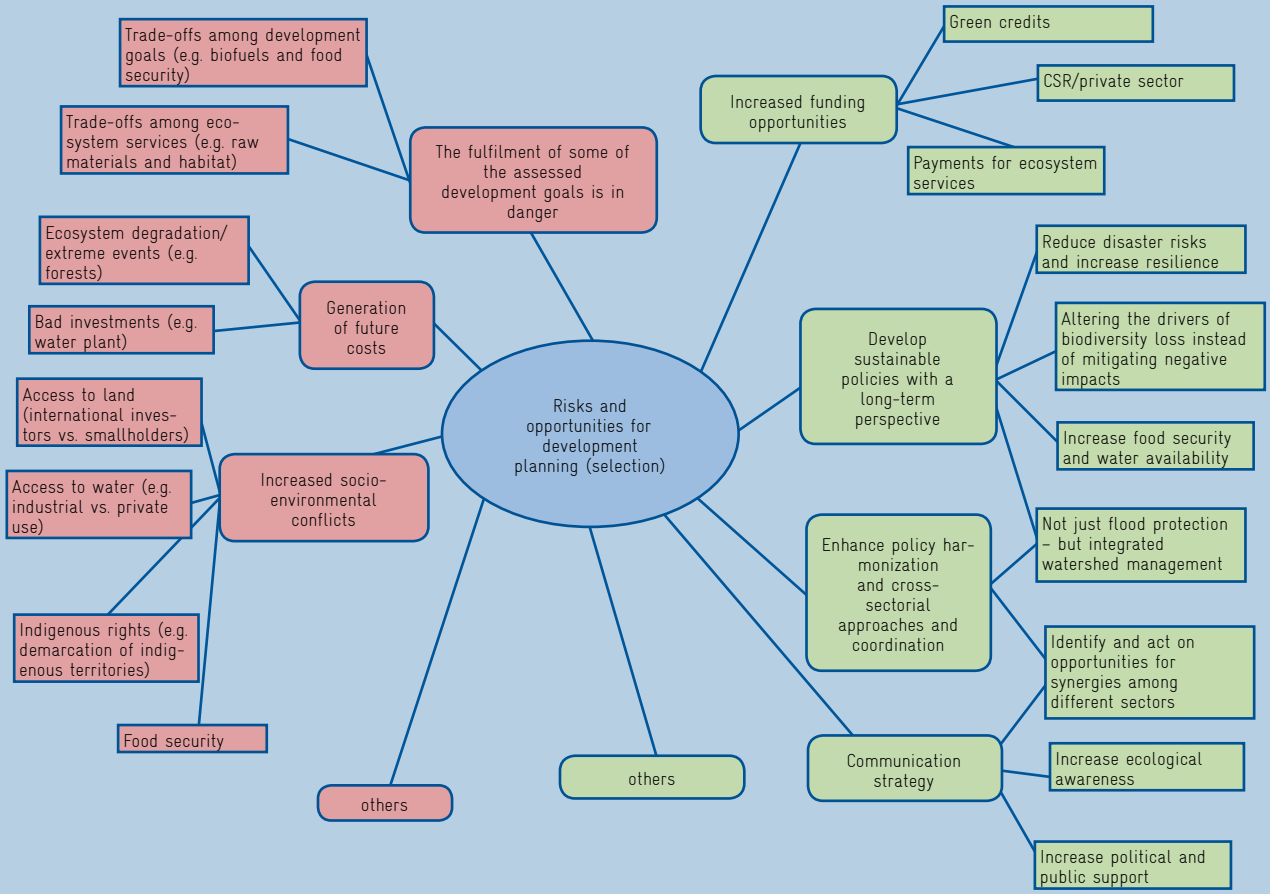
While some of these aspects will require technical review and analysis, much of the information required to prioritise policy options and entry points can be generated through stakeholder consultation. It is particularly important to involve the target groups that are or will be affected by the development plan and the proposed policy instruments, and those who are responsible for making the decisions that will enable the selected instruments to be delivered.

Expected outputs of step 5:

- *Analysis of risks and opportunities based on the synthesis of data and information collected in steps 1–4.*
- *Information on economic values (if required).*
- *Shortlist of policy options and corresponding entry points.*

Indare Provincial Development Plan, Bakul

In order to review the information gathered in the assessment, as well as to identify the risks and opportunities that ecosystem services pose to the Indare Provincial Development Plan, a series of stakeholder consultations were arranged. These targeted government agencies, the scientific and research community, the private sector, NGOs and local land and resource users. The output of these processes is summarised in the figure below, which provides an overview of ecosystem-related risks (in pink) and opportunities (in green) for the Provincial Development Plan.



It was decided that economic valuation would provide valuable information in relation to one particular issue: the development goal concerning the enhancement of water supply and quality. This was for two main reasons. First, in order to mainstream investments in upper catchment ecosystem conservation, it was clear that a justification would have to be provided to the Ministries of Finance and Water Development. Secondly, it emerged that there could be potential for introducing payments for ecosystem services (PES) as a means of funding ecosystem conservation – a system whereby downstream water consumers would transfer payments to reward upper watershed communities and the government agencies responsible for catchment forest protection for sustainable land and resource uses. Information on the economic value of ecosystem water services would both provide a convincing argument for such arrangements, and point to the types and levels of investments that might be required. As ecosystem valuation expertise is as yet undeveloped in Bakul, an international consultant was hired to provide oversight and capacity support to a team of national experts to undertake this study.

In addition to PES, a variety of other policy options were identified as having potential to help minimise the risks and capture the opportunities that ecosystem services had been shown to pose to the Indare Provincial Development Plan. These are shown in the table below. Some of the most important revolved around the clarification and better enforcement of property rights and other land and resource use regulations, and a more supportive use of taxes and subsidies in relation to ecosystem use and management.

Development goal	Related risks and opportunities	What do we want to change? Drivers to influence and causes to reverse	New/different policy option(s)	Entry points
Promotion of biofuels	Trade-offs with supply of food, water in quality and quantity, and habitat conservation. The measure Increases at the expense of other services, putting the goals of food security and water quality in danger. It also competes with other stakeholder groups (smallholders) for limited resources (land, water,..).	Inappropriate land conversion due to negative incentives such as lack of land planning, incentives such as subsidies, shadow prices, unclear property rights.	• Introduce regulation for land use • Increase the conditionality of related subsidies • Create incentives for agro-ecological systems • Clarifying property rights	• Floods and natural hazards related to land conversion • Soil degradation • Social movements against biofuels • Reputation of biofuel investment companies
Enhance water quality through treatment plant	No trade-offs with other development goals but weak sustainability of the measure if this is not complemented with a sustainable watershed-management. Positive costs benefit ratio if the treatment plant is replaced by a better ecosystem management.	Contamination and land conversion due to unsustainable productive systems.	• Promote sustainable land uses and productive systems. Possible instruments: payments for ecosystem services	• Interest of a water company to work with stakeholders in the upper part (because of better reputation – corporate social responsibility and costs saving) • Need of farmers to improve their land uses • Political booming of the payments for ecosystem services topics
Support timber export	Risks related to decline in the supply of timber and non-timber forest products. Trade-offs with promotion of non-timber forest products, provision of water in quantity and quality, with habitat conservation and cultural services for community based tourism. Opportunities are based for example on the combination of sustainable forest management with tourism.	Deforestation and unsustainable timber management. Lack of resources for sustainable forest management, illegal logging, unclear property rights. Inappropriate timber concessions.	• Promotion of sustainable forest management through legal management plans • Improve transparency in the concessions • Introduce incentives (regulation and economics)	• Need of the timber Industry to get more concessions • Improve their reputation • Need for a multiple forest use and pressure from international markets to legal and sustainable timber • Pressure from civil society and NGOs

Step 6 Implementing change

- *Are the prioritised policy options realistic, feasible and acceptable and coherent with the development plan?*
- *Are there the necessary financial, technical, human resource and institutional capacities to deliver on the selected policy options?*
- *Who is going to be involved in implementing the policy measures, and in what role?*
- *How will the impacts of the policy measures be monitored?*
- *How will learning be generated, shared and communicated?*

What to do?

Having identified suitable policy options, the final step in the IES assessment process is to **set up an implementation strategy and operational workplan.**

The implementation strategy lays out the process, guiding principles and intended outcomes for the policy measures and instruments to integrate ecosystem services into development actions. The operational workplan sets out tasks, timelines, responsibilities and stakeholder involvement, and shows the financial resources and other inputs that are needed for successful delivery. By the end of step 6, we should be ready to commence implementation of the selected policy options.

The identified measures and instruments need to be properly resourced and funded. Ideally this should be as part of the overall development plan, but in some cases it may be necessary to secure additional funds or to work through partnerships with others or as part of other initiatives that are already underway.

- *Find opportunities to build on initiatives that are already under way.*
- *Consider best practices from other regions and countries.*
- *Creating a network of partner agencies and interest groups can be a way to strengthen the implementation of the policy instrument.*
- *Political, institutional and community support must be secured to implement policy options successfully and sustainably.*

Decision-maker and stakeholder buy-in in also essential. If those who are affected by the policy options, or are responsible for implementing and enforcing them, are not on board, then it is unlikely that the measures will be implementable. It is usually necessary to provide a clear justification for the proposed actions, and ensure that key stakeholders are consulted and closely involved in planning for them.

How to do it?

Prior to getting started on planning for implementation – via the strategy and workplan – it is first of all important to review the policy measures and entry points identified in step 5, and make quite sure that they are consistent with the development plan objectives. Revise the shortlist of policy measures and entry points identified in step 5 and make sure they are all realistic, feasible and acceptable and coherent with the overarching objectives.

Once a final selection of policy measures has been made, an implementation strategy and workplan can be developed. A wide variety of other guidance is available on formulating strategies and developing workplans (see, for example, the GTZ "Capacity Works" approach to process design and management monitoring (GTZ 2009) and "Results-based Monitoring" (GTZ 2008). The details of these processes need not be repeated in the current guide. Some key points to include, and bear in mind, are:

- **Adaptive management and learning:** adjustments to the scope, target and means of delivery of the policy instruments will almost inevitably need to be made over the course of time. The necessary learning processes, feedback loops and adaptive approaches should be built into the implementation process.
- **Monitoring:** it will be necessary to track the effects of the policy measures in relation to the changes in behaviour that it is intended they will stimulate. Performance indicators should be "SMART": specific, measurable,

achievable, relevant and time-bound, and the means of monitoring them should be built into the strategy and workplan for implementation. In most cases it will also be desirable to monitor their broader impacts and higher-level objectives. Socio-economic/developmental effects and changes in the provision of ecosystem services are likely to be particularly important. It is however worth bearing in mind that establishing accurate baselines and subsequent monitoring protocols is often difficult, time-consuming and costly. There are also typically challenges in attributing changes in socio-economic or ecosystem service indicators to the introduction of a particular policy measure or instrument. If this level of monitoring is to be carried out, it is important to ensure that sufficient data, skills, time and resources are available to do so. Further guidance on ecosystem service indicators and monitoring procedures is provided in the annex (**Box 20**).

- **Information needs and knowledge gaps:** The IES approach that has been outlined in this guide, and has resulted in the identification of policy measures, is a rapid assessment tool. It will not, in most cases, be based on long and detailed primary data collection, or provide a large body of documented material. Knowledge gaps may well remain, which may need to be filled during the course of policy implementation. Information collection and dissemination should form a part of the strategy and operational plan.
- **Communication, education and public awareness:** Are all vital to the successful integration of ecosystem services into public and private decision-making. Communication is required in order to transfer information to stakeholders and the general public, and there should also be an active strategy for learning from others and for sharing lessons and experiences. Consider who may be the partners in communication and how communication strategies promoting the value of ecosystem services can be delivered.
- **Resourcing:** Identification of the financial, material, human resource and institutional needs to deliver the selected policy measures will be an integral part of the operational workplan. In some cases, not all of these resources will be immediately available. The workplan may need to include additional tasks, such as training needs assessment and capacity-building, development of new financial mechanisms and funding proposals, or plans for organisational change.
- **Timing:** Choosing the right time to set up a policy instrument can be important. Opportunities or circumstances which can help or hinder the project's success include: political stability, new government policies and strategies, re-organisation of government departments and institutions. Look out for windows of opportunity. The time taken to initiate or revise a development plan and policy instruments should not be underestimated, especially when they depend on participatory processes. At the same time, it is essential that policy measures can be realised in a timely manner. If they take too long to get off the ground, and if environmental, political, legal, social or economic conditions have changed over the intervening period, they may become redundant.
- **Stakeholder involvement and responsibilities:** Establish who needs (or wants) to be involved in implementing the policy measures, and in what way. A strategy will need to be formulated for ensuring appropriate stakeholder engagement. It is also important to have a clear, and agreed, allocation of responsibilities, specifying who is accountable and in charge of delivering what, and when.

Indare Provincial Development Plan, Bakul

Five policy measures for implementation as part of the Indare Provincial Development Plan were selected from those identified in step 5. These were the ones that were demonstrated to be the most important in terms of the stakeholders and issues they addressed, and which had been proven – via a rapid feasibility assessment of all the policy options – to be the ones that were the most cost-effective, and likely to succeed given the time and resource available for implementing the development plan. Although the budget that had been allocated to the development plan had only limited room for incorporating additional activities, three of the identified policy options (PES, subsidy reform and eco-labelling/certification) would become financially self-sustaining within the development plan period, and so there was no need to search for additional funding sources.

The five policy measures, for which a simplified version of the operational workplan is summarised below were: payments for water ecosystem services; land-use/land-allocation planning to enshrine property rights over agricultural and forest land; reform of subsidies to agro-industry and logging; and introduction of deposit bond systems, support to eco-labelled and certified forest and livestock products; and collaborative forest management agreements between government pa agencies, indigenous communities and ecotourism developers.

Measure	Tasks	Responsible	Notes on resources/inputs
Payments for water ecosystem services (supply and quality)	1. Conduct detailed studies on hydrological services, legal frameworks, user willingness to pay and watershed land use practices.	Units for Environment and Agricultural Development, Hanku University	• Hanku University can provide required technical expertise, and are willing to contribute co-financing from research budget.
	2. Support stakeholder dialogues and negotiations.	Unit for Environment, Environmental NGO, city dwellers and water-using industries	• District-level development budgets can support dialogues.
	3. Develop recommendations and model for PES scheme.	Units for Environment and Agricultural Development, Hanku University	• International technical expertise will be required, and may be funded by multilateral or bilateral donors.
	4. Establish sold legal base.	Unit for Environment, Ministry of Justice	• Staffing inputs can be provided by Ministry of Justice experts.
	5. Pilot PES in priority sub-catchments.	Unit for Environment, Environmental NGO, rural smallholders, indigenous communities, city dwellers and water-using industries	• Only short-term start-up finance required before PES schemes become self-financing.
Land-use/land-allocation planning to enshrine property rights over agricultural and forest land	1. Establish base maps and population censuses.	Land Department, Hanku University	• Will be need to purchase new satellite imagery.
	2. Convene community-level meetings and boundary demarcation exercises.	Land Department, rural smallholders, indigenous communities	• District-level development budgets can support dialogues. • Land Department budget and staffing will cover boundary demarcation.
	3. Establish a supportive legal framework.	Land Department, Ministry of Justice	• Staffing inputs can be provided by Ministry of Justice experts.
	4. Prepare and distribute land certificates.	Land Department, Ministry of Justice, Local Authorities	• Land Department budget and staffing will cover.
Reform of subsidies to agro-industry and logging, and introduction of deposit bond systems	1. Conduct advocacy and awareness campaign among high-level decision-makers and corporate sector.	Unit for Agricultural Development, sectoral line agencies, biofuel and timber companies	• Bakul Chamber of Commerce has expressed willingness to fund.
	2. Identify key policy and legal niches to reform subsidies and introduce positive incentives.	Unit for Agricultural Development, Ministry of Justice	• Staffing inputs can be provided by Ministry of Justice experts.
	3. Draft and formalise revised legal text.	Unit for Agricultural Development, Ministry of Justice	• Staffing inputs can be provided by Ministry of Justice experts.
	4. Facilitate awareness campaign among affected industries.	Unit for Agricultural Development, sectoral line agencies, biofuel and timber companies	• District-level development budgets can support campaign. • May be potential for co-financing by private sector.
Support to eco-labelled and certified forest and livestock production	1. Conduct studies in land use practices and on domestic/international market dynamics.	Land Department, Unit for Environment, Hanku University	• Hanku University can provide required technical expertise, and are willing to contribute co-financing from research budget.
	2. Work with farmers and forest companies to extend and promote sustainable practices.	Land Department, Unit for Environment, Hanku University, rural smallholders, timber companies	• Existing development plan budget line for agricultural extension can be used.
	3. Provide training in new technologies and marketing arrangements.	Hanku University, rural smallholders, timber companies	• Existing development plan budget line for rural training centres can be used.
	4. Develop and apply internationally-certified national standards and labels.	Land Department, Unit for Environment, Ministry for Export Promotion, rural smallholders, timber companies	• Additional support to be sought from International Tropical Timber Organisation and Forest Stewardship Council.
	5. Support national and international marketing and PR campaign.	Land Department, Unit for Environment, Ministry for Export Promotion	• Will require contract with private sector marketing and PR firm.
Collaborative forest management agreements between government PA agencies, indigenous communities and ecotourism developers	1. Facilitate dialogues between PA authorities, communities and private sector.	Unit for Environment, rural smallholders, indigenous communities, ecotourism companies	• District-level development budgets can support dialogues.
	2. Review existing legal, institutional and customary frameworks to identify needs and niches for collaboration.	Unit for Environment, Ministry of Justice	• Staffing inputs can be provided by Ministry of Justice experts.
	3. Establish a supportive legal and institutional framework for collaboration	Unit for Environment, Ministry of Justice	• Staffing inputs can be provided by Ministry of Justice experts.
	4. Identify concrete joint management opportunities and plans.	Unit for Environment, rural smallholders, indigenous communities, ecotourism companies	• Presidential Fund for Cultural and Natural Tourism may be able to supplement funds.
	5. Formulate pilot collaborative forest management agreements.	Unit for Environment, rural smallholders, indigenous communities, ecotourism companies	• Presidential Fund for Cultural and Natural Tourism may be able to supplement funds.

PART 3
Glossary and References

Glossary of terms

Access and Benefit Sharing (ABS): The ABS principle of the Convention on Biological Diversity (CBD) aims at ensuring a fair and equitable sharing of the benefits arising from the use of genetic resources. This means that, where genetic resources are used for scientific or commercial purposes, the country of origin is to be recompensed. (GIZ 2011).

Biodiversity is the variety of life on earth and the foundation of ecosystem services. The United Nations Convention on Biological Diversity (CBD) defines bio-logical diversity as the variability among living organisms from all sources, including terrestrial, marine, and other aquatic ecosystems, and the ecological complexes of which they are part. This includes diversity within species (genetic diversity), between species and of ecosystems, with corresponding elements, functions and structures. The different levels and aspects of biodiversity directly and indirectly contribute to ecosystem goods and services. For example, the decomposition process which relies on the participation of a variety of micro-organisms is essential to nutrient cycling, a supporting service that helps to maintain productive soils for agriculture. Pest control is another key ecosystem service underpinned by biodiversity, which is determined by the abundance of natural enemies of the pest species involved.

Certification: Certification of ecological and socially responsible management sets businesses apart from their competitors and can allow them to realise added value. A well-known example is the certification of forest enterprises based on the standards of the Forest Stewardship Council (FSC), whose wood products enter higher-grade markets.

Command and control policy: Refers to environmental policy that relies on regulation (permission, prohibition, standard setting and enforcement) as opposed to financial incentives, that is, economic instruments of cost internalisation. (OECD 2011).

Development refers to actions that aim to improve human well-being. It encompasses social, economic, and environmental issues, such as economic growth, poverty reduction, infrastructure expansion, energy independence, and adaptation to climate change (WRI 2008). **Development planning** is seen here as the process of preparing and carrying out a project that seeks to ameliorate the living conditions in a community, region or nation. Development planning comprises strategic measurable goals that have to be met within a certain time period. The planning process always requires the involvement of stakeholders. The term **development plan** refers to all actions that are part of the planning process (projects, policy instruments, activities).

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 (e.g. harvesting goods) and non-consumptive uses (e.g. enjoyment of scenic beauty). (TEEB 2010).

Discount rate: A rate used to determine the present value of future benefits (TEEB 2010). Basic underlying idea is that we value something in the future less than something that we can have right now. The practice of discounting applies first and foremost to an individual deciding how to allocate scarce resources at a particular point in time. In general, an individual would prefer to have something now, rather than in the future, though with some exceptions (the value of anticipation, for example). This is the main argument for a positive discount rate. But, again in general, a higher discount rate will lead to the long-term degradation of biodiversity and ecosystems. For example, a 5 % discount rate implies that biodiversity loss 50 years from now will be valued at only $^1/_7$ of the same amount of biodiversity loss today. There is a fundamental difference between the individual-at-a-point-in-time discount rate and the social discount rate.

Drivers of biodiversity loss: Any natural or human-induced factor that directly or indirectly causes biodiversity loss. (IUCN 2010)

Ecological infrastructure: A concept referring to both services by natural ecosystems (e.g. storm protection by mangroves and coral reefs or water purification by forests and wetlands), and to nature within man-made ecosystems (e.g. microclimate regulation by urban parks).

Ecosystem based adaptation (EbA): The use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change. As one of the possible elements of an overall adaptation strategy, ecosystem-based adaptation uses the sustainable management, conservation, and restoration of ecosystems to provide services that enable people to adapt to the impacts of climate change. (CBD, IUCN 2010).

Ecosystem: A community of plants, animals and smaller organisms that live, feed, reproduce and interact in the same area or environment (IUCN 2010). It is a dynamic complex of animals, plants and micro-organisms and their non-living environment interacting as a functional unit, and depending on one another. If one part is damaged it can have an impact on the whole system. Humans are an integral part of ecosystems. Ecosystems can be terrestrial or marine, inland or coastal, rural or urban. They can also vary in scale from global to local. Examples of ecosystems include forests, wetlands, marine/open ocean, coastal, inland water, drylands, desert, cultivated (cropland, pasture, e.g.) and urban ecosystems.

Ecosystem restoration: The process of assisting the recovery of an ecosystem that has been degraded damaged or destroyed. (SER Primer 2004).

Ecosystem services are goods and services provided by the environment that benefit and sustain the well-being of people. These services come from natural (e.g. tropical forests) and modified ecosystems (e.g. agricultural landscapes). While there is no single, agreed method of categorising all ecosystem services, the Millennium Ecosystem Assessment (MEA) framework of provisioning, regulating, supporting and cultural services is widely accepted and seen as a useful starting point.

Ecosystem services: The benefits people obtain from nature. Ecosystem services are the transformation of natural assets (soil, plants and animals, air and water) into things that we value. They can be viewed as provisioning such as food and water; regulating, for example, flood and disease control; cultural such as spiritual, recreational, and cultural benefits; or supporting like nutrient cycling that maintain the conditions for life on Earth. Ecosystem 'goods' include food, medicinal plants, construction materials, tourism and recreation, and wild genes for domestic plants and animals. (IUCN 2010).

Emissions certificates: An example for trade with emissions certificates with regard to emergent and developing countries is the Clean Development Mechanism (CDM). CDM enables private or government investors to implement projects for emissions reduction in developing countries and get credit for the reductions for their obligations laid down in the Kyoto Protocol of the UN Framework Convention on Climate Change in industrialised countries. Units consist of certified emissions reductions (CERS) in metric tonnes of CO_2 equivalents (tCO_2e).

Endemic: Restricted to a particular area. Used to describe a species or organism that is confined to a particular geographical region, for example, an island or river basin. (IUCN 2010).

Environmental and conservation funds: Financing mechanisms that foster sustainable and effective management as well as the protection of ecosystems and our environment. There are at least two different main areas of application for environmental and conservation funds: i) Financing environmental protection measures and environment-related projects. This includes environmentally-sound investments in urban-industrial areas in an effort to improve companies' or the state's business activities (e.g. energy, water and wastewater services) and to improve the quality of life in cities and industrial centres. ii) Financing conservation measures, especially the long-term financing of operating costs for conservation areas within the context of conservation area management, but also financing other measures such as efforts to combat desertification. (GTZ 2004).

Environmental Fiscal Reform (EFR): Refers to a range of taxation and pricing measures that can free up economic resources and/or generate revenues while helping to reach environmental goals. Provided the reform is appropriately designed, EFR can also have direct and positive effects on poverty reduction, helping to address environmental problems by influencing

behaviour through price mechanisms and markets or paid licences. It can also have an indirect effect by generating resources for anti-poverty programmes in areas such as water supply and sanitation, or for pro-poor investments in health and education, for instance. (OECD 2005).

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). (TEEB 2010).

Externalities: 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. (TEEB 2010).

External benefits or positive externalities: are external or side effects that benefit other people from production and consumption activities. If these are added to the private benefits we get the total social benefits. An example of a positive externality would be when somebody has and takes care of a garden and his or her neighbour can benefits from its beautiful view and the perfume of the flowers, not having to pay or work for it.

External costs or negative externalities: are external or side effects that damage other people from production and consumption activities. If these are added to the private costs we get the total social costs. An example of negative externalities would be the side effects of production process such as the pollution (noise, dust and vibration) endured by people living next to a quarry.

Governance: The rules and enforcement mechanisms that guide and coordinate people's behaviour. Governance is the body of rules, enforcement mechanisms and corresponding interactive processes that coordinate and bring into line the activities of the involved persons with regard to a common outcome (Huppert, Svendsen & Vermillion 2003). Governance is not only what a central government or a dictator may do. It is the result of the interaction of a multitude of actors and mechanisms. Consequently, governance occurs whenever more than one single person makes use of a natural resource. (GTZ 2004).**Governance of ecosystems:** The process of regulating human behaviour in accordance with shared ecosystem objectives. The term includes both governmental and nongovernmental mechanisms. (TEEB 2010).

Habitat change: Change in the local environmental conditions in which a particular organism lives. Habitat change can occur naturally through droughts, disease, fire, hurricanes, mudslides, volcanoes, earthquakes, slight increases or decreases in seasonal temperature or precipitation, etc. However, it is generally induced by human activities such as land use change and physical modification of rivers or water withdrawal from rivers. (IUCN 2010).

Habitat: The place or type of site where an organism or population naturally occurs. (IUCN 2010).

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. (TEEB 2010).

Incentives: Factors that motivate human behaviour. They can be positive and foster certain behaviour, but they can also act as disincentives and deter people from doing something. Incentives can be material, but also non-material. Reputation and appreciation are examples of non-material incentives. We assume that people act under bounded rationality, i. e.,that they always try to increase their individual utility, restricted by their actual opportunities and capabilities. In many cases, people cannot maximise their utility since they have access to a limited amount of information only, or because their willingness to make an effort and spend time on a particular decision is low. But at large, people strive for an increased overall individual utility. In this manual we do not discuss issues such as the occurrence of bounded rationality, if irrational behaviour exists at all, or how people make decisions. (GTZ 2004).

Indirect-use value (of ecosystems): The benefits derived from the goods and services provided by an ecosystem that are used indirectly by an economic agent. For example, the purification of drinking water filtered by soils. (TEEB 2010).

Institutions: Formal and informal rules (North 1990) including the corresponding measures to enforce them. Institutions can guide human behaviour and reduce uncertainty (Richter & Furubotn 1999). They can take

various shapes and forms – meeting your colleagues for lunch every day at a particular time, established procedures of conflict resolution in a school class, the right of way in traffic, but also agreements on the use of a particular grazing area – all these guidelines for human behaviour can be considered institutions. (GTZ 2004).

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. (TEEB 2010).

Natural capital is the extension of the economic notion of capital (manufactured means of production) to environmental goods and services. A functional definition of capital in general is: „a stock that yields a flow of valuable goods or services into the future". Natural capital is thus the stock of natural ecosystems that yields a flow of valuable ecosystem goods or services into the future. For example, a stock of trees or fish provides a flow of new trees or fish, a flow which can be sustainable indefinitely. Natural capital may also provide services like recycling wastes or water catchment and erosion control. Since the flow of services from ecosystems requires that they function as whole systems, the structure and diversity of the system are important components of natural capital (Costanza 2008). Natural capital is generally considered to comprise three principal categories: natural resource stocks, land and ecosystems. All are considered essential to the long-term sustainability of development for their provision of "functions" to the economy, as well as to mankind outside the economy and other living beings (OECD 2011).

Natural resources: Those parts of nature that have an economic or cultural value to people. In an economic sense, man-made capital and labour are also resources. However, they are not of a 'natural' origin. Some natural resources require the use of man-made capital and/or labour in order to make them accessible and ready to use. In this manual however, we focus on the streams of benefits and costs, i. e., the goods and services that derive from resources, rather than on the resources themselves. Thus, in this context it is not necessary to differentiate between pure natural resources and other kinds of resources. (GTZ 2004).

Non-use value: Benefits which do not arise from direct or indirect use. (TEEB 2010).

Opportunity costs: Foregone benefits of not using land/ecosystems in a different way, e.g. the potential income from agriculture when conserving a forest. (TEEB 2010).

Payments for ecosystem services (PES): Payments for ecosystem services aim to bring about sustainable land use through direct incentives. This approach works towards the goal of promoting improved and more cost-efficient sustainable use of resources. The core concept of PES is that those who provide ecosystem services should be compensated for doing so and that those who benefit from the services should pay for their provision. (World Bank 2002).

Policy/policies: Has a contextual dimension and considers the different fields of politics as e.g. economic policy, social policy and environmental policy. Each policy looks at the actual situation of a field, the tasks it contains the goals of the policy to be passed, the realisation of it and the expected and achieved results.

Politics: Has a procedural dimension and focuses more on the processes of politics which evolve during the formation of consent and the resolving of conflicts and which eventually result in a decision-making process. Not only does implementation and enforcement belong to these processes, but also "non-decisions".

Polity: Has a formal, value-orientated and institutional dimension and pays attention to the organisation of the state and how to manage the system to obtain political order and stability. Parts of polity are the constitution, the wordings of laws and the institutions of the state as administrative offices and their tasks.

Private goods: Goods characterised by very high levels of subtractability and excludability. Subtractability means that one person's consumption of the good reduces the quantity available to others. Excludability means that the producer can restrict use of the product to those consumers who are willing to pay for it, while excluding those who do not meet this or other criteria. Private goods can be produced under private ownership or under public ownership.

Property rights: are..."socially enforced rights to selected uses of an economic good"... (Alchian 1987:1031). They may connote the type of relationships among social actors "In the sense of sanctioned behavioural

relations among men that arise from the existence of things and pertain to their use as well in the sense of the right to manage, to transfer, to compensate, to income, to exclusion". (Hanna and Munasinghe 1995).

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. (TEEB 2010).

Resilience (of ecosystems): Their ability to function and provide critical ecosystem services under changing conditions. (TEEB 2010).

Risk: The combination of the probability of an event and its negative consequences. (UN ISDR 2009).

Sustainability: Does not only imply long-term considerations, but – in the sense of the Brundtland-Commission – also the economic, social and ecological dimensions of sustainable development. In line with the 1992 UN Conference on Environment and Development (UNCED), for the Federal Ministry of Economic Cooperation and Development (BMZ) the ultimate objective of all German Development work is sustainable development. (GTZ 2004).

Threshold/tipping point: A point or level at which ecosystems change, sometimes irreversibly, to a significantly different state, seriously affecting their capacity to deliver certain ecosystem services. (TEEB 2010).

Total economic value (TEV): A framework for considering various constituents of value, including direct use value, indirect use value, option value, quasi-option value, and existence value. (TEEB 2010).

Trade-offs: A choice that involves losing one quality or service in return for gaining another quality or service. In other words, it describes an exchange where you give up one thing in order to get something else that you also desire.

Transaction costs: The resources expended for the creation, maintenance and use of institutions (Richter & Furubotn 1999).

Use value: The value that is derived from using or having the potential to use a resource. This is the net sum of direct use values, indirect use values and option values. (TEEB 2010).

Valuation, economic: The process of estimating a value for a particular good or service in a certain context in monetary terms. (TEEB 2010).

Willingness-to-pay (WTP): Estimate of the amount people are prepared to pay in exchange for a certain state or good for which there is normally no market price (e.g. WTP for protection of an endangered species). (TEEB 2010).

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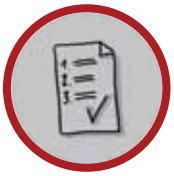
PART 4

Annex – Information, tools & more



Useful information and tools for Step 1 and 2

Table 7 Checklist of ecosystem services

Service	Sub-category	Definition	Examples
Provisioning services: The goods or products obtained from ecosystems			
Food	Crops	Cultivated plants or agricultural produce that are harvested by people for human or animal consumption as food.	Grains Vegetables Fruit
	Livestock	Animals raised for domestic or commercial consumption or use.	Chicken Pigs Cattle
	Capture fisheries	Wild fish captured through trawling and other non-farming methods.	Cod Crabs Tuna
	Aquaculture	Fish, shellfish, and/or plants that are bred and reared in ponds, enclosures, and other forms of freshwater or saltwater confinement for purposes of harvesting.	Shrimp Oysters Salmon
	Wild foods	Edible plant and animal species gathered or captured in the wild.	Fruit and nuts Fungi Bushmeat
Fibre	Timber and wood fibre	Products made from trees harvested from natural forest ecosystems, plantations, or non-forested lands.	Industrial roundwood Wood pulp Paper
	Other fibres	Non-wood and nonfuel fibres extracted from the natural environment for a variety of uses.	Textiles (clothing, linen, accessories) Cordage (twine, rope)
Biomass fuel (wood fuel)		Biological material derived from living or recently living organisms - both plant and animal - that serves as a source of energy.	Fuelwood and charcoal Grain for ethanol production Dung.
Freshwater		Inland bodies of water, groundwater, rainwater, and surface waters for household, industrial, and agricultural uses.	Freshwater for drinking, cleaning, cooling, industrial processes, electricity generation, or mode of transportation.
Genetic resources		Genes and genetic information used for animal breeding, plant improvement, and biotechnology.	Genes used to increase crop resistance.
Biochemicals, natural medicines, and pharmaceuticals		Medicines, biocides, food additives, and other biological materials derived from ecosystems for commercial or domestic use.	Echinacea, ginseng, garlic Paclitaxel as basis for cancer drugs Tree extracts used for pest control.
Regulating services: Regulating services are the benefits obtained from an ecosystem's control of natural processes			
Air quality regulation		Influence ecosystems have on air quality by emitting chemicals to the atmosphere (i.e., serving as a – "source") or extracting chemicals from the atmosphere (i.e., serving as a "sink").	Lakes serve as a sink for industrial emissions of sulphur compounds Vegetation fires emit particulates, ground-level ozone, and volatile organic compounds

Climate regulation	Global	Influence ecosystems have on global climate by emitting greenhouse gases or aerosols to the atmosphere or by absorbing greenhouse gases or aerosols from the atmosphere.	Forests capture and store carbon dioxide. Cattle and rice paddies emit methane.
	Regional and local	Influence ecosystems have on local or regional temperature, precipitation, and other climatic factors.	Forests can impact regional rainfall levels. Lakes regulate humidity levels and influence frequency of frosts, important for agriculture.
	Carbon sequestration	The extraction of carbon dioxide from the atmosphere serving as a sink.	Expanding areas of boreal forests, increases the sink. Deforestation in the tropics, decreases the sink. Ocean carbon sequestration.
Water regulation		Influence ecosystems have on the timing and magnitude of water runoff, flooding, and aquifer recharge, particularly in terms of the water storage potential of the ecosystem or landscape.	Permeable soil facilitates aquifer recharge River floodplains and wetlands retain water - which can decrease flooding during runoff peaks - reducing the need for engineered flood control infrastructure.
Erosion regulation		Role vegetative cover plays in soil retention.	Vegetation such as grass and trees prevents soil loss due to wind and rain and siltation of waterways Forests on slopes hold soil in place, thereby preventing landslides.
Water purification and waste treatment		Role ecosystems play in the filtration and decomposition of organic wastes and pollutants in water; assimilation and detoxification of compounds through soil and subsoil processes.	Wetlands remove harmful pollutants from water by trapping metals and organic materials Soil microbes degrade organic waste, rendering it less harmful.
Disease regulation		Influence that ecosystems have on the incidence and abundance of human pathogens.	Some intact forests reduce the occurrence of standing water - a breeding area for mosquitoes - which lowers the prevalence of malaria.
Pest regulation		Influence ecosystems have on the prevalence of crop and livestock pests and diseases.	Predators from nearby forests - such as bats, toads, and snakes -consume crop pests.
Pollination		Role ecosystems play in transferring pollen from male to female flower parts.	Bees from nearby forests pollinate crops.
Natural hazard regulation		Capacity for ecosystems to reduce the damage caused by natural disasters such as hurricanes and to maintain natural fire frequency and intensity.	Mangrove forests and coral reefs protect coastlines from storm surges Biological decomposition processes reduce potential fuel for wildfires.
Cultural services: The nonmaterial benefits obtained from ecosystems			
Recreation and ecotourism		Recreational pleasure people derive from natural or cultivated ecosystems.	Hiking, camping, bird watching and going on safari.
Spiritual, religious and ethical values		Spiritual, religious, aesthetic, intrinsic, - "existence", or other values people attach to ecosystems, landscapes, or species.	Spiritual fulfilment derived from sacred lands and rivers Belief that all species are worth protecting regardless of their utility to people – "biodiversity for biodiversity's sake".
Aesthetic values		The beauty and aesthetic values of nature in all its appearances.	Beauty of nature, from a molecule to a flower to a forest.
Supporting Services: Ecosystem services that are necessary for the delivery of all other ecosystem services and that maintain the conditions for life on Earth. Supporting services differ from all other service categories in that their impacts on people are indirect.			
Primary production		The formation of biological material by plants, some protest and some bacteria through photosynthesis and nutrient assimilation.	Algae transform sunlight and nutrients into biomass, thereby forming the base of the food chain in aquatic ecosystems.
Production of atmospheric oxygen		The process of oxygen production by plants, green algae and cyanobacteria.	Green algae and cyanobacteria in marine environments provide about 70 % of the free oxygen produced on earth and the rest is produced by terrestrial plants.
Nutrient cycling		Role ecosystems play in the flow and recycling of nutrients (e.g., nitrogen, sulphur, phosphorus, carbon) through processes such as decomposition and/or absorption.	Decomposition of organic matter contributes to soil fertility.

Soil formation and retention	Soil formation is the combined effect of physical, chemical, biological, and anthropogenic processes on soil parent material. Also soil has the retention capacity for nutrients and water.	The weathering of bedrock produces the parent material from which soils form.
Water cycling	The flow of water through ecosystems in its solid, liquid, or gaseous forms.	Transfer of water from soil to plants, plants to air, and air to rain.
Provisioning of habitat	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.

Source: adapted from WRI/WBCSD 2008

Useful information and tools for Step 3

Table 8 Measures and indicators of biodiversity and ecosystem services

Category	Examples
Measures of diversity	Species diversity, richness and endemism Beta (turnover of species), phylogenetic, genetic, functional diversity
Measures of quantity	Extent and geographic distribution of species and ecosystems, Abundance/population size Biomass/net primary production
Measures of conditions	Threatened species/ecosystems Red List Index (RLI) Ecosystem connectivity and fragmentation (fractal dimension, core area index, connectivity, patch cohesion)
Measures of pressures	Land cover change Climate change Pollution and eutrophication (nutrient level assessment) Human footprint indicators (e.g. human appropriate net primary productivity, HANPP, Living Planet Index (LPI), ecological debt. Levels of use (harvesting abstraction Alien invasive species
Measures of provisioning services	Timber, fuel, fibre livestock and fisheries production Wild animals products Harvested medicinal plants Water yield and regulation Biological infrastructure need for nature based recreation
Measures of regulating services	Carbon sequestration, water flows regulation and production, natural hazard regulation, waste assimilation, erosion regulation, soil protection, disease regulation, pollination, pest control
Measures of cultural services	Recreational use, tourism numbers or income, spiritual values, aesthetic values

Source: TEEB Foundation 2010

Figure 7 Challenges in assessing ecosystem services

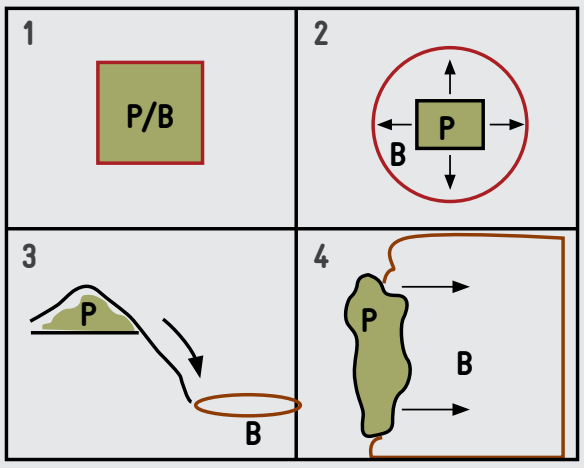
When assessing the condition and trends of ecosystem services a clear understanding of scale, spatial pattern, and timing of service flows can lead to more effective environmental policies and management interventions. First, ecosystem services are not homogenous across landscapes or seascapes, nor are they static phenomena. They are heterogeneous in space and evolve through time.

Classifying ecosystem services in this way recognises such characteristics as the spatio-temporal dynamics of ecosystems:

1. Spatial and temporal variation of energy flow determines location and productivity of ecosystems (e.g., temperature and precipitation greatly influence abundance and distribution of biodiversity in a given landscape)
2. Provision and delivery of services from ecosystems is a function of spatial configuration of ecosystems (e.g., type of vegetation and its location influences water provision, nutrient transport and some cultural services)
3. "Ecosystem services do not always decline or improve in a linear and predictable manner. They may naturally go through cycles of collapse and renewal." (WRI 2008)
4. The spatial configuration of land cover in a region affects ecological patterns and processes. For example, changes in the structure of the landscape can alter (in a negative way) nutrient transport and transformation, species persistence and biodiversity, and nurture invasive species.
5. In many cases impacts due to changes in ecosystems (e.g. deforestation) are highly site-specific, and the intensity of the impact (e.g. floods) will depend on the receiving end (e.g. size/location of community along floodplain)

Another challenge when making management decisions is the "spatial mismatch" regarding the area where the ecosystem service is produced and the area that benefits from it. The following figure shows possible spatial relationships between service production areas (P) and service benefit areas (B).

Figure 8 Spatial mismatch between service production and service benefit areas



Source: Fisher et al, 2009

In panel 1, both the service provision and benefit occur at the same location (e.g. soil formation, provision of raw materials). In panel 2, the service is provided omni-directionally and benefits the surrounding landscape (e.g. pollination, carbon sequestration). Whereas panel 3 and 4 demonstrate services that have specific directional benefits. In panel 3, down slope areas benefit from services provided in uphill areas, for example water regulation services provided by forested slopes. In panel 4, the service provision unit could be coastal wetlands providing storm and flood protection to a coastline.

Figure 9 Choosing the right assessment method

The selection of an assessment method should be undertaken considering:

- Objective of the assessment - What do you want to do/to achieve with the results?
- Level of accuracy needed - How detailed has to be your assessment?
- Financial and personnel resources available to you - What is realistic to do in the given conditions?
- Technical skills required - Shall the assessment be easily to repeat, for example for monitoring purposes?
- Given time frame - How soon do you need results?

Table 9 Assessment methods and their common usage

Tool	Description	Sample use
Remote Sensing	Data obtained from satellite sensors or aerial photographs (LANDSAT, MODIS).	Assessment of large areas, land cover/land use, wetland distribution, primary productivity, and other attributes of the land. Repeated observations of the same area are possible and allow for the assessment of trends.
Inventories	Lists.	Tally ecosystem services (e.g. types of services provided by a wetland), biodiversity (e.g. lists of endemic or threatened species, lists of habitats or vegetation types), and natural resources (data on locations and amounts of provisioning services such as water, timber, agricultural products, and fisheries) for a specific site. Information in inventories is collected through field surveys (e.g. transect walks, rapid ecological assessments), biophysical studies, historical records and databases, paleo studies etc.
Participatory Approaches and Expert Opinion	Information supplied by stakeholder groups, scientific experts, workshops, traditional knowledge.	Collection of forms of data not available in scientific literature (e.g. from traditional and indigenous knowledge). Fills gaps on qualitative information of ecosystems. Adds new perspectives, knowledge, and values to assessment. Approaches: Focus group workshops, semistructured interviews with key informants, interactive theatre, participatory mapping, ranking and scoring (e.g. asking community members to use the number of stones to score the water quality in various areas under different forms of tenure over a certain amount of time), trend lines, problem trees, role-playing, and seasonal calendars.
Economic Valuation	Economic valuation is a technique used to place a value on the benefits derived by humans from ecosystems and their services.	The economic value is expressed in monetary terms in order to measure the benefits of a wide variety of services using a common metric. Several techniques are used in the economic valuation of services (see Step 5 for further information).
Corporate ecosystem valuation	Corporate ecosystem valuation is a new innovation, developed by the World Business Council for Sustainable Development (WBCSD) specifically for business and the private sector. It can be used in relation to business operations as well as to suppliers, customers and other stakeholders. For further information see WBCSD 2011.	Corporate Ecosystem Valuation (CEV) can be defined as a process to make better-informed business decisions by explicitly valuing both ecosystem degradation and the benefits provided by ecosystem services. By including ecosystem values, the company's aim is to improve corporate performance in relation to social and environmental goals and the financial bottom-line. Valuation can make decision-making around ecosystems more compelling and practical, thereby enhancing sustainable development strategies and outcomes.
(Proxy) Indicators	An indicator is a scientific construct that uses data to measure the condition and trends of ecosystem services, drivers of change, or human well-being (MA 2003). Indicators of ecosystem services ideally convey information about the flow of service. Due to the difficultly in measuring the flow of benefits from some regulating and cultural services, it may be necessary to rely on proxy indicators. A proxy indicator is a substitute measure used to provide insight into the area of interest when it is not possible to measure the issue directly.	Indicators allow spatial and temporal comparisons between values. Ecosystem state indicators can help policy-makers understand how decisions and policies may impact the flow of services. Examples of ecosystem state indicators include forest extent, nutrient levels in streams, and prevalence of non-native species. Examples of proxy indicators include tons of wheat produced on a hectare of land, the amount of nutrient removed from agricultural runoff by wetlands, cubic kilometers of water stored in a forest, and the tourist income received by a coastal community.
Geographic Information Systems	Software that spatially maps and analyses digitized data (ArcGIS, ArcView, IDRISI).	Analysis of temporal changes in ecosystems. Determine spatial characteristics such as distance, patch size, and shape. Integrate land cover information from different sources. Overlap social, economic, and ecological information. Correlate trends in ecosystem services with land use change. Analyze trade-offs between ecosystem service provision and development measures. Provide a graphic interface with spatial models of ecosystem processes and scenario outputs.

Ecological Models	Models are simplified representations of reality. They are mathematical expressions that represent the complex interactions between physical, biological, and socioeconomic elements of ecosystems (SWAT, IMAGE, IMPACT, WaterGAP, EcoPath, Ecosim).	Filling gaps in existing data; quantifying the effects of management decisions on the condition of ecosystem services; projecting long-term effects of changes in ecosystem condition; assessing the effects of individual drivers and scenarios on ecosystem condition and the supply of ecosystem services (e.g. simulate the change of carbon storage for different land use scenarios); exploring the links between elements in a system.
INVEST (INtegrated Valuation of Ecosystem Services and Tradeoffs)	InVEST is a tool to model and map the delivery, distribution, and economic value of ecosystem services. It aims to enable decision-makers to assess the tradeoffs associated with alternative choices and to identify areas where investment in natural capital can enhance human development and conservation in terrestrial, freshwater, and marine ecosystems. For more information: www.naturalcapitalproject.org/InVEST.html	• Conservation organizations can use InVEST to align their missions to protect biodiversity with activities that improve human livelihoods. • Corporations, such as bottling plants, timber companies, and water utilities, can use InVEST to decide how and where to make investments to protect their supply chains. • Government agencies can use InVEST to help determine how to manage lands and waters to provide an optimal mix of benefits to people or to help design permitting and mitigation programs that sustain nature's benefits to society.
ARIES (ARtificial Intelligence for Ecosystem Services)	ARIES is a web-based technology offered to users worldwide to assist rapid ecosystem service assessment and valuation. Its purpose is to make environmental decision making easier and more effective. ARIES is an open source software. For more information: www.ariesonline.org	ARIES can help: • Conservation planning by identifying crucial areas to protect the flow of ecosystem services. • Businesses reducing liability. • Link marine and terrestrial habitats by accounting for biophysical flows of ecosystem services across the landscape. • Generate scenarios to explore changes in ecosystem service provision and use based on changes in ecosystem service supply or demand.
MIMES (Multiscale Integrated Models of Earths Systems)	A suite of models that enables understanding of the contributions of ecosystem services by quantifying the effects of varying environmental conditions derived from land use change. The goal of MIMES is to illuminate the value of ecosystem services and to aid decision-makers in making more informed decisions about their management. For more information: www.uvm.edu/giee/mimes	Assists ecosystem managers to quickly understand the dynamics of ecosystem services, how their services are linked to human welfare, how their function and value might change under various management scenarios. It provides economic arguments for land use managers to approach conservation of ecosystems as a form of economic development. The model facilitates quantitative measures of ecosystem service effects on human well-being.
Corporate Ecosystem Service Review	Developed by the World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI), the Corporate Ecosystem Service Review tool provides a stepwise approach to for identifying the business risks and opportunities arising from ecosystem change. For further details see WBCSD, WRI and Meridian Institute 2008 and visit www.wri.org/ecosystems/esr	This tool provides corporate managers with a proactive approach to making the connection between ecosystem change and their business goals. It introduces the Corporate Ecosystem Services Review–a structured methodology to help businesses develop strategies for managing risks and opportunities arising from their dependence and impact on ecosystems. It is a tool for corporate strategy development and can augment existing environmental management systems.
CITYGreen	CITYGreen was developed by American Forest and is a GIS-based software tool enabling city planners to integrate the benefits of urban forestry in decision making. The software conducts complex statistical analyses of ecosystem services, and creates easy-to-understand maps and reports. For more information: www.americanforests.org/productsandpubs/citygreen	• Landscape architects can use CITYgreen to: • Conduct ecosystem services analyses at various scales. • Conduct a site-specific analysis using either georeferenced data about soil and climate conditions provided with the program or user-provided data on local conditions. • Model the environmental and economic impact of different land cover and development scenarios and future tree growth. • Calculate monetary benefits, e.g. for stormwater runoff, air quality, water quality, carbon storage and sequestration based on local site conditions.
BGIS (Biodiversity GIS)	BGIS is a web-based mapping tool providing free information on spatial biodiversity planning aiming to assist decision makers and spatial planners in South Africa. They also provide tools, such as interactive mapping tools, for analysing and applying the available biodiversity information. For more information: www.bgis.sanbi.org	The interactive online map allows users to perform basic map querying and analysis. In addition to this, users can also text markups to their maps, create or load their own shapefiles, point localities, save and email map sessions over a secure link and create visually aesthetic maps.

Biodiversity Planning Toolkit	The toolkit has been developed by the Association of Local Government Ecologists (ALGE) for the United Kingdom and is an on-going project. It uses an interactive landscape, which contains a number of animated scenarios showing how biodiversity issues can be addressed in various types of development and in different planning situations. For more information: www.biodiversityplanningtoolkit.com	Use of the toolkit as a starting point for anybody searching for expert advice or guidance on how biodiversity and geodiversity can be incorporated into various types of development, considering the legal and policy implications that need to be addressed for each situation encountered.

Source: Adapted from MA 2005, WRI 2008, and TEEB D2 2010

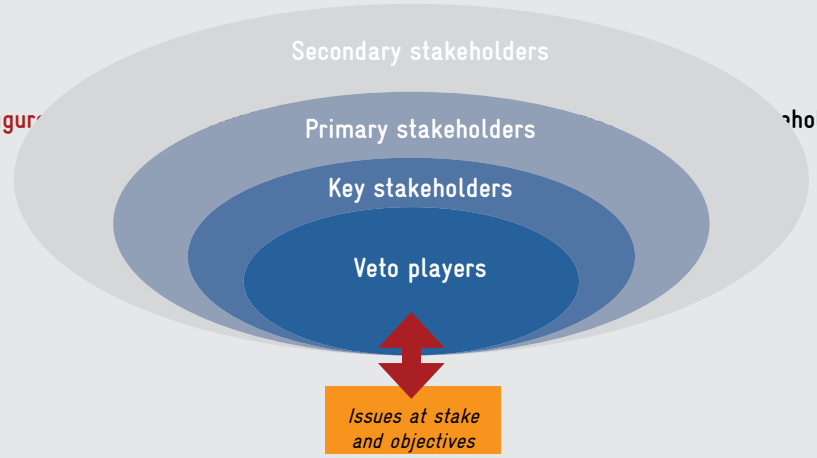
Table 10 Examples of ecosystem service trade-offs

Decision	Goal	Example winners	Ecosystem services decreased	Example losers
Increasing one service at the expense of other services				
Draining wetlands for farming	Increase crops, livestock	Farmers, consumers	Natural hazard regulation, water filtration and treatment	Local communities including farmers and some downstream users of freshwater
Increasing fertilizer application	Increase crops	Farmers, consumers	Fisheries, tourism (as a result of dead zones created by excessive nutrients)	Fisheries industry, coastal communities, tourism operators
Converting forest to agriculture	Increase timber (temporarily), crops, livestock, and biofuels	Logging companies, farmers, consumers	Climate and water regulation, erosion control, timber, cultural services	Local communities, global community (from climate change), local cultures
Converting ecosystems and their services into built assets				
Coastal development	Increase capital assets, create jobs	Local economy, government, developers	Natural hazard regulation, fisheries (as a result of removal of mangrove forests or wetlands)	Coastal communities, fisheries industry (local and foreign), increased risks to coastal businesses
Residential development replacing forests, agriculture or wetlands	Increase capital assets, create jobs	Local economy, government, developers, home buyers	Ecosystem services associated with removed ecosystems	Local communities, original property owners and downstream communities
Competition among different users for limited services				
Increased production of biofuel	Reduce dependency on foreign energy	Energy consumers, farmers, government	Use of crops for biofuels instead of food	Consumers (rising food prices), livestock industry
Increased water use in upstream communities	Develop upstream areas	Upstream communities, industries	Water downstream	Downstream communities, industries

Source: WRI 2008

Useful information and tools for Step 4

Figure 10 Stakeholder map



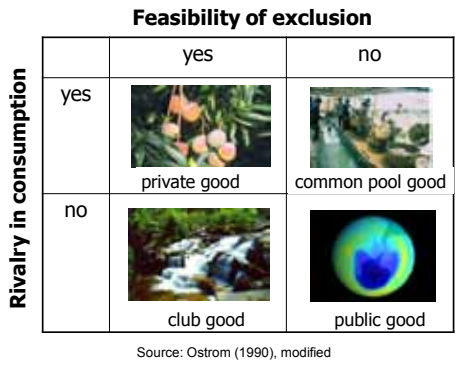
Source: Capacity Works (GIZ 2009)

Figur …**eholders and rules**

a) The **characteristics of ecosystem services** have repercussions on the incentives for their use. The appropriateness of institutions to govern people's behaviour also depends strongly on these attributes. Ecosystem services are most of the time bundled and it is not always easy to determine their ownership. There are basically two relevant characteristics related to the physical attribute of the services; these are (i) excludability or the feasibility to control access to a service and (ii) rivalry in consumption or subtractability.

The feasibility of exclusion depends not only on the physical attributes of a service, but also on situational factors such as the location (Figure). It is much easier to control access to a mango tree on my compound – I could e.g., fence the garden and let only those people enter whom I trust – than to a mango tree that grows far away from my house. These attributes are can be modified through changes such as location, availability of new financial resources, introduction of new rules and development of enforcement mechanisms. However, these will require resources (such as time and human, financial and other resources).

Figure 12 Characteristics of goods



Source: Ostrom (1990), modified

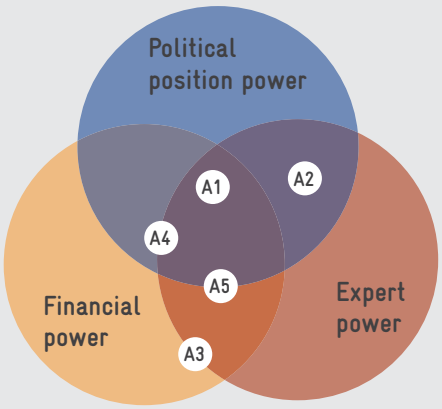
Source: GIZ (2004)

b) Incentives also depend on the characteristics of the actors (institutions, organizations and local people). It is important to know which are the characteristics of groups that are relevant for the conditions and trends of ecosystem services, thinking how such characteristics might influence user behaviour. This could be based in the history of the groups, their pattern of social interaction (e.g. conflicts among them), social factors such as ethnicity, economic factors like livelihood strategies and cultural factors such as beliefs.

   Remember that positions are related to interests and these ones are connected to the different kind of needs of the different actors. Such needs could be either material (such as income) or social (like prestige). Material needs are close related to dependences and impacts of people actions on ecosystem services. Needs could be (i) complementary to each other e.g. timber industry clears up the forest, than palm oil plantations use the land; or timber industry and livestock); or competing (palm oil plantations vs. food security or tourism).

c) Furthermore, it is important to know the characteristics of social co-ordination among actors that are usually called rules. In this context, is necessary to know whether these rules work and what kind of incentives they create. Remember that existing rules can contribute to overuse of natural resources. Remember also, that modifying them requires time, effort, and costs money. Additionally, expected costs are an incentive that influences whether people consider if the modification of rules is feasible or not.

Figure 13 Tool for identification of key stakeholders



Source: Capacity Works (GTZ 2009)

Useful information and tools for Step 5

What is economic valuation of ecosystem services?

Economic valuation is the process of assigning a monetary value to ecosystem goods and services. It quantifies the benefits provided by ecosystems and the impact of ecosystem changes on the well-being of people.

There are three aspects of the economic value of ecosystems to be considered:

- The ecosystems as assets – as a stock of natural capital[1], which, if conserved and managed sustainably, yield a
- Flow of economically valuable goods and services – the return on investments in conservation, which in turn contributes towards
- Positive economic and human wellbeing outcomes – the measures and indicators which are used to judge progress towards economic growth and development.

Economic values are essential to consider when making economic choices. Valuing ecosystem services and incorporating those values into decision-making processes can help in:

- Evaluating the impacts of development policies and policy interventions that alter the condition of an ecosystem and consequently in human well-being.
- Comparing the real cost-effectiveness of an investment or project.
- Evaluating trade-offs between different ecosystem management options and choosing between competing uses, e.g. of land use.
- Assessing liability for damage to the environment;
- Creating markets for ecosystem services in order to mobilize financial resources, e.g., global carbon market and payments for ecosystem services.
- In awareness building and communication to the public on the overall contribution of ecosystem services to social and economic well-being.

What types of economic values exist?

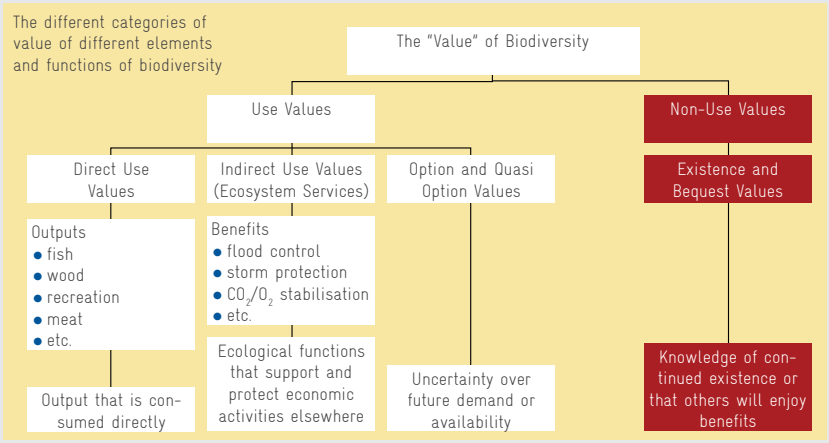
The clearest and most useful way to trace through the relationships between ecosystem services, economic values and human wellbeing outcomes is to combine two frameworks: one, total economic value (TEV), which is commonly applied by economists; and the other, the ecosystem services-human wellbeing framework presented in the Millennium Ecosystem Assessment (MEA), which is widely used by conservation planners and decision-makers.

Since it was first developed in the late 1980s and early 1990s (Barbier 1989, Pearce and Turner 1990), TEV has become the standard and most widely applied framework used by economists to categorise ecosystem values. The major innovation of TEV is that it extends beyond the marketed and priced commodities to which economists have conventionally limited their analysis, and considers the full gamut of economically important goods and services associated with ecosystems. Although it is no easy matter to quantify these values, as prices and markets do not exist for many ecosystem services, a range of methods have been developed which enable them to be expressed in monetary terms. The framework comprises use and non-use values. Use values are further broken into direct use, indirect use and option values. Non-use values typically refer to existence and bequest value.

Understanding what types of value under TEV are affected can help in determining which economic valuation approach may be required to value a specific impact. Economic valuation studies may attempt to quantify all or some of the values of an ecosystem service.

[1] The concept of natural capital is an extension of the notion of economic capital (i.e. manufactured means of production) to environmental goods and services. It refers to a stock of natural resources (for example forests, wetlands) which produce a flow of goods (for example crops, trees, fish) as well as services (for example carbon sink, erosion control, waterflow regulation). When combined with other types of capital (such as financial, human, produced, institutional, and so on), it generates important benefits for human economies. In addition to the livelihoods and income provided by ecosystems, natural capital can also be measured in end-products, such as a healthy and well-fed labour force (Emerton 2008).

Figure 14 Total Economic Value of Biodiversity



Source: Land & Water Australia (2005)

- Direct use values include ecosystem services that are directly used for consumption or production; tangible (e.g., wood, fish) and intangible (e.g., recreation, research).
- Indirect use values include the benefits derived from functional services that support current production and consumption, such as water filtration and shoreline protection by mangroves.
- Option values estimate the price that people are willing to pay for an un-utilized asset, simply to avoid the risk of not having it available in the future. For example, a person may hope to visit the Galápagos Islands sometime in the future, and thus would be willing to pay something to preserve the area in order to maintain that option. This is sometimes considered a non-use value because there is no current use of the resource.
- Existence value arises from the satisfaction of merely knowing that ecosystems and their services continue to exist, even if the person will never visit or use it, e.g., valuing the existence of pandas despite never actually seeing one.
- Bequest value is associated with the knowledge that the natural environment will be passed on to future generations.

How can we place value on ecosystem services?

A variety of economic valuation approaches have been developed that aim to quantify all or parts of the TEV of an ecosystem service. Most of the values are determined by people's preferences or/and by making assumptions and comparing different possible sceneries. The easiest and most straightforward way to value goods and services, and the method used conventionally, is to look at their market price: what they cost to buy or are worth to sell. However, as biodiversity and ecosystem services very often have no market price (or are subject to market prices which are highly distorted as regards their real value), these techniques obviously only have very limited application.

For this reason, a suite of methods have been developed by which to value ecosystem services that cannot be valued accurately via the use of market prices. It is beyond the scope of this document to describe these valuation methods in detail, as there are now many publications and toolkits dealing specifically with ecosystem valuation methods (which are listed in the key references in the Annex to this report). In addition to market prices, these valuation techniques include (**Table 10**):

- Production function approaches: These approaches attempt to relate changes in the output of a marketed good or service to a measurable change in the quality of quantity of ecosystem goods and services by establishing a biophysical or dose-response relationship between ecosystem quality, the provision of particular services, and related production.
- Surrogate market approaches: These approaches look at the ways in which the value of ecosystem goods and services are reflected indirectly in people's expenditures, or in the prices of other market goods and services.
- Cost-based approaches: These approaches look at the market trade-offs or costs avoided of maintaining ecosystems for their goods and services.
- Stated preference approaches: Rather than looking at the way in which people reveal their preferences for ecosystem goods and services through market production and consumption, these approaches ask consumers to state their preference directly.

Table 11 Description of economic valuation methods

Approach	Method	Element of TEV captured	Application	Advantages	Challenges
Market price (marketed goods)	Market values	Direct and indirect use	Money paid for ecosystem goods and services that are traded in commercial markets, e.g., timber, fish.	Market data readily available and robust.	Limited to those ecosystem services for which a market exists.
Production Function Trace impact of change in ecosystem services on produced goods	Change in production	Indirect use	Value is inferred by considering the changes in quality and/or quantity of a marketed good that result from an ecosystem change (e.g., fisheries income resulting from improvements in water quality).	Market data readily available and robust.	Data-intensive and data on changes in services and the impact on production often missing.
Surrogate Market approach or revealed preference (uses market based information to infer a non-marketed value)	Travel cost	Direct and indirect use	It assumes that the value of a site is reflected in how much people are willing to pay to travel to visit the site. Costs considered are travel expenditures, entrance fees, and the value of time.	Based on observed behaviour.	Generally limited to recreational benefits. Difficulties arise when trips are made to multiple destinations.
	Hedonic price	Direct and indirect use	Value of environmental amenities (air quality, scenic beauty, cultural benefits, etc.) that affect prices of marketed goods (e.g., the higher market value of waterfront property, or houses next to green spaces).	Based on market data, so relatively robust figures.	Very data-intensive and limited mainly to services related to property.
Cost based	Avoided damage costs	Direct and indirect use	Value is based on the costs of actions taken to avoid damages if a specific ecosystem service did not exist (e.g., the costs to protect a property from flooding).	Market data readily available and robust.	Can potentially overestimate actual value.
	Replacement/ substitute costs		Value is based on the cost of replacing the ecosystem service (function) or providing substitutes (e.g., previously clean water that now has to be purified in a plant).		
	Costs of Illness human capital		Health costs (morbidity and mortality) due to changes in ecosystem services (e.g., air or water pollution).		
Stated preference					
(questionnaire surveys; these methods can be used to estimate non-use values)	Contingent valuation	Use and non-use	Involves directly asking people how much they would be willing to pay to prevent loss of, or enhance an ecosystem service (e.g., willingness to pay to keep a local forest intact).	Able to capture use and non-use values.	Bias in responses, resource-intensive method, hypothetical nature of the market.
	Choice modelling	Use and non-use	People chose from a 'menu' of options with differing levels of ecosystem services and differing costs, e.g., policy decisions where a set of possible actions might result in different impacts on ecosystems.		
Transfer of values	Benefits transfer (not a valuation method in itself)	All	Transferring a value from studies already completed in another location and/or context (e.g., estimating the value of a forest using the calculated economic value of a different forest of a similar size and type).	Can reduce the need for primary valuation studies. For projects with multiple non-market impacts, for instance, conducting original studies is unlikely to be feasible.	Degree of accuracy of the valuation might not be sufficient for making a decision.

Adapted from IUCN, TNC, World Bank (2004)

The choice of valuation method generally depends on the type of service, availability of resources, time and data for the study as well as its purpose.

Table 12 References and guidance on ecosystem valuation

	Publisher	Date	Coverage
Guidelines for biodiversity valuation			
An Exploration of Tools and Methodologies for Valuation of Biodiversity and Biodiversity Resources and Functions	Convention on Biological Diversity	2007	Global
Making Economic Valuation Work for Biodiversity Conservation	Department of Environment and Heritage, Land & Water Australia	2005	Australia
Handbook of Biodiversity Valuation: A Guide for Policy Makers	Organisation for Economic Co-operation & Development (OECD)	2002	OECD countries
Valuation of Biodiversity	Organisation for Economic Co-operation & Development (OECD)	2001	OECD countries
The Valuation of Biological Diversity for National Biodiversity Action Plans and Strategies: A Guide for Trainers	United Nations Environment Programme (UNEP)	2000	Global
Economic Valuation of Biological Diversity	Convention on Biological Diversity	1996	Global
The Economic Value of Biodiversity	International Union for Conservation of Nature (IUCN)	1994	Global
Economic Value of Ecosystems: 3 - Biological Diversity	International Institute for Environment & Development (IIED)	1991	Global
Guidelines for ecosystem services & environmental valuation			
An introductory guide to valuing ecosystem services	UK Department for Environment, Food & Rural Affairs (DEFRA)	2007	United Kingdom
Valuation for Environmental Policy: Ecological Benefits	US Environmental Protection Agency	2007	United States
The Economic, Social and Ecological Value of Ecosystem Services	UK Department for Environment, Food & Rural Affairs (DEFRA)	2005	United Kingdom
Estimating the Cost of Environmental Degradation: A Training Manual in English, French and Arabic	World Bank	2005	Global
Valuing Ecosystem Benefits: Readings and Case Studies on the Value of Conservation	World Bank, International Union for Conservation of Nature (IUCN), and The Nature Conservancy (TNC)	2005	Global
How Much is an Ecosystem Worth ? Assessing the Economic Value of Conservation	International Union for Conservation of Nature (IUCN), The Nature Conservancy (TNC) and the World Bank	2004	Global
Assessing the Economic Value of Ecosystem Conservation	World Bank and International Union for Conservation of Nature (IUCN)	2004	Global
Environmental Valuation A Worldwide Compendium of Case Studies	United Nations Environment Programme (UNEP)	2000	Global
Environment and Economics in Project Preparation	Asian Development Bank	1999	Asia
Economic Analysis and Environmental Assessment Sourcebook Update No. 23, 1998	World Bank	1998	Global
A Review of Economic Appraisal of Environmental Goods and Services: With a Focus on Developing Countries	International Institute for Environment & Development (IIED)	1996	Developing Countries
Monetary Measurement of Environmental Goods and Services: Framework and Summary of Techniques for Corps Planners	US Army Corps of Engineers	1996	United States
Review of Monetary and Non-Monetary Valuation of Environmental Investments	US Army Corps of Engineers	1995	United States
Economic Values & the Environment	United Nations Environment Programme (UNEP)	1994	Global
The Measurement of Environmental and Resource Values: Theory & Methods.	Resources for the Future (RFF)	1993	Global
Economic Valuation and the Natural World	World Bank	1992	Global
Policy Appraisal and the Environment	UK Department of the Environment	1991	United Kingdom
Values for the Environment	UK Overseas Development Administration (ODA)	1991	Global
Economic Analysis of the Environmental Impacts of Development projects	Asian Development Bank	1986	Asia
Guidelines for Preparing Economic Analyses	US Environmental Protection Agency	2000/2008	United States

Guidelines for forest valuation			
Using Economic Valuation to Promote Forest Biodiversity Conservation: A Toolkit	International Union for Conservation of Nature (IUCN)	2004	Eastern and Southern Africa
Valuing Forests: A Review of Methods and Applications in Developing Countries	International Institute for Environment and Development (International Institute for Environment & Development (IIED))	2003	Developing countries
Herramientas para la valoración y manejo forestal sostenible de los bosques sudamericanos	International Union for Conservation of Nature (IUCN)	2003	South America
Economic Valuation of Forests and Nature: A support tool for effective decision-making	Wageningen University	2002	Global
The Value of Forest Ecosystems	Convention on Biological Diversity	2001	Global
Forest Valuation for Decision Making	Food & Agriculture Organization of the United Nations (FAO)	1997	Global
Valuing the Hidden Harvest: Methodological approaches for local-level economic analysis of wild resources	International Institute for Environment & Development (IIED)	1997	Developing countries
Economic Value of Ecosystems: 2 - Tropical Forests	International Institute for Environment & Development (IIED)	1991	Global
Guidelines for marine & coastal valuation			
Valuing the Environment in Small Islands	UK Overseas Territories Environment Programme (OTEP) and the UK Joint Nature Conservation Committee (JNCC)	2007	Global
Economic Valuation of Natural Resources: A Guidebook for Coastal Resources Policymakers	National Oceanic and Atmospheric Administration (NOAA)	1995	United States
Economic Value of Ecosystems: 4 - Coral Reefs	International Institute for Environment & Development (IIED)	1992	Global
Guidelines for Protected Areas valuation			
Valuing Nature: Assessing Protected Area Benefits	The Nature Conservancy (TNC) and Convention on Biological Diversity	2008	Global
The Use off Economic Valuation for Protected Area Management: A Review of Experiences and Lessons Learned	International Union for Conservation of Nature (IUCN)	2001	Global
Economic Values of Protected Areas: Guidelines for Protected Area Managers	International Union for Conservation of Nature (IUCN)	1998	Global
Guidelines for watershed & wetland valuation			
Watershed Valuation as a Tool for Biodiversity Conservation	The Nature Conservancy (TNC)	2007	Latin America
Valuing wetlands: Guidance for valuing the benefits derived from wetland ecosystem services	Ramsar Convention and Convention on Biological Diversity	2006	Global
Tools for Wetland Valuation	International Union for Conservation of Nature (IUCN)	2005	Southern Africa
Value: Counting Ecosystems as an Economic Part of Water Infrastructure	International Union for Conservation of Nature (IUCN)	2004	Global
Economic Value of Ecosystems: 1 - Tropical Wetlands	International Institute for Environment & Development (IIED)	1989	Global

Source: WBCSD 2009a

Table 13 Online databases of ecosystem valuation references

Database	Publisher	Web
Biodiversity valuation library	International Union for Conservation of Nature (IUCN) & World Wide Fund for Nature (WWF)	biodiversityeconomics.org/valuation
Coastal environmental economics extension network	National Oceanic and Atmospheric Administration (NOAA) & Sea Grant	www.mdsg.umd.edu/programs/extension/valuation
Conservation value map	Conservation International (CI)	www.consvalmap.org
Ecosystem Valuation	Dennis M. King & Marisa Mazzotta	www.ecosystemvaluation.org
Envalue	New South Wales Department of Environment and Climate Change	www.environment.nsw.gov.au/envalue
Environmental valuation and cost benefit website	The Cost-Benefit Group	www.costbenefitanalysis.org/envirovaluation.org

Environmental Valuation Reference Inventory	Environment Canada	www.evri.ca
Environmental Valuation Source List for the UK	UK Department of Environment, Food and Rural Affairs	www.defra.gov.uk/environment/economics/evslist
Nature Valuation and Financing Casebase	Nature Valuation and Financing Network	www.eyes4earth.org/casebase
New Zealand Non Market Valuation Database	Lincoln University	learn.lincoln.ac.nz/markval
ValueBaseSWE	Beijier Institute	www.beijer.kva.se/valuebase.htm

Source: WBCSD 2009a

Table 14 Policy options for integrating ecosystem services

Policy option	How it works	Design and implementation considerations	Examples of experience
National and sub-national policies			
Mainstream ecosystem services into economic and development planning.	Addresses indirect drivers of ecosystem change over the longer term by including ecosystem services in poverty reduction strategies, national economic and development plans, or country assistance strategies.	Overcoming separate agency mandates, integrating different skills and perspectives, aligning with other policies such as financial and economic incentives.	Tanzania's 2005 National Strategy for Growth and Reduction of Poverty explicitly recognizes many of the drivers of ecosystem service degradation as impediments to poverty reduction. The strategy sets goals to address these drivers, establishes a set of poverty-environment indicators, and includes 15 environmental targets (Assey et al 2007).
Include investments in ecosystem services in government budgeting.	Makes the crucial link between policies focused on ecosystem services and providing funds to carry them out.	Improving ability to value and integrate ecosystem services in cost-benefit analysis and identifying specific investments to sustain them.	UK Treasury drew on the Millennium Ecosystem Assessment in preparing its Comprehensive Spending Review of government funding. Notes that Assessment is relevant to achieving sustainable growth, employment, security and equity, and that Treasury will aim to release resources to meet environmental challenges (UK House of Commons Environmental Audit Committee 2007).
Establish protected areas.	Helps protect ecosystems and their associated services from drivers of over exploitation and conversion.	Incorporating goal of sustaining ecosystem services into site selection, linking biodiversity conservation and sustaining ecosystem service goals Including local communities, taking a landscape approach that recognizes drivers of change outside the protected area, and ensuring financial sustainability.	In 1986, St. Lucia designated marine reserves with the involvement of local people and businesses, leading to regeneration of mangrove forests (WRI et al 2000:176-77).In 1993, Austria established 20-year contracts with all forest owners requiring them to protect the land. Financial compensation was offered to owners who lost income (Hackl and Rohrich 2001).
Economic and fiscal incentives			
Use tax deductions and credits to encourage investment in and purchase of ecosystem services.	Provides economic incentive to manage ecosystems in ways that sustain services.	Avoiding equity problems or protecting one service at the expense of others.	U.S. law gives landowners tax deductions for donating conservation easements, which restrict use of the property to protect associated resources (House 2006).
Establish fees for use of resources or services.	Reduces waste of resource.	Avoiding equity issues, where those with lower incomes are less able to pay and balancing number of users.	In Colombia, Cauca Valley water associations voluntarily agreed to increase user fees paid to the local utility in exchange for improved watershed management. The associations aim to improve stream flow for the benefit of agricultural producers (FAO 2002).

Use taxes or other public funds to pay for the maintenance of regulating and cultural services.	Creates economic incentive to supply services that do not normally have a market value.	Maintaining one service at the expense of others, avoiding creating equity issues such as loss of harvest rights or ineligibility because of lack of tenure Depending on still emerging market infrastructure such as quantification, verification, and monitoring tools Informing public about use of funds to provide accountability.	The UK Nitrate Sensitive Areas (NSA) Scheme uses direct government payments to compensate farmers for adopting management practices that reduced leaching of nitrates into groundwater (IUCN 2007). A Costa Rican fund mainly from fuel tax revenues pays forest owners for watershed protection (Perrot-Maître and Davis 2001). Belize charges foreign tourists a conservation fee, which funds a trust dedicated to the sustainable management and conservation of protected areas (Conservation Finance Alliance 2003).
Reduce perverse subsidies.	Removes incentive for intensive production of provisioning services at expense of other services.	Overcoming vested interests in maintaining subsidies, creating mechanisms to transfer reduction in subsidies to payments for maintenance of regulating and cultural services.	As a result of eutrophication of waterways and threats to drinking water supply, many Asian countries have reduced fertilizer subsidies, including Pakistan (from US$178 million to US$2 million per year), Bangladesh (US$56 million to US$0), and the Philippines (US$48 million to US$0) (Myers 1998).
Set limits and establish trading systems for use of ecosystems and their services.	Achieves more cost-effective improvements in ecosystem services than conventional regulatory approaches.	Ensuring limit is stringent enough to provide an incentive to participate Allocating permits or credits in cases of unclear property rights. Keeping transaction costs manageable, especially for non-point sources.	In 1980, New Jersey established Tradable Pinelands Development Credits to limit development in environmentally sensitive areas and allow prospective developers to trade for development rights on available land (Landell-Miles and Porras 2002). In 1999, Australia established a Water Transpiration Credits Scheme, to reduce river salinity (Brand 2005). Under its National Water Initiative, Australia sets limits on water use in the Murray Darling Basin and, as of January 2007, the basin states are able to buy and sell permanent water entitlements (Parliament of Australia 2006).
Fund valuation of ecosystem services and research into improving valuation methods.	Increases societal awareness of the value of ecosystem services and strengthens cost-benefit analysis for public decisions.	Dealing with techniques for valuing ecosystem services that are still in their infancy. Discrediting ecosystem service approach by overestimating values.	A study found Canada's Mackenzie Watershed's 17 ecosystem services worth nearly US$450 billion undisturbed, offering new perspective of economic benefits and costs of proposed gas pipeline (Canadian Parks and Wilderness Society 2007). A study found that on a single Costa Rican farm natural pollination by insects increased coffee yields 20 percent on plots that lay within a kilometer of natural forest, service worth approximately US$60,000 (Rickets et al 2004).
Use procurement policies to focus demand on products and services that conserve ecosystem services.	Creates incentives for suppliers to adopt approaches that are ecosystem friendly.	Avoiding high transaction costs of demonstrating responsible behaviour Implementing cost- effective monitoring and verification systems.	UK Government timber procurement policy stipulates timber must come from legal and sustainable sources (CPET 2007).
Support wetland banking schemes.	Provides way of maintaining overall services provided by wetlands by requiring substitution by developers.	Ensuring that substituted wetlands are of equal value to those destroyed Ensuring equity for local populations who lose services.	Wetland banking schemes in California allow developers who destroy wetlands to offset the environmental damage by paying to protect a sensitive wetland in another location (Office of Policy, Economics, and Innovation and Office of Water 2005).

Sector Policies			
Include ecosystem services in sector policies and strategic environmental assessments (SEA).	Goes beyond addressing impacts of economic development to look at dependence on services Broadens scale of analysis.	Dealing with limited experience of public sector using Ecosystem Services Approach in decision processes and limited information on ecosystem services.	South Africa's Working for Water Program combines social development goals of job creation and poverty relief, and agricultural goals of increasing productivity of cleared lands, as well as ecosystem rehabilitation goals of eradicating alien species and restoring stream flows (Department of Water Affairs and Forestry 2007).
Set targets to encourage use of renewable energy.	Provides incentive to replace fossil fuels with renewable sources.	Using land to produce renewable energy sources such as biofuels can lead to soil erosion and degradation of ecosystem services such as water quality.	Under the UK Renewable Transport Fuel Obligation, transport fuel suppliers must ensure a proportion of their fuel sales is from renewable sources, as of 2008 (Commons 2007).
Require ecosystem management best practices in granting licenses or concessions.	Creates incentives for managing ecosystems in ways that sustain ecosystem services.	Defining and enforcing best practice standards.	Cameroon's 1996 Forest Code calls for all commercial logging to be regulated under designated forest concessions. This legislation establishes rules for concession allocation, local distribution of forest revenues, as well as requirements for submitting and gaining approval for forest management plans (WRI 2007).
Use zoning or easements to keep land available for priority ecosystem services.	Provides way to maintain priority ecosystem services.	Needing legal framework in place and fair political process to apply zoning.	Some flood plains are zoned for uses such as recreation or agriculture rather than housing or commerce. Easements can be used to keep land available for cultural and regulating ecosystem services.
Use physical structures or technology to substitute for ecosystem services.	Provides a substitute for degraded ecosystem services that may mimic natural design.	Building structures such as sea walls to substitute for ecosystem services such as coastal protection often simply shifts the problem, distributing costs and benefits unfairly, fostering false confidence, and providing only a single benefit rather than multiple benefits of ecosystem service.	Seattle's street edge projects mimic natural ecosystems, reducing storm water runoff by 99%. Roof gardens also reduce runoff (Seattle Public Utilities 2007). Dikes and levees substitute for coastal protection. Sea walls avoid coastal erosion.
Use regulating ecosystem services such as natural hazard protection or water filtration instead of built structures.	Usually provides co-benefits such as carbon storage and recreation.	Procuring time and funds for negotiations and continued maintenance. Dealing with limited knowledge about ecosystem service flows, especially for regulating and cultural ecosystem services.	New York City protected its watershed instead of building a filtration plant (US EPA 2007b). Reforestation and conservation of mangroves in coastal areas affected by the 2004 tsunami can help prevent future damage (UNEP-WCMC 2006).
Establish certification schemes that encourage best management practices.	Provides those growing or harvesting timber, fish, or crops a way to learn about best management practices and to demonstrate use of the practices.	Ensuring development of transparent, scientifically valid standards and their adoption. Paying transaction costs that may limit participation Informing consumers.	U.S. Department of Agriculture provides farms with organic certification (USDA 2006). Forest Stewardship Council provides certification for sustainable timber harvesting practices (US FSC 2006). In the Pacific U.S. states, "Salmon-safe" certifies farms and urban land that practice fish-friendly management (IUCN 2007).
Introduce education or extension programs on good practices.	Provides knowledge to those maintaining ecosystem services.	Providing economic incentives for participation.	U.S. National Conservation Buffer Initiative educates farmers to control pollution by using filter strips and other measures such as wind barriers (USDA NRCS 2007).

Develop and encourage use of products and methods that reduce dependence and impact on ecosystem services.	Reduces degradation of ecosystem services by avoiding harmful substances or using services more efficiently.	Evaluating potential negative trade-off, such as organic agriculture potentially requiring use of more land, which could lead to further habitat conversion.	Drip irrigation in Israel allows for more efficient use of water for agriculture (Sandler 2005). Rainwater harvesting practices increase the supply of drinking water in parts of India (CSE India 2004). Organic agriculture reduces negative impacts on soil and water by avoiding agrochemicals.
Governance			
Clarify or strengthen local community rights to use and manage ecosystem services.	Ensures involvement of stakeholders who may depend on ecosystem services for their immediate livelihood and well-being.	Identifying who represents the community, clarifying the role of traditional authorities, ensuring that women and the poor are included.	Vietnam's 1994 Land Law allows organizations, households, and individuals to manage forests for long-term purposes. Some one million families living in upland areas have managed five million hectares of forest. This decentralization has resulted in an increase in protected forests as well as an increase in the benefits the people gain from the forests' services (FAO 2000).
Develop and use private and public sector indicators for ecosystem services.	Provides information about the state of ecosystem services and shows where practices need to be changed.	Obtaining funding to develop ecosystem indicators and continued funding to disseminate and use data on regular basis.	The European Union makes indicators on natural resource management publicly available online (Eurostat 2006). Silicon Valley Environmental Partnership provides indicators and tracks local trends to foster more informed decision making (Silicon Valley Environmental Partnership 2007). Global Reporting Initiative standards for corporate sustainability reports require companies to report on water and natural resource use (GRI 2007).
Establish processes to work across levels of government, from local to national.	Shifts focus to boundaries of ecosystem services rather than boundaries of government jurisdictions, uses complementary authorities, skills, and resources of different levels of government.	Requiring transaction costs and time for building partnerships.	In Samoa, 40 local communities work with national agencies to co-manage fisheries. National government provides legal authority, research, market information, credit, and transport. Local communities have clear rights and authority to manage local fishery under a management plan (WRI et al 2005:93).
Ensure public access to information and participation.	Allows the public to hold public and private actors accountable for their actions in relation to ecosystem services.	Requiring investment in building the capacity of individuals, civil society, and government to produce, analyse, disseminate, and use information and to engage effectively in decision making.	Evaluation of Brazilian ecological tax system recommends making amounts transferred public so local governments can be held accountable for their use (WWF 2003).

Source: WRI (2008)

Useful information and tools for Step 6

Box 20 Recommendations for developing ecosystem services indicators

1. Ensure objectives are clear

   The process of defining and developing indicators requires a guiding plan or framework. Indicators are there to answer specific questions or to assess policy objectives and can only be developed in the context of those questions/objectives. Clear objectives and targets help to identify and define indicators as specifically as possible to avoid misinterpretation.

2. Adopt a small set of specific, policy-relevant indicators

   Don't try to do everything. Resources should be used to address key elements (i.e. those most policy relevant) and information gaps. Where possible include linked indicators covering as many aspects of the ecosystem assessment framework (socio-ecological system) as possible (e.g. state and trends, driving forces, policy effectiveness).

3. Go beyond provisioning services

   Where possible, create indicators for different types of ecosystem service. Currently there is an overreliance on indicators that capture the value of a few species and ecosystems relevant to food and fibre production, which are rarely good proxies for other kinds of service or for resilience.

4. Utilise existing data and proxies (but recognise limits)

   Developing ecosystem service indicators is best viewed as an iterative process. Start with the low hanging fruit (i.e. do what it is possible) and improve over time. Use available knowledge and indicators as a starting point. Where direct measures are not yet developed or where there are no data, good proxy indicators can be used. Note that not all ecosystem services are easily quantifiable. Qualitative metrics can be as useful as quantitative ones.

5. Think about sustainability – include indicators for both ecosystems and benefits

   Measure both the supply of the service (including state/condition of the ecosystem or its relevant components) as well as the benefits from services and impacts on well-being.

6. Include biodiversity

   Since biodiversity indicators are better developed, and biodiversity underpins the delivery of ecosystem services, they are sometimes used as proxies for ecosystem services. However, although in some categorisations biodiversity is classified as an ecosystem service they are not inter-changeable. It is important not to lose sight of the importance of biodiversity by focusing only on ecosystem service benefits.

7. Be sensitive to scale

   The scale at which ecosystem services are measured and reported should be appropriate to the decision-making context. Some things are more appropriate at certain scales and not others. Not everything can be scaled up.

8. Assess trends and consider synergies and trade-offs

   Some indicators are snapshots or baselines, but replicable measures are important for monitoring change and tracking progress. Monitoring multiple services over time allows a better understanding of synergies and trade-offs.

9. Engage stakeholders early

   Defining and developing indicators should involve all relevant stakeholders from the outset. Ecosystem service indicators should be chosen to meet the needs of specific users. Establishing a dialogue with data providers and end users of indicators is crucial. Wide stakeholder engagement will also aid in defining indicators as specifically as possible to avoid misinterpretation. In addition the process of developing indicators requires collaboration with other sectors. Mainstreaming is a key component of indicator development. Key to this is to identify entry points for mainstreaming ecosystem service indicators in assessments. Linking the indicators to national development plans helps.

10. Focus on communication

Communicating indicators is important but sometimes neglected. It may incorporate raising public awareness as well as engaging policy-makers. It is important to use indicators that policymakers are likely to be most interested in, whilst presenting storylines in the most policy-relevant way. Ecosystem services cut across different sectors, all of which may require tailored communication. Some key communication messages include:

- Be clear about what indicators are telling you: Use a common language. Some work may be required on definitions of key terms for communicating that story.
- Be transparent about uncertainty: Keep in mind the limits of indicators, and uncertainty – use clear terminology. Provide accurate interpretation of the storyline.
- Use maps (spatially explicit data) where possible: Where possible and relevant, these can be useful aids to communication and analysis. Be sure to present the findings at the scale most relevant to decision-makers.
- Avoid over-simplification: Ecosystem services do not necessarily co-vary, and so aggregation is challenging and needs further work. Bundling indicators into related packages/storylines may aid communication.
- Economic metrics are useful but don't ignore nonmonetary values: Where possible, using economic metrics helps mainstreaming in other sectors. Not all indicators are practical to determine in monetary values but that does not lessen their utility.

For further information on monitoring biodiversity and ecosystem services, case studies and examples for indicators consult the Biodiversity Indicators Partnership: www.bipindicators.net

Source: UNEP-WCMC (2011)

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