


Integrating Ecosystem Services in Strategic Environmental Assessment:
A guide for practitioners

ProEcoServ
Project for Ecosystem Services

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Foreword

In the past half century, humankind has altered ecosystems and other natural capital more quickly and dramatically than in any comparable time frame. The skyrocketing demand for timber, fresh water, food, fiber and fuel has resulted in an irreversible loss of a great portion of the earth's biodiversity on which all life depends.

Every three seconds, a forest the size of a football field is felled, and the total yearly forest loss averages some 13 million hectares a year. With the economic value of tropical forests' ecosystem services alone estimated at USD 6,120 per acre, this is truly a staggering loss on many levels. Indeed, while the exploitation of ecosystems has increased human well-being, the impact of their unsustainable use is taking an extraordinarily high toll. Ecosystem services may be devastated to such a degree that in a growing number of cases they may collapse and never recover unless immediate action is taken to reverse the losses and restore as many as possible.

In this context, the Strategic Environmental Assessment (SEA) provides a platform for incorporating environmental considerations in the formulation of development policies, plans and programmes. It is a tool that enables policy-makers to systematically analyze the environmental impacts at the upstream source in policy and planning processes, reducing the need for mitigating their "downstream symptoms" at the project level. The use of the ecosystem services concept in SEA also offers the advantage of presenting a more holistic and integrated consideration of the socio-ecological system, and an effective framing of the (natural) environment in terms of communicating with and influencing stakeholders and decision makers.

This manual provides practical, step-by-step guidance and explains how ecosystem services tools can be integrated into the SEA process. It represents a major contribution to UNEP's ongoing work in capacity development and showcases examples of innovative and successful practices. The manual is an important step forward towards integrating ecosystem services and their critical benefits into national social, economic and sustainable development policies, with a view towards accelerating the global transition to an inclusive green economy.

UN Under Secretary General
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List of Acronyms

CBD:	Convention on Biological Diversity
CICES	The Common International Classification of Ecosystem Services
EIA:	Environmental Impact Assessment
EU	European Union
IPBES	Intergovernmental Platform on Biodiversity and Ecosystem Services
IUCN	International Union for Conservation of Nature
MA	Millennium Ecosystem Assessment
NTFP	Non-timber Forest Products
OECD	Organisation for Economic Co-operation and Development
PES	Payment for Ecosystem Services
PPP	Policies, plans and programmes
SEA	Strategic Environmental Assessment
TEEB	The Economics of Ecosystems and Biodiversity
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
WWF	World Wide Fund for Nature/World Wildlife Fund

Summary of key messages

Introduction

- Ecosystem services are the benefits human populations derive from the ecosystems, such as food, fresh water, buffers against natural disasters and nonmaterial contributions of ecosystems to human wellbeing.
- Strategic Environmental Assessment (SEA) aims to integrate environmental considerations into policies, plans and programmes and evaluate the interlinkages with economic and social considerations.
- An innovative approach for SEA is required to clarify the potential impacts of strategic decisions on the state of ecosystems and their services.

Methodological approach for integrating ecosystem services in SEA

- SEA is a promising tool to integrate ecosystem services in strategic decisions and improve the understanding of the consequences of policies, plans and programmes on human wellbeing.
- SEA must be flexible and able to adapt to the planning and policy-making context, as well as to the specific circumstances of the strategic action under consideration.
- A methodological approach for integrating ecosystem services in SEA is proposed, divided into four stages each comprising two or three specific tasks:
  - Stage 1: Establish the ecosystem services context
  - Stage 2: Determine and assess priority ecosystem services
  - Stage 3: Identify alternatives and assess impacts on ecosystem services
  - Stage 4: Follow up on ecosystem services
- Stakeholder consultation is a vital component of SEA, and it is relevant in all four stages.

Stage 1: Establish the ecosystem services context

Task 1.1: Identify and map ecosystem services and beneficiaries

- Link ecosystems, services and beneficiaries through a conceptual framework.
- Include all ecosystem services in order to see later on which ones are the most important.

Task 1.2: Review existing regulations concerning ecosystem services

- Analyse the possible implications for the strategic action of existing regulations that set conditions for the use or protection of ecosystem services.

Task 1.3: Identify links with other strategic actions

- Harmonize the strategic action with existing actions at different tiers (national, regional and local).
- Identify possible conflicts and synergies related to the supply or demand of ecosystem services.

Stage 2: Determine and assess priority ecosystem services

Task 2.1: Determine priority ecosystem services

- Identify: a) The services upon which the strategic action depends, and b) The services that the strategic action may affect (positively or negatively).
- Consult all potentially affected stakeholders to properly set the boundaries of the SEA.
- Address the geographical relationships between the area where the ecosystem services are produced, and the area where they are used by beneficiaries.

Task 2.2: Assess baseline conditions and trends for priority ecosystem services

- Analyse the current state and likely evolution of priority ecosystem services to understand:
  - The distribution of services and benefits provided to different groups of people
  - Key direct and indirect driving forces
  - Likely future trends (and relevant drivers), threats and opportunities
- According to context, assess ecosystem services in a qualitative or quantitative way, and by using monetary or non-monetary measures.

Stage 3: Identify alternatives and assess impacts on ecosystem services

Task 3.1: Identify alternatives

- Consider an appropriate "hierarchy of alternatives", from the more strategic to the most operational ones.

Task 3.2: Predict and evaluate impacts for each alternative

- Determine which ecosystem services would benefit or be worse off, and which groups of people would win or lose, if a given alternative is selected.
- Predict impacts by describing the expected changes in the ecosystem services conditions due to the implementation of a given alternative.
- Evaluate impacts by describing the significance of the predicted changes for beneficiaries.
- Address cumulative effects, by considering all activities of the strategic action, as well as of other existing/foreseen action.
- Make ecosystem services tradeoffs and synergies explicit.

Task 3.3: Identify measures to enhance and mitigate impacts

- Seek measures that, in order of priority:
  - Enhance ecosystem services
  - Avoid negative effects on ecosystem services
  - Reduce negative effects
  - Repair negative effects
  - Off-set negative effects

Stage 4: Follow up on ecosystem services

Task 4.1: Monitor and manage ecosystem services during implementation

- Collect evidence about contextual changes and actual impacts of the strategic actions on ecosystem services, and evaluate to what extent they differ from predictions.
- Propose management interventions and adjustments to the strategic action early enough to improve its overall performance in terms of ecosystem services.
- Communicate results and involve stakeholders in monitoring, evaluating and managing as appropriate.

Task 4.2: Test the quality of the SEA

- Test the process iteratively, to highlight shortcomings and limitations and propose changes when they can materially be used to improve the strategic action.
- Disseminate lessons learned from quality control checks to improve the future practice of integrating ecosystem services in SEA.

Photo Credit: © Jonathan Gomez

Introduction

Key messages

- Ecosystem services are the benefits human populations derive from ecosystems, such as food and freshwater, raw materials, regulation of natural processes including buffers against natural disasters and nonmaterial contributions of ecosystems to human wellbeing.
- Strategic Environmental Assessment (SEA) aims to integrate environmental considerations into policies, plans and programmes and evaluate the interlinkages with economic and social considerations.
- An innovative approach for SEA is required to clarify the potential impacts of strategic decisions on the state of ecosystems and their services.

Ecosystem Services and Strategic Environmental Assessment (SEA)

Ecosystem services are the benefits human populations derive from the ecosystems, such as goods and products (e.g. fresh water, fuel), regulation of natural processes (e.g. climate, flooding, erosion), and nonmaterial benefits (e.g. recreation, aesthetic enjoyment). The concept of ecosystem services has attracted a lot of attention in recent years, and especially after The Millennium Ecosystem Assessment (MA, 2005) and subsequent studies documented the rate of degradation of many services, and the associated negative consequences for human wellbeing. A general conclusion drawn from these studies is that ecosystem services must be brought into strategic decision-making processes because their conservation is essential to safeguard people's security, health, social relations and material needs. Policies, plans and programmes are often developed based on untested assumptions, without clear evidence of the potential environmental impacts and their implications for human wellbeing.

Strategic Environmental Assessment (SEA) is potentially a very suitable tool to integrate information of ecosystem services in strategic decision-making. SEA refers to a "range of analytical and participatory approaches that aim to integrate environmental considerations into policies, plans and programmes and evaluate the interlinkages with economic and social considerations" (OECD, 2006). Through SEA, the effects of certain development options on ecosystems, and the services they provide, can be considered at the earliest appropriate stage. An innovative approach for SEA is required to clarify the potential impacts of strategic decisions on the state of ecosystems and their services, so as to avoid unintended negative consequences and seize opportunities for improvement. There is a need for operational guidance to promote such innovative approach in practice at all decision levels and for all sectors.

Purpose, target audience and structure of this guide

The purpose of this guide is to provide practical, step-by-step guidance on how to integrate ecosystem services effectively in SEA. The guide focuses on ecosystem services only, given that it aims at supplementing existing guidance material that addresses more in general the treatment of biodiversity in SEA (EC, 2013). The target audience for the guide consists primarily of practitioners who take on the role of advocating the integration of

ecosystem services into planning and policy making at national, sectoral and subnational levels. These include high-level decision-makers and government officials who serve as ambassadors for mainstreaming ecosystem services. Practitioners also include stakeholders from the government (e.g. environment, finance and planning bodies; sector and subnational bodies, political parties and members of parliament), non-governmental actors (civil society, academia, business and industry, the general public and local communities and the media) and actors in the environment, development and poverty reduction fields. A secondary audience consists of United Nations officials who engage with governments on national development priorities and whose work involves ecosystem services and environmental assessment.

The guide is divided into six sections, which can be read individually according to user interests and needs, referring to other sections of the guide as required. Key messages are highlighted in each section, and numerous examples and case studies are presented in boxes, tables and figures.

After the Introduction, the second section describes the need for integration of ecosystem services in SEA, provides an overview of how SEA is applied in practice and introduces the proposed methodological approach. Sections 3 through 6 detail the four stages of the approach and the associated tasks, by presenting step-by-step guidance and providing illustrative cases:

- Stage 1: Establish the ecosystem services context
- Stage 2: Determine and assess priority ecosystem services
- Stage 3: Identify alternatives and assess impacts on ecosystem services
- Stage 4: Follow up on ecosystem services.

The conclusion summarizes the practitioner's manual and explains the challenges and constraints - as well as the added value - of mainstreaming ecosystem services into future policy and decision-making processes.

Photo Credit: ©ProEcoServ South Africa

Methodological approach for integrating ecosystem services in SEA

Key messages

- SEA is a promising tool to integrate ecosystem services in strategic decisions and improve the understanding of the consequences of policies, plans and programmes on human wellbeing.
- SEA must be flexible and able to adapt to the planning and policy-making context, as well as to the specific circumstances of the strategic action under consideration.
- A methodological approach for integrating ecosystem services in SEA is proposed, divided into four stages each comprising two or three specific tasks:
  - Stage 1: Establish the ecosystem services context.
  - Stage 2: Determine and assess priority ecosystem services.
  - Stage 3: Identify alternatives and assess impacts on ecosystem services.
  - Stage 4: Follow up on ecosystem services.
- Stakeholder consultation is a vital component of SEA, and it is relevant in all the four stages.

Need for integrating ecosystem services in SEA

The ultimate objective of SEA is to help protect the environment and promote sustainability by ensuring that environmental considerations inform "strategic actions", i.e. policies, plans and programmes (PPP) **(Box 1)**. SEA applies primarily to development-related initiatives promoted individually in sectors (e.g. transport, energy, water and tourism), or collectively in a geographical area (e.g, regional spatial or land use plan). It is considered one of the most promising tools to integrate environmental concerns into strategic decision- making, and more broadly to help face development challenges (World Bank, 2009) **(Box 2)**. The content of SEA is increasingly extending beyond the biophysical environment to include also other issues (social, health and economic) associated to human wellbeing. All these characteristics make SEA a suitable tool to integrate ecosystem services in decisions, and improve the understanding of the unattended and unintended consequences of PPP implementation on human wellbeing (Kumar et al. 2013; **Figure 2**). The use of the ecosystem services concept in SEA offers also the advantage of presenting a more holistic and integrated consideration of the socio-ecological system, and an effective framing of the (natural) environment in terms of communicating with and influencing stakeholders and decision-makers (Baker et al. 2013). **Table 1** summarizes the possible contribution of ecosystem services to good-quality SEA.

The growing interest in the potential of SEA to mainstream ecosystem services concerns in decision making is reflected by both scientific literature and practice (Geneletti, 2013a; van Beukering, 2008), showing the need for comprehensive guidance. The next section provides more details on how SEA is applied in practice, paving the way for the subsequent presentation of the methodological approach to fit ecosystem services into SEA.

Box 1: Policies, plans and programmes (PPP)

PPP mean different things in different contexts, even though most definitions have overlapping aspects and are essentially variants on the same theme. Put simply:

- Policy: A general course of action or proposed overall direction that a government or organization is or will be pursuing, and that guides ongoing decision-making. It may take the form of a law, document, statement or precedent.
- Plan: A purposeful forward looking strategy or design, often with coordinated priorities, options and measures that elaborate and implement policy.
- Programme: A coherent, organized agenda or schedule of commitments, proposals, instruments and/or projects that elaborate and implement policy.

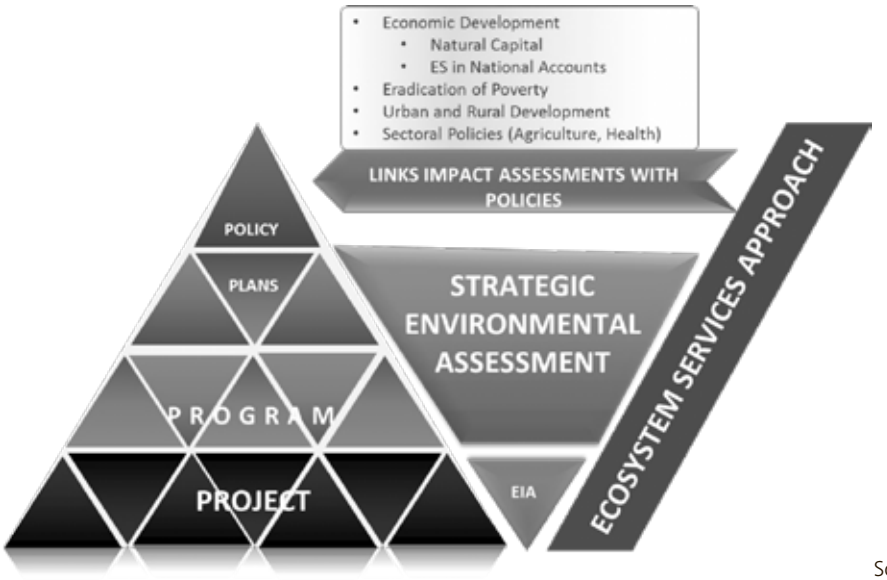
Source: Sadler and Verheem, 1996.

Box 2: Why is SEA important?

- Promotes environmentally sound and sustainable development, shifting from a "do least harm" to "do most good" approach.
- Allows problems of environmental deterioration to be addressed at their "upstream source" in policy and plan-making processes, rather than mitigating their "downstream symptoms" at project level, extending the principles of Environmental Impact Assessment (EIA).
- Provides early warning of large-scale and cumulative effects, including those resulting from a number of smaller-scale projects.
- Facilitates identification and discussion of development options and provides guidelines to help development to follow sustainability trajectories.
- Encourages political willingness, stimulates changes to mentalities and creates a culture of strategic decision-making.

Source: Partidario, 2012; Sadler, 2011; Abaza et al. 2004.

Figure 1: Ecosystem services approach as a catalyst to strengthen the linkages between environmental assessments and PPP



Source: Kumar et al. 2013

Table 1: Contributions of ecosystem services to the quality of SEA

Characteristics of good-quality SEA (IAIA, 2002)	Contribution of ecosystem services information
Integrated	Ecosystem services inherently address the interrelationships between biophysical and socio-economic aspects. The analysis of ecosystem service-related scale issues facilitates the interaction with relevant plans and policies at different decision-making tiers.
Sustainability-led	Ecosystem services approaches explicitly link changes in ecosystems and biodiversity with effects on human wellbeing. Hence, ecosystem service-inclusive SEA processes extend beyond the assessment of biophysical and environmental factors only, and promote plans that are more sustainable from both environmental and social perspectives.
Focused	Ecosystem services approaches offer a key to read the most important interactions between human society and the environment, identifying issues that are important for the specific decision-making context.
Accountable	Analysis of expected future trends in ecosystem services under different scenario conditions can be used to document how sustainability issues were taken into account, and to justify planning choices.
Participative	Information on ecosystem services by definition requires the identification of beneficiaries and stakeholders (including by gender), paving the way to more participative SEA processes.
Iterative	The analysis of ecosystem services can be included, in different forms, throughout the whole process, so as to provide information on the expected impacts of plan's choices during the different "decision windows" of the planning/policy-making process.

Source: Geneletti, 2011.

How is SEA applied in practice?

SEA approaches vary in different contexts and for different sectors and levels of decision-making. Nonetheless, there is broad agreement on certain defining principles (Therivel, 2004):

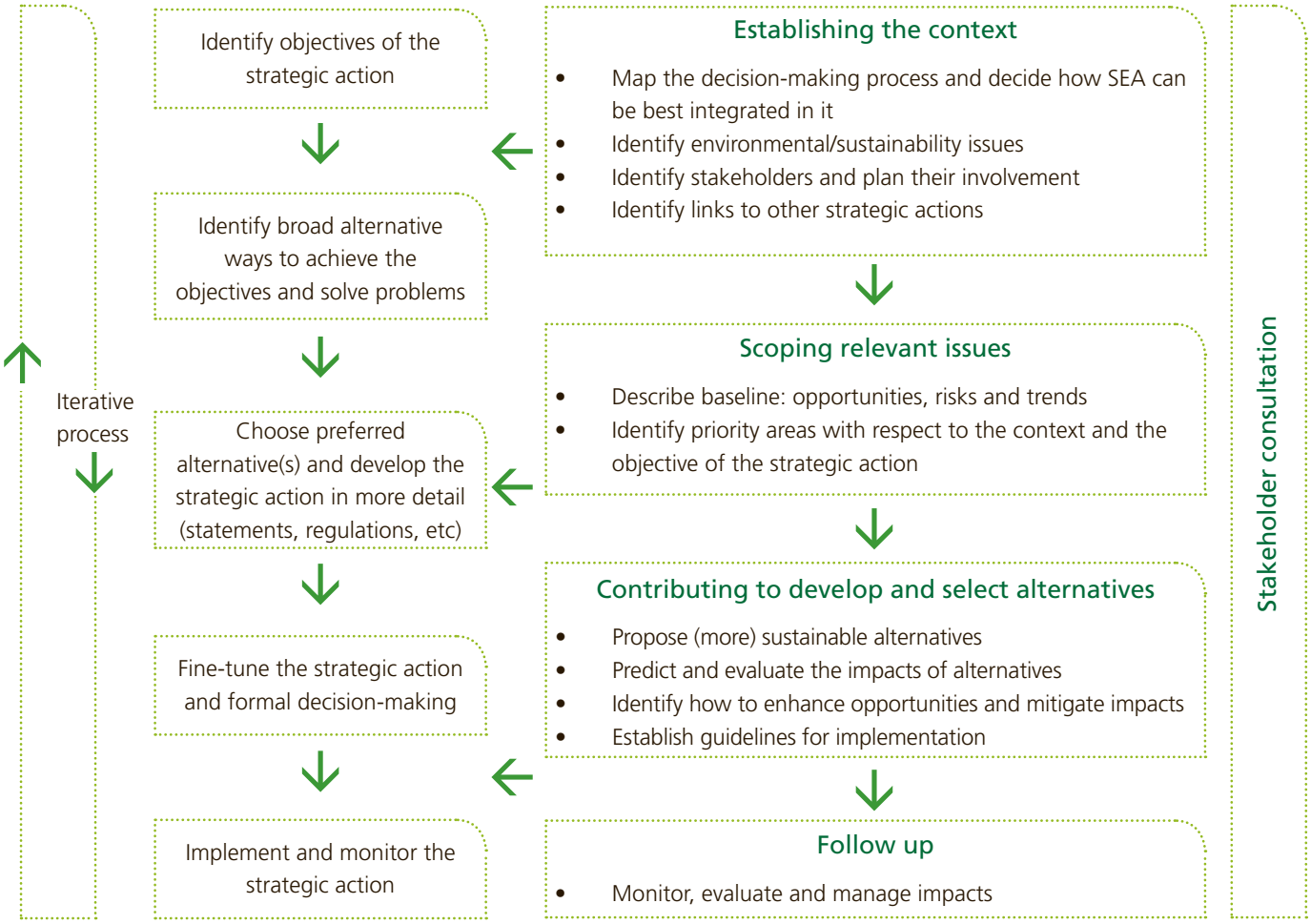
- SEA is a tool for improving strategic actions. Hence, SEA should start early, and be undertaken as an integral part of the decision-making process. Decision-makers should be involved in the SEA process to ensure that proper considerations is given to SEA findings;
- SEA should promote stakeholders participation and ensure transparency in the decision-making process, including sensitivity to gender;
- SEA should focus on key environmental and sustainability concerns that are appropriate for the specific strategic action, considering the timescale and resources of the decision-making process. A scoping stage is always important to sort out the key issues;
- SEA should include the analysis and comparison of possible options for the strategic action, and the identification of the most suitable one(s);
- SEA should aim at minimizing negative effects, enhancing positive ones, compensating for the loss of valuable features and benefits, and ensuring that irreversible damage are not caused. This requires predicting the effects of the strategic decision, and comparing the likely future situation without the action (the baseline) against the situation with the action. It also requires evaluation of the significance of the effects.

In short, a good-quality SEA process informs planners, decision-makers and the affected public of the sustainability of strategic decisions, facilitates the search for the best alternative and ensures a democratic decision-making process (IAIA, 2002). SEA must be flexible and adapt to the planning and policy-making context (including legal, institutions, procedural and political factors), which may be very different among countries,

decision tiers (national, regional, etc.), and sectors (land use, agriculture, water, energy, etc.). Most specifically, the circumstances of the strategic action under consideration (in terms of content, level of definition, availability of data, timing, etc.) will determine the way in which SEA is undertaken. A number of methodological approaches have been proposed over the years to tailor SEA to different decision-making contexts, and to show the broad range of possible SEA forms (Partidario, 2012; Ahmed and Sánchez-Triana, 2008; OECD, 2006).

Even though SEA cannot be represented by a standard sequence of activities, the SEA principles described earlier allow identification of a number of typical stages through which SEA can feed into decision making. **Figure 2** presents these SEA stages associated with the broad stages of strategic decision making. Building on these stages, a methodological approach is proposed in the next section to integrate ecosystem services effectively. The approach is not intended to replace, but rather to supplement the more traditional content of SEA (focused on issues such as environmental safety, air and water pollution, waste management, etc.).

Figure 2: Strategic decision-making and SEA stages



Source: (Author representation, building on Therivel, 2004, which can be referred to for more details on the stages and associated activities).

A four-stage approach for integrating ecosystem services in SEA

The methodological approach is structured in four stages, each comprising two or three specific tasks **(Figure 3)**:

- Stage 1: Establish the ecosystem services context. In this first stage, SEA needs to provide an understanding of the context within which the strategic action will be developed and implemented. This requires identifying and mapping ecosystem services and beneficiaries for the region that will be affected by the strategic action **(Task 1.1)**, reviewing existing regulations concerning these services **(Task 1.2)**, and identifying links with other existing or foreseen strategic actions **(Task 1.3)**.

- Stage 2: Determine and assess priority ecosystem services. The purpose of this stage is to generate detailed information on a limited set of "priority" ecosystem services, which are considered relevant for shaping and informing the development of the strategic action. This requires determining priority ecosystem services **(Task 2.1)**, and assessing their baseline conditions and trends **(Task 2.2)**.

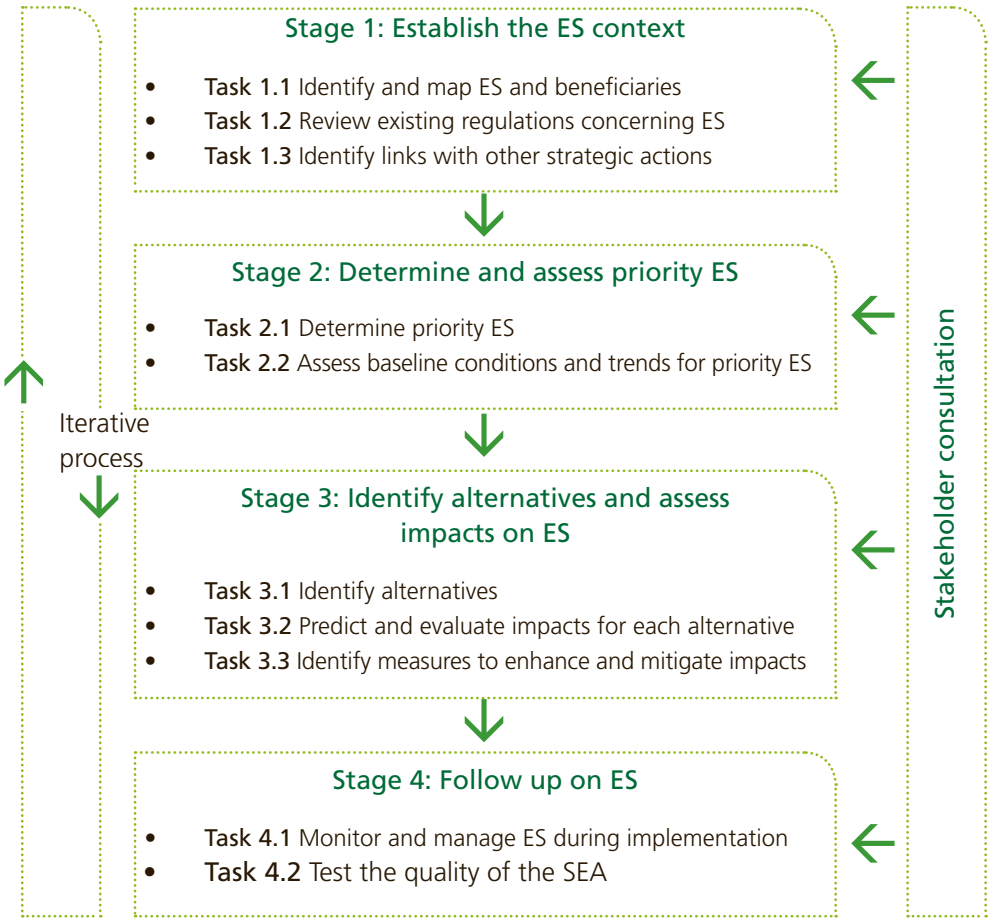
- Stage 3: Identify alternatives and assess impacts on ecosystem services. In this stage, the strategic action is taking shape and specific alternatives are proposed to achieve the objectives proposed through the action. SEA has the purpose of contributing to the identification of possible alternatives to enhance ecosystem services, or at least minimize negative effects on them **(Task 3.1)**, predicting and evaluating impacts for each alternative **(Task 3.2)**, and identifying measures to enhance and mitigate impacts **(Task 3.3)**.

- Stage 4: Follow up on ecosystem services. This stage begins when all alternatives have been closed, and the strategic action has been approved. It aims at understanding the effective progress in the implementation of the action, the actual impacts on ecosystem services, as well as relevant contextual changes. It entails two tasks: monitoring and managing ecosystem services during implementation **(Task 4.1)**, and testing the quality of the SEA process **(Task 4.2)**.

The proposed methodological approach aims at ensuring that all relevant information of ecosystem services is collected, processed and used to support decision-making. Stakeholder consultation is a vital component of SEA, and it is relevant in all the stages, as shown by **Figure 3**. Timely and well-planned consultation programmes facilitate the development of a shared vision of problems and objectives, contributing to the successful design, implementation and management of strategic actions. **Box 2.3** expands on the objectives of stakeholder consultation in SEA, the tools and techniques to engage stakeholders, and the potential constraints to effective consultation. It presents also possible groupings of stakeholders associated to ecosystem services.

Each successive stage in the proposed approach builds on previous work, but the sequence is not intended to be followed strictly. SEA is an iterative process, and many tasks may take place in parallel or in an order different from that presented here, according to the particular needs of the specific case. This is described in the *"Iterate!"* boxes, presented at the end of each of the chapters that follow.

Figure 3: Stages and tasks to integrate ecosystem services (ES) in SEA



Box 3: Stakeholders consultation in SEA

The objectives of stakeholders consultation and public involvement include:

- Obtaining local and traditional knowledge before decision making
- Allowing more sensitive consideration of alternatives, mitigation measures and tradeoffs
- Ensuring that important impacts are not overlooked and benefits are maximized
- Reducing conflict through the early identification of contentious issues
- Creating a sense of ownership of the strategic action
- Integrating gender differences in resources use
- Improving transparency and accountability of decision making
- Increasing public confidence in the SEA and policy/plan making process.

There are a number of tools and techniques to involve stakeholders and the general public, such as:

- Public meetings, open houses, advisory panels;
- Interviews, questionnaires, household surveys;
- Participatory appraisal techniques, stakeholder analysis and mapping;
- Focus group, newsletters, social networks.

The following potential constraints may hamper effective public participation, and should be carefully considered when designing participation programmes:

- Poverty: involvement means time spent away from income-generating activities.
- Rural settings: long distances and poor infrastructures make communication more difficult and expensive.
- Illiteracy (or lack of command of non-local languages): may inhibit participation, particularly if written communication is used.
- Culture and gender issues: behavioural norms or cultural practice can inhibit involvement of some groups (e.g. women).
- Languages: a number of different languages or dialects may be spoken, making communication difficult;
- Legal systems: conflicts with traditional systems may cause confusion about rights and responsibilities for resources.
- Interest groups: may have conflicting or divergent views, and vested interests.
- Confidentiality: can be important for the decision-makers, who may be against early involvement and consideration of alternatives.

With respect to ecosystem services, the following groupings of stakeholders can be distinguished:

- Ecosystem services beneficiaries: People making use of, benefit from, or putting a value to, ecosystem services that will be positively or negatively affected by the strategic action
- Formal or informal organizations that represent these beneficiaries
- Sectors and levels of government that are responsible for managing the identified ecosystem services and the drivers affecting them
- Institutions or enterprises that use or depend on the ecosystem services affected by the strategic action (e.g. water-supply enterprises, hotels using the touristic interest of protected areas)
- People, organizations or institutions that manage/control the supply of ecosystem services on which the strategic action depends (e.g. land owners upstream of the enterprises that depend on water supply)
- The general public who wants to be informed on new developments in their region
- Youth, stakeholders of future generations, who may rely on ecosystem services about which decisions are made today. Formal and informal organizations are increasingly aware of their responsibility to take into account the interests of these "absent stakeholders".

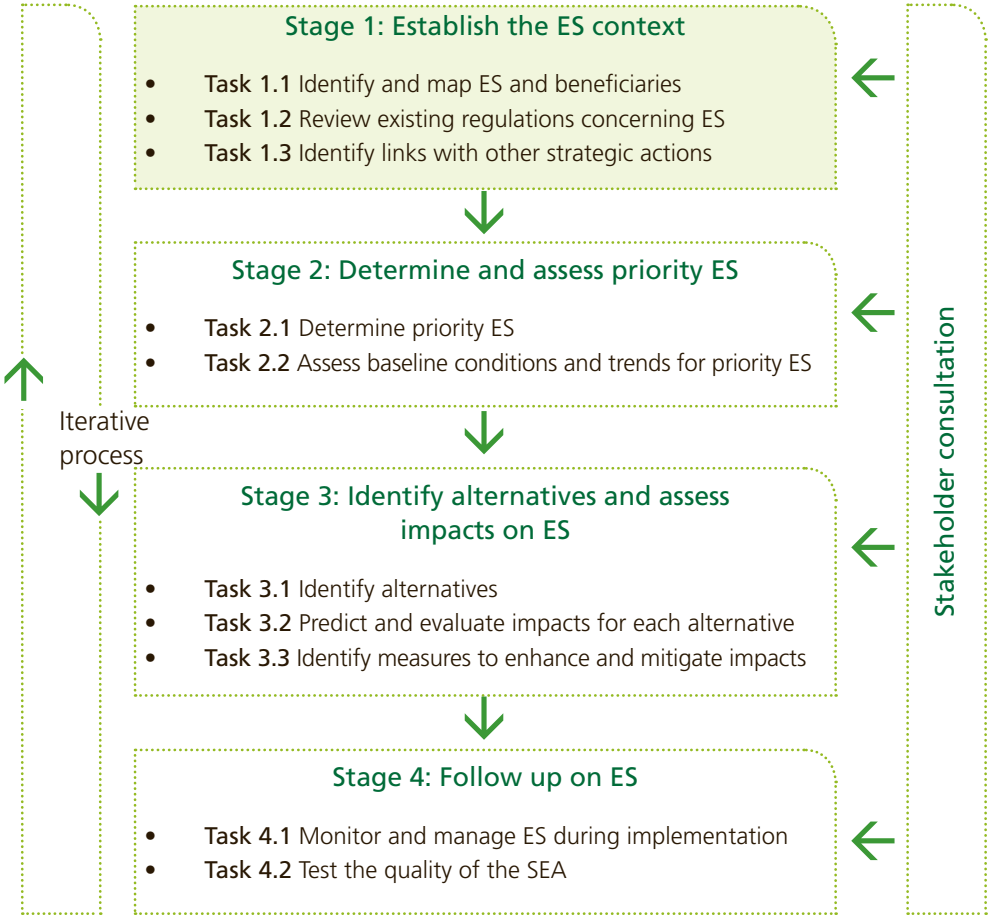
Source: (Modified after Abaza, et al. 2004;, Slootweg, et al. 2006; and OECD, 2008).

Photo Credit: © Patricio Jofre

Stage 1:
Establish the ecosystem services context

In this first stage, SEA needs to establish the ecosystem services context within which the strategic action will be developed and implemented. This can be performed through the following tasks:

- **Task 1.1:** Identify and map ecosystem services and beneficiaries
- **Task 1.2:** Review existing regulations concerning ecosystem services
- **Task 1.3:** Identify links with other strategic actions



Key messages

Task 1.1: Identify and map ecosystem services and beneficiaries

- Link ecosystems, services and beneficiaries through a conceptual framework.
- Include all ecosystem services, in order to see later on which ones are the most important.

Task 1.2: Review existing regulations concerning ecosystem services

- Analyse the possible implications for the strategic action of existing regulations that set conditions for the use or protection of ecosystem services.

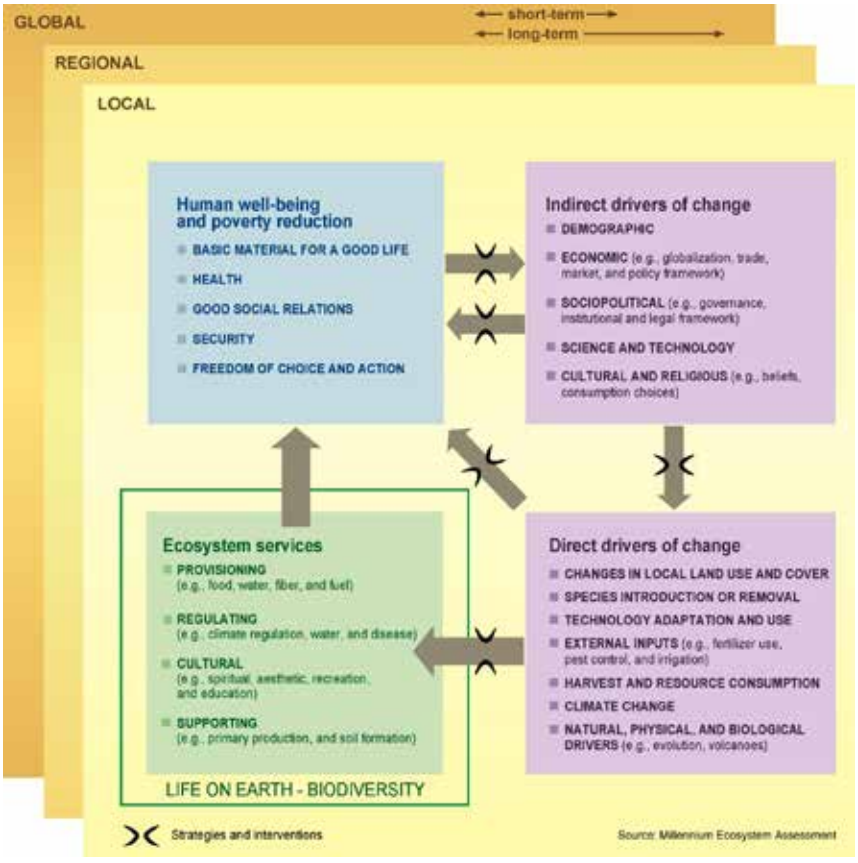
Task 1.3: Identify links with other strategic actions

- Harmonize the strategic action with existing actions at different tiers (national, regional, local).
- Identify possible conflicts and synergies related to the supply or demand of ecosystem services.

Task 1.1: Identify and map ecosystem services and beneficiaries

In order to incorporate information on ecosystem services into SEA, a general understanding of how ecosystem services are produced and used in the strategic action region needs to be achieved from the very beginning of the process. This can be obtained by: a) identifying the main ecosystem types occurring in the study area, b) determining the services produced by these ecosystems, and c) describing the beneficiaries of such services (disaggregated by gender and other sensitive groups, if possible) and the contribution provided to their wellbeing (e.g.in terms of health, material assets, security). Alternatively, one may start by identifying the key elements of wellbeing for the region's inhabitants, whether or not they are shaped by ecosystem services. Then, the ecosystem goods and services that matter the most for those elements should be identified, and traced back to the ecosystems that supply them.

Figure 4: The Millennium Ecosystem Assessment conceptual framework links factors that directly or indirectly affect ecosystems with changes in ecosystem services, and effects on the constituents of human wellbeing.



Source: MA, 2005.

In other words, this task requires building a conceptual framework to link socio-economic systems with ecosystems, via the flow of ecosystem services. Many frameworks have been proposed for this purpose, including the MA **(Figure 4)**, TEEB (TEEB, 2011), and IPBES (IPBES, 2013) frameworks, the ecosystem services cascade model (Haines-Young and Potschin, 2010) and the EU framework for ecosystem assessments (Maes et al. 2013). All these conceptual frameworks relate to one another to some extent, even though they introduce differences, for example in the description of the wellbeing components or in the definition of the relationships between ecosystems and the values provided to people. Practitioners can refer to these frameworks to identify the most suited to their specific SEA context.

Whenever possible, details should be added concerning the relevance of ecosystem services for the wellbeing of different groups of beneficiaries (see example in **Table 2**), with specific attention paid to the most vulnerable groups in terms of geographical location, as well as socio-economic conditions (e.g. by considering the level of dependence of different livelihoods on a given ecosystem service and the "substitutability" of that service). In addition, it is desirable to have also a (rough) geographical indication of where ecosystem services are produced and used (see **Box 16** in the next chapter for more on spatial issues).

At this stage, all ecosystem services should be included, in order to see later on **(Stage 2)** which ones are the most important and relevant. Practitioners may choose among the many existing classifications and lists of ecosystem services. In particular, three international classification systems have been proposed: MA, TEEB and CICES **(Box 4)**. Even though they share many similarities, each system has its own advantages and disadvantages, due to the specific context within which they were developed. A comparison of the classification of ecosystem services in the three systems is presented in **Annex I**.

Table 2: Example of identification of main ecosystem types, ecosystem services and beneficiary groups

Ecosystem type	Ecosystem service	Beneficiaries	Level of importance
Primary forest	Provision of timber and fuelwood	Local villages Private companies in the region	Very high High
Primary forest	Provision of non-timber forest products	Local villages	Medium
Primary forest	Spiritual (sacred places)	Indigenous groups	Very high
Primary forest	Water regulation	Local villages Urban settlements in the region	Very high High
Mangrove ecosystems	Shoreline protection	Local villages Land owners	Very high High
Coral reef ecosystems	Food provisioning through fish	Local fisherman Local traders	High
Coral reef ecosystems	Opportunity for recreational activities	Tourists nationwide Tourism agencies in the region	Medium Medium

Box 4: Ecosystem services classification systems

- **MA** (Millennium Ecosystem Assessment, http://www.maweb.org). It was the first large scale ecosystem assessment and it provides a framework that has been adopted and further refined by TEEB and CICES. The MA classifies ecosystem services into four groups: 1) provisioning services, 2) regulating services, 3) cultural services, and 4) supporting services.
- **TEEB** (The Economics of Ecosystems and Biodiversity, www.teeb.org). It proposes a typology of 22 ecosystem services divided in four main categories, mainly following the MA classification: 1) provisioning services, 2) regulating services, 3) habitat services, and 4) cultural and amenity services. TEEB omits supporting services, which are seen as a subset of ecological processes. Instead, habitat services have been identified as a separate category to highlight the importance of ecosystems to provide habitat for species and gene-pool "protectors" (e.g. natural habitats allowing natural selection processes to maintain the vitality of the gene pool).
- **CICES** (The Common International Classification of Ecosystem Services, http://cices.eu/). It offers a structure that links with the framework of the UN System of Environmental-Economic Accounting (SEEA). In the CICES system services are either provided by living organisms or by a combination of living organisms and abiotic processes. CICES has a five level hierarchical structure (section – division – group – class – class type). The more detailed class types makes the classification particularly user-friendly. At the highest level are the three sections of provisioning, regulating and maintenance, and cultural services.

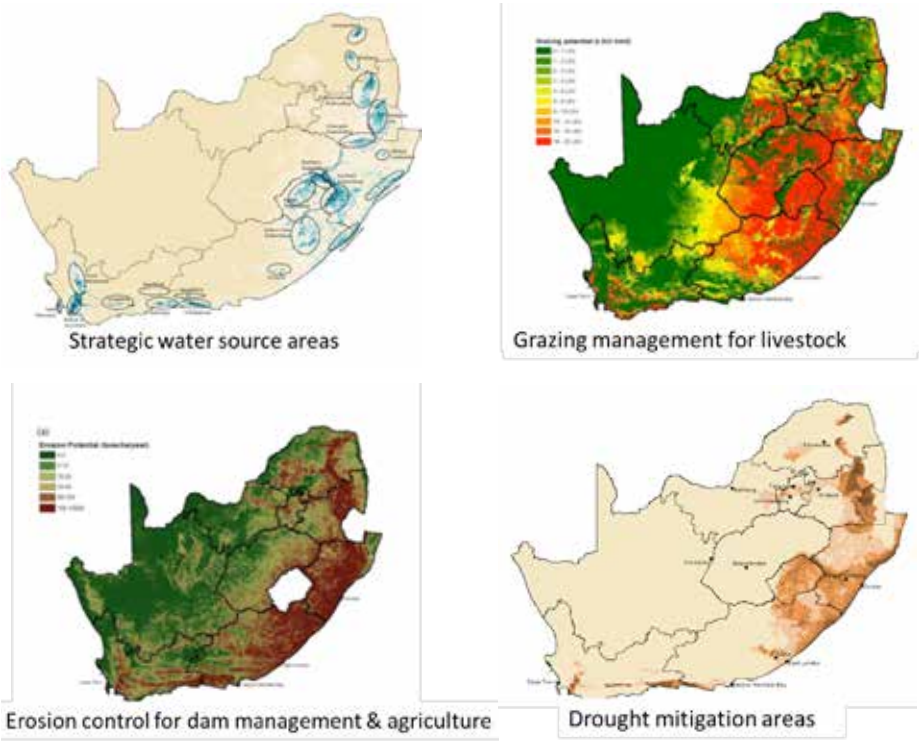
Source: (Modified after Maes et al. 2013).

Stakeholder consultation is essential for this task. Stakeholders' opinions can help to simplify the problem and get the essential right. For example, participatory mapping approaches can be undertaken **(Box 5)** to gain a clearer view on what matters for people's wellbeing, and how this is associated to ecosystems, and their services. Men and women often have different roles, albeit related, in the use and management of natural resources and ecosystem services. It is essential, therefore, to take these roles into consideration during the design of stakeholder consultation activities, as well as the subsequent SEA stages **(Box 6)**.

The level of detail of this analysis may vary largely, according to the scale of the strategic action (is it a nation-wide policy or a municipal plan?) and the availability of information. If the SEA represents the first study explicitly addressing ecosystem services in the region, most of the information will have to be collected and processed from scratch. In these cases, time and resource constraints might be significant. Therefore, the task might rely extensively on expert opinion, with limited support of field data and models. At the other extreme, there are situations where ecosystem service assessments have been already carried out for other purposes in the study region (e.g. TEEB country study). In these cases, the SEA can produce a synthesis of such assessments, and (if required) a fine-tuning or an update. Timing is essential for SEA, which must keep the pace with the planning/ policy making process. There will be ample opportunities for revising and integrating the information in sub-sequent stages, as needed (for example by including monitoring data, field measurements, computer-based modelling, or targeted interviews).

Spatial information. Maps will improve the output of this task, and should be provided whenever possible. Maps of ecosystem services are particularly important for those strategic actions whose objectives or policies are spatially-explicit (e.g. a land use plan indicating what activities are permitted and where). Possible approaches for ecosystem services mapping range from participatory mapping (as illustrated in **Box 5**) to GIS analysis and modelling **(Figure 5)**. Further information and examples of ecosystem services mapping approaches are provided in Stage 2 and 3.

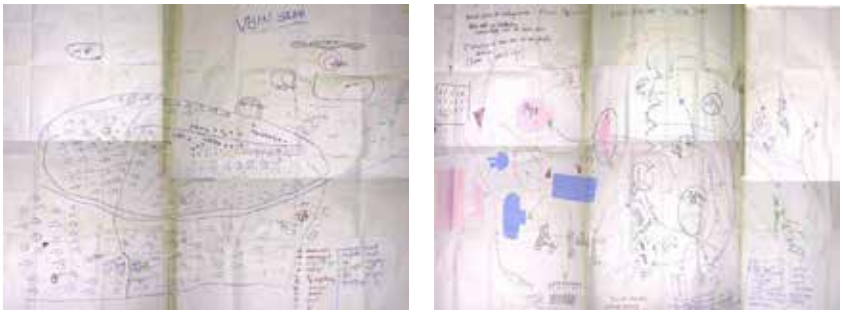
Figure 5: Results of a GIS analysis to map ecosystem services in South Africa



Source: ProEcoServ South Africa (www.proecoserv.org)

Box 5: Participatory mapping of ecosystem services and benefits flow

Wetlands are vital to the livelihoods of hundreds of millions of people residing in the Lower Mekong region, and particularly to the food security of many of the rural poor. The International Union for Conservation of Nature (IUCN) conducted a study aimed at supporting wetlands management for poverty alleviation in Stoeng Treng Ramsar site (Cambodia). In Veun Sean (one village within the Ramsar site), participatory mapping approaches were used to gather information on the contribution of ecosystem services to people's livelihoods and wellbeing. The "resource map" (left) shows the distribution of fishing pools, rice cultivation areas and forests that are important for hunting and collection of non-timber forest products. In the "flow diagram" (right), participants described the values derived from the wetlands and identified benefit flows and market linkages. Key wetland uses included fishing, spawning for fish, waterbird hunting, cooking and drinking, irrigating cash crops and transport.



Source: Chong, 2005.

Box 6: Gender and ecosystem services

The importance of biodiversity and ecosystem services to individuals varies according to gender. Hence, gender dimensions need to be incorporated into our understanding of ecosystems, the services they provide, and the sharing of benefits. Analogously, environmental conditions have a different impact on the lives of women and men, due to existing gender inequality. In particular, lack of access to safe water and energy, environmental degradation and natural disasters disproportionately affect women in terms of unremunerated work, health and mortality. The gender-differentiated impacts of environmental degradation require the integration of gender perspectives in the design and implementation of strategic actions. This is not only to avoid women or men suffering more than the other, but also to capture economic and social opportunities that have so far been neglected. There are a number of factors that continue to constrain the development of gender responsive policies and strategies. Firstly, for a full understanding of the connection between gender and the environment, the collection of sex-disaggregated data in key sectors, such as agriculture, forestry, fishing, energy and water is mandatory. Secondly, to ensure that policies are truly gender responsive, the concept of gender has to feature throughout the life-cycle of a policy, i.e. design, implementation, monitoring and evaluation meaning that gender-sensitive indicators have to be developed. Thirdly, both women and men should participate in decision- and policy- making process in order to ensure that their interests equitably represented.

Source: (Guidance note on gender analysis at project level, UNEP, 2013).

Task 1.2: Review existing regulations concerning ecosystem services

Ecosystem services often have some form of legal protection. Hence, a first and obvious step is to make sure that the strategic action is at least compliant with existing regulations and legal obligations. Of course, policy-making should comply with legal obligations irrespective of whether a SEA is carried out or not. However, SEA makes sure that this is actually performed, so as to enhance the compatibility of plans and policies with the existing regulatory and strategic frameworks (see also next task). This task can be broken-down into three activities. Firstly, identify all the existing regulations and legal obligations that set conditions for the use or protection of ecosystem services in the region (see example in **Box 7)**. This activity is made difficult by the fact that regulations may contain "hidden" or implict references to ecosystem services. For example, an Act concerning indigenous people may contain implications on how land need to be used and managed to ensure supply and fruition of ecosystem services (e.g. access to religious or cultural sites, food supplies, traditional medicines, etc.). A list of possible regulations to be reviewed is presented in **Box 8**.

Box 7: A policy and legislative framework for mainstreaming ecosystem services in Trinidad and Tobago

A report was produced in 2012 to review the existing policy and legislative framework relating to biodiversity and to assess opportunities for the development of payment of ecosystem services in the Republic of Trinidad and Tobago. This exercise required the review of approximately 12 policies and 53 pieces of legislation that govern biodiversity. The assessment revealed a fragmented and uncoordinated approach to the conservation of biodiversity. The assessment has further indicated that despite numerous laws relating to biodiversity many have become obsolete or need to be revised to reflect current management trends in biodiversity. While initiatives have been undertaken to review and revise these laws (such as the Forests Act and the Conservation of Wildlife Act) many remain in draft form and are yet to be enacted. In addition there is an urgent need for the development of new policy and legislation, particularly with regards to the management and trade of wildlife in Trinidad and Tobago.

Source: ProEcoServ Trinidad and Tobago (www.proecoserv.org)

Box 8: Examples of formal regulations linked to ecosystem services

Provisioning services:

- Extractive reserves (forest, marine, fisheries)
- Areas of high-quality soil
- Areas of indigenous interest
- Groundwater and surface water protection areas

Regulating services:

- Urban and regional regulations on impervious surfaces
- Flood storage areas;
- Regulations on forest and pasture for preventing hazards
- Regulations on riversides
- PES (Payment for ecosystem services) schemes

Cultural services:

- Natural monuments, natural heritage sites and cultural heritage sites
- Archaeological parks
- Sacred sites
- Urban green areas

Supporting services:

- Nationally protected areas/habitats, protected species
- International status: Ramsar convention, UNESCO Man and Biosphere, World Heritage Sites
- Subject to national (e.g. UK Biodiversity Action Plans) or regional regulations (e.g. European Union Natura 2000 Network)
- Sites hosting species listed on Appendices of the Convention on the Conservation of Migratory Species of Wild Animals (CMS) and the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES)
- Sites hosting species listed on Appendices of the Bern Convention

Source: (Modified after Slootweg et al. 2006).

Secondly, distil the specific ecosystem services-related content of the identified regulations, and present it in a way that can be easily communicated to policy-makers and stakeholders. This may include producing maps showing areas of concern for the specific regulation (e.g. designated sites; buffer zones of water bodies, habitat maps) or summaries of key elements (e.g. minimum requirements for green space in urban areas; no-net-loss policy on pervious surfaces; constraints on land development). Thirdly, provide initial comments (as far as it is feasible at this stage) on the implications of the regulation for the development of the strategic action. The latter action involves answering questions such as:

- What geographical areas/ecosystem types are addressed by the regulation?
- What stakeholders and beneficiary groups, disaggregated by gender and other sensitive groups, are mainly concerned?
- Does the regulation set constraints to decision making? How?
- Does the regulation offer opportunities for synergy with the strategic action? How can the strategic action contribute to the regulations objectives and vice versa?
- What specific elements of the strategic action are concerned the most by the regulation?

Box 9 provides possible answers to the questions above for a hypothetical regulation and strategic action.

In conclusion, the output of this task should not be a mere listing of existing regulations; this would simply add a layer to the huge pile of information that decision-makers should be aware of, with likely limited effects on the

final outcome. A further step needs to be taken, by identifying key content and bringing it to the attention of decision-makers in a clear and concise way, together with comments on the potential synergies and criticalities. In this way, the output can serve the purpose of both reminding decision-makers of issues that need to be taken into account (in a "reactive" way), and proposing ideas and strategies (in a "proactive" way). Obviously, synergies and constraints can be more or less identifiable according to the state of advancement of the strategic action (see example in **Box 9**). For this reason, the output of this task is not intended as a static picture, but needs to be updated and revised during the SEA and used to inform the process.

Box 9: Exploring the interaction with existing regulations concerning ecosystem services

Task 1.2 is exemplified by considering the possible interaction between an hypothetical Coastal Zone Management Plan (hereafter "the Plan") under development and an existing Act on coastal ecosystem conservation. The Act regulates trimming and alteration of mangroves, bans the use of herbicides and other chemicals, and identifies replenishment initiatives. Answers to the questions below are useful to identify possible synergies and constraints between the Plan and the Act:

- What geographical areas/ecosystem types are addressed by the regulation?
  Mangrove ecosystems and other coastal ecosystems that play a key role in terms of protection from storms.
- What stakeholders and beneficiary groups are mainly concerned?
  Tourism operators, developers, fishing villages, inhabitants of risk-prone areas.
- Does the regulation set constraints to the Plan's decision making? How?
  By imposing no-development areas and compensation measures for ecosystem services loss; by restricting permitted activities and land uses.
- Does the regulation offer opportunities for synergy with the Plan? How can the Plan contribute to the regulation objectives and vice versa?
  The policies and actions of the Plan can be directed at promoting eco-tourism activities and other recreational uses that require well-preserved coastal ecosystems. In this way their preservation is also instrumental to the economic development of the area.
- What specific elements of the Plan are concerned the most by the regulation?
  The Zoning Map, which identifies permitted, prohibited and preferred land use conversion in the coastal areas.

Task 1.3: Identify links with other strategic actions

This task aims at identifying other relevant strategic actions at various levels (e.g. national, regional, local), whose content must be taken into account to exploit synergies and reduce inconsistencies in terms of ecosystem services use and conservation. The task is similar to the previous one in that its purpose is to harmonize the strategic action with the external context. Even though the analysis is typically carried out for external actions that belong to higher or equal decision levels (e.g. for a regional strategic action: national and regional PPP), it can be worth exploring also actions on lower levels (e.g. local-level PPP), as well as individual projects. In particular, large-scale projects (e.g. a dam, a major transportation infrastructure) may influence the content and implementation of the strategic action.

In SEA, this task is called "external compatibility appraisal". It can be conducted both in a reactive (i.e. by testing if the proposed strategic action is compatible with the external context) and proactive way (i.e. by using information on the external context to shape the content of the strategic action and exploit synergies). **Box 10** provides a set of guiding questions that can help identify critical ecosystem service-related interactions between the strategic action and existing PPP. The output of this task can be summarized in a matrix, such as the one presented in **Box 11.**

Box 10: Guiding questions to identify links with other strategic actions

- Do the objectives of other PPP depend on ecosystem services that will be affected by the strategic action? (see cells 2, 3 and 5 in **Box 11**)
- Are other PPP likely to affect ecosystem services that are needed to achieve the objectives of the strategic action? (see cell 1 in **Box 11**)
- Does the strategic action contribute to enhance ecosystem services that are needed by an external PPP, or vice versa? (see cells 4 and 6 in **Box 11**)

This task needs to be repeated throughout the planning/policy-making process. In the preliminary stages it is conducted by looking at the objectives proposed in the strategic action. Later on it can be performed by analysing the specific policies and activities proposed to achieve such objectives. This reiteration is important because objectives might be too broad or too vague to allow a proper understanding of their effects on ecosystem services. Specific policies (e.g. a zoning scheme for a spatial plan) will unveil critical interactions that can be brought to the attention of the decision-makers at a stage where they can still be corrected or reviewed.

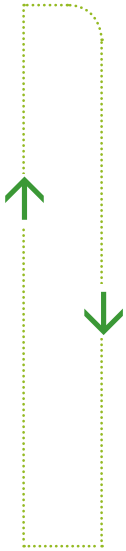
Box 11: Describing the ecosystem services-related links between a plan and existing strategic action

The matrix below describes the links between two objectives of a hypothetical Municipal Development Plan and three other strategic actions at different decision tiers: a National Energy Policy, a Regional Water Management Plan and the Municipal Development Plan of a neighbouring municipality. Potential conflicts (red boxes) and synergies (green boxes) related to the supply and use of ecosystem services are described in the relevant cells.

Table 1: Contributions of ecosystem services to the quality of SEA

	National Energy Plan	Regional Water Management Plan	Municipal Development Plan of neighboring municipality
Objective 1: Develop tourism infrastructures along rivers and coastal area	The National Energy Plan provides for hydropower development that may affect the touristic attractiveness of the river environment. **Ecosystem service:** Recreation and aesthetic appreciation	New tourism infrastructure may interfere with river ecosystems, upon which the Water Management Plan relies to reduce the population exposure to flood risk. **Ecosystem service:** Moderation of extreme events (floods)	Tourism infrastructure development in the coastal areas may increase water pollution and turbidity, affecting fish populations and the livelihoods of neighboring fishing villages. **Ecosystem service:** Provision of food (fish)
Objective 2: Agricultural land consolidation	Consolidating agricultural land fosters one of the objectives of the National Energy Plan: increase large-scale biofuel cultivation. **Ecosystem service:** Provision of raw material (biofuel)	Land consolidation may reduce hedgerows and vegetation along field margins and creeks, reducing the capacity to remove pollutants and decreasing water quality, in contrast with the objective of the Water Management Plan. **Ecosystem service:** Water purification	Land consolidation may optimize water use for irrigation, leading to increased water availability for a neighboring downstream municipality. This is synergic with the objective of the Municipal Development Plan of that municipality that aims at increasing food production and security. **Ecosystem service:** Provision of fresh water

Iterate!



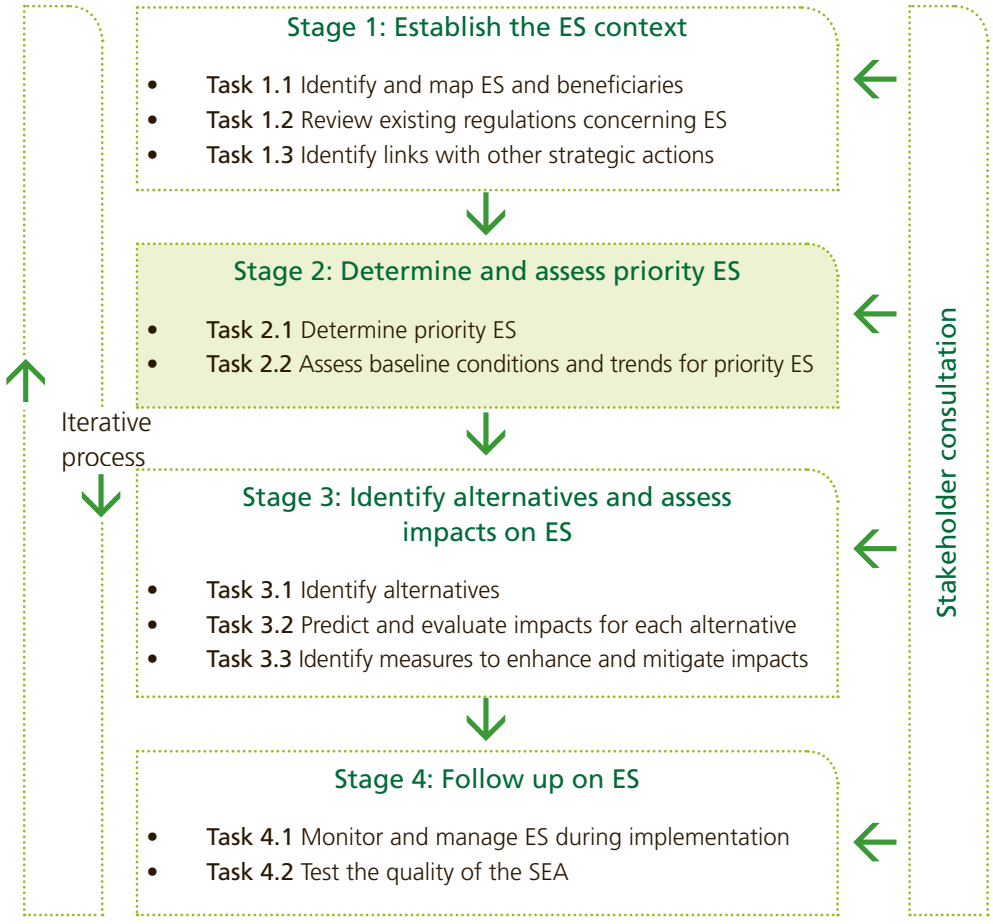
- The three tasks described in this chapter are undertaken in the initial stages of planning/ policy making, when the strategic action starts taking shape. Hence, their output can contribute to the definition of the scope and objectives of the strategic action, i.e. by proposing the revision of existing objectives or by identifying additional objectives. This suggests that, as soon as the content of the strategic action evolves and changes, some of the activities presented here may need to be iterated.
- Timing is essential for SEA, which must keep pace with the planning/policy- making process. In many situations the information collected at this stage may not be comprehensive. There will always be opportunities for revising and integrating the information in sub-sequent stages.
- Task 1.3 might need to be repeated throughout the planning/policy-making process. In the preliminary stages it will be conducted by looking at the proposed objectives of the strategic action. Later on it can be performed by analysing the specific activities and regulations proposed to achieve such objectives. This iteration is important because objectives might be too broad or too vague to allow a proper understanding of their connection to other strategic actions.

Photo Credit: © Proecoserv Vietnam.

Stage 2:
Determine and assess priority ecosystem services

The purpose of this stage is to generate detailed information on the ecosystem services that are most relevant to shaping and informing the development of the strategic action. To this purpose, the following tasks are undertaken:

- **Task 2.1:** Determine priority ecosystem services
- **Task 2.2:** Assess baseline conditions and trends for priority ecosystem services



Key messages

Task 2.1: Determine priority ecosystem services

- Identify: a) The services upon which the strategic action depends, and b) The services that the strategic action may affect (positively or negatively).
- Consult all potentially affected stakeholders to properly set the boundaries of the SEA.
- Address the geographical relationships between the area where the ecosystem services are produced, and the area where they are used by beneficiaries.

Task 2.2: Assess baseline conditions and trends for priority ecosystem services

- Analyse the current state and likely trends of priority ecosystem services to understand:
  - The distribution of services and benefits provided to different groups of people
  - Key direct and indirect driving forces
  - Likely future trends (and relevant drivers), threats and opportunities.
- According to context, assess ecosystem services in a qualitative or quantitative way, and by using monetary or non-monetary measures.

Task 2.1: Determine priority ecosystem services

The output of Stage 1 is likely to include an extensive list of ecosystem services, and associated beneficiary groups (see Task 1.1). In order for SEA to be effective, the number of services included in the analysis should be kept to a minimum, by considering only those that are relevant for the specific context, and content of the strategic action. Setting priority ecosystem services is best done in close collaboration with stakeholders and beneficiaries. In these initial stages, the content of the action is typically in the form of a draft set of problems that the action wishes to solve, and objectives that it wishes to achieve. By analysing this content, a preliminary screening can be performed in order to identify:

- The services upon which the strategic action depends
- The services that the strategic action may affect (positively or negatively).

A strategic action depends on an ecosystem service if the service is an input or if it enables, enhances or regulates the conditions necessary for a successful outcome of the action (OECD, 2008). For instance, a tourism development plan may depend upon cultural services (such as aesthetic value) provided by coastal ecosystems. **Table 3** provides examples of dependence of policy objectives on ecosystem services. A strategic action affects an ecosystem service if it triggers drivers that decrease (negative impact) or enhance (positive impact) the quantity or quality of that service (Box 4.1). For instance, a regional development plan may promote land-use changes that negatively affect the provision of freshwater. This systematic analysis of dependences and impacts helps uncover unforeseen interactions between ecosystem services and the strategic action. Identifying these interactions up-front will enable decision-makers to proactively manage any associated risks and opportunities (Ranganathal et al. 2008).

Table 3: Examples of possible links between broad policy objectives and ecosystem services.

Policy objectives	Link to dependence on ecosystem services
Adaptation to climate change:	Climate change alters the quantity, quality, and timing of ecosystem services flows, creating vulnerabilities for those individuals, communities, and sectors that depend on the services. Healthy ecosystems can reduce climate change impacts. Vegetation provides climate regulating services by capturing carbon dioxide from the atmosphere. Water and erosion regulation, natural hazard protection, and pest control can help protect communities from climate-induced events.
Energy security:	Many renewable energy sources, such as biofuels or hydroelectric power, are derived from ecosystems and depend on nature's ability to maintain them (e.g. hydropower relies on regular water flow as well as erosion control, both of which depend on intact ecosystems).
Food production:	Ecosystems are vital to food production, yet there is pressure to increase agricultural outputs in the short-term at the expense of ecosystems' long-term capacity for food production. Intensive use of ecosystems to satisfy needs for food can erode ecosystems through soil degradation, water depletion, contamination, collapse of fisheries, or biodiversity loss.
Freshwater provision:	Ecosystems help meet peoples' need for water by regulating the water cycle, filtering impurities from water, and reducing the erosion of soil into water. Population growth and economic development have led to rapid water resource development and many naturally occurring and functioning systems have been replaced with highly modified systems. Needs for irrigation, domestic water, power, and transport are met at the expense of water bodies that offer recreation, scenic values, and the maintenance of fisheries, biodiversity, and long-term water cycling.
Health:	Ecosystem services such as food production, water purification, and disease regulation are vital in reducing child mortality, improving maternal health, and combating diseases. In addition, changes in ecosystems can influence the abundance of human pathogens resulting in outbreaks of diseases such as malaria and cholera, and the emergence of new diseases.
Poverty reduction:	The majority of the world's 1.2 billion poorest people (who live on less than US$1.25 per day) live in rural areas. They depend directly on nature for their livelihoods and wellbeing. For example, ecosystem services represent 75 per cent of the "GDP of the poor" in Indonesia (TEEB, 2011). Investments in ecosystem service maintenance and restoration can enhance rural livelihoods and be a stepping stone out of poverty.

Source: (Modified after Ranganathan et al. 2008).

Box 12: Analysis of the interactions between the objectives of a strategic action and ecosystem services

The analysis of the possible relationships between some of the objectives of the Regional Spatial Plan of The Araucania (Chile) and ecosystem services is presented in the matrix below (The matrix is not exhaustive and aims at illustrating the concept only). For each objective, the first column indicates the ecosystem services required for its achievement (e.g. the horticulture sector relies on soil formation and retention). The matrix indicates also when such dependence may extend beyond the boundary of the area being planned, hence requiring a broader scale analysis (e.g. the regulation of water may depend upon decisions taken outside the region). The second column identifies situations where the achievement of the objective will have a positive/negative effect on the ecosystem services. For instance, the protection of natural areas is bound to contribute to soil formation and retention, but it may reduce recreation opportunities.

Similar analyses are useful to set the context for SEA (by identifying critical interactions that deserve to be addressed in more detail), but also to test the "internal consistency" of the strategic action. Potential inconsistencies exist whenever the achievement of one objective relies on a given service, which can be affected by a different objective. These situations can be detected by looking at each row of the matrix (see, for instance, the case of water regulation and supply). The results of the analysis can suggest revisions of the objectives, but also additional stakeholders to be consulted (i.e. beneficiaries of the services affected). Maps can be used to identify critical spatial relationships (see **Box 16**). A better understanding of how the objectives of the plan trigger drivers of change may be required to fill-in the matrix (see **Task 2.2**).

Spatial plan's objectives												
	Promote the nature tourism sector		Promote the timber sector		Promote the aquaculture sector		Reduce exposure to natural risks		Protect areas with high natural value		Respect and promote cultural and ethnic diversity	
Ecosystem services	Depend	Affect	Depend	Affect	Depend	Affect	Depend	Affect	Depend	Affect	Depend	Affect
Climate regulation				+								
Water regulation/ supply				–	●		●			+		
Waste treatment						–						
Soil formation			o							+		
Erosion control			o				●	+		+		
Raw materials				+						–		
Cultural	o	+		–		–				+	o	+
Recreation	o			–						–		
Food production				–		+				–		
Disturbance regulation				–		–	●			+		
Refugia	o	–		–		–		+	o	+		

Key:
+: Positive influence. –: negative influences.
o : Dependence between objective and ecosystem service.
●: Dependence that extends beyond the planning region.

Source: Geneletti, 2011.

Once the ecosystem services relevant for a strategic action have been identified, priority services can be selected by considering those with the most significant interactions. Some useful guiding questions to perform this selection are presented in **Box 13**. Answering to some of those questions may require detailed information on ecosystem services state, trends and relationships with beneficiary groups and their wellbeing. Hence, strong interaction with Task 2.2 may be necessary. Also, a proper understanding of spatial relationships is often important (see **Box 16**). Finally, the selection of priority services should always be conducted according to the precautionary principle (i.e. lack of full knowledge or understanding shall not be used as a reason for excluding an ecosystem service, see **Box 28**).

Box 13: Useful guiding questions to identify priority ecosystem services

- Would the strategic action trigger (or reinforce) drivers that contribute to the degradation of the ecosystems?
  - Would this affect the supply (quality, quantity, spatial distribution) of a given ecosystem service?
  - Is the ecosystem service already degraded?
- Can the strategic action trigger (or reinforce) drivers that contribute to enhancement of ecosystem services important for people's wellbeing?
  - Can it improve the conditions of the ecosystems (e.g. directly through restoration or indirectly through regulations and policies)?
  - Can it improve the quality and quantity of ecosystem services supply?
  - Can it enhance the ability of people (within and outside the strategic action region) to benefit from the ecosystem service (e.g.by improving access, by expanding potential beneficiary groups)?
- Would the strategic action limit the ability of people (within and outside the strategic action region) to benefit from ecosystem services?
- Would the strategic action affect the demand for a given ecosystem service, either directly (because the action depends on it for the achievement of its objectives) or indirectly (because it increases demand by other)?
- Will economic development and human wellbeing, for different groups of people, be affected by a decline in the ecosystem service?
- Is the affected ecosystem service a major contributor to the wellbeing of any of the potentially affected groups of people?
- Does the affected ecosystem service have a cost-effective substitute?
- Would the impact on ecosystem services contribute to conflict among users who depend on this service?

Sources: (Modified and integrated after OECD, 2008 and Landsberg et al. 2013).

Stakeholder consultation. This task requires wide stakeholder consultation to obtain existing information and to confirm the values, interests and dependencies on priority ecosystem services with people who need and use them, considering also gender issues (see **Box 6**). Stakeholder engagement is crucial to answer questions such as the ones presented in **Box 13**, and to understand the complex relationships between a society and its biophysical environment. An effective stakeholder consultation ensures that no relevant issues are left out, and allows to properly setting the "boundaries" of the SEA in a way to encompass the views and interests of all affected people. Stakeholder groups that can be identified in this stage include (see also **Box 2.3**):

- People that use or depend on the ecosystem services affected by the strategic action;
- Formal or informal organizations that represent them (e.g. farmers' unions);
- People (or institutions/authorities/enterprises) that use (or are responsible for managing) the ecosystem services upon which the strategic action relies. This group includes, for example, water supply companies, authorities of relevant sectors (e.g. forestry), neighbouring regions' governments, etc.

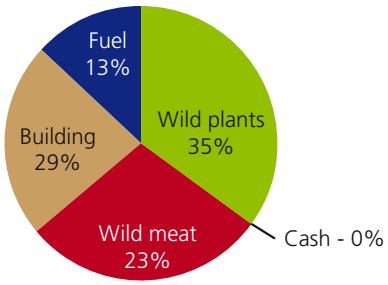
Including the poor. A critical issue in stakeholder consultation is represented by the involvement of the poor. Biodiversity has been described as "the wealth of the poor" (WRI, 2005), but power imbalances and governance failures make the poor often invisible and not fully involved in the planning/policy making processes concerning the use of natural resources. This, together with problems such as weak land rights, weakly enforced legislation and corruption, cause the benefits of ecosystems to be captured by those far away (e.g. genetic resources

exploited by international corporations) or by national government with limited local effects (e.g. wildlife tourism), to the detriment of the poor who are stewards of the ecosystems (Roe et al. 2011). This issue needs to be seriously considered in SEA, by improving participation of the less wealthy and more vulnerable groups (e.g. minorities) in the identification of priority ecosystem services (as well as in subsequent decision-making stages), in order to ensure that their interests are not overridden in favour of more powerful concerns (see **Box 14** and **Box 15**).

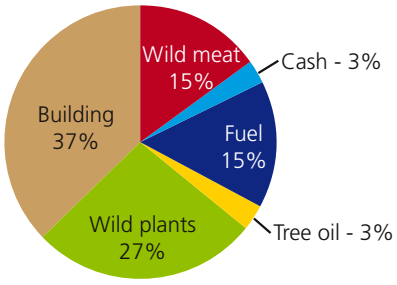
Box 14: Identifying the most important ecosystem services for different income categories

IUCN and WWF jointly undertook a study in Lao PDR to assess the value of conserving natural forest. Focus group discussions and Participatory Environmental Valuation techniques (see Figure below, top) were conducted in three villages to collect values and priorities of local villagers with respect to the use of non-timber forest products (NTFPs). These techniques were preferred to conventional cash-based measurements, which might be of little relevance to subsistence economies. The study was conducted separately for different income categories. As can be seen in the Figure below (bottom), all income categories see building material as the most important forest product, followed by wild plants. However, rich households perceive cash products to be much more important than wild meat, which is ranked third by poor households. This approach allows understanding and addressing the perceptions and needs of the poorer and more vulnerable groups.

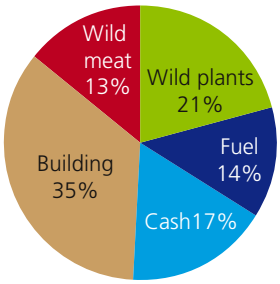
Poor (Focus Group Discussion)



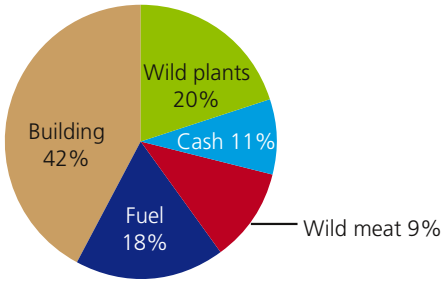
Poor (Household Interviews)



Rich (Focus Group Discussion)



Rich (Household Interviews)



Source: Rosales et al. 2005.

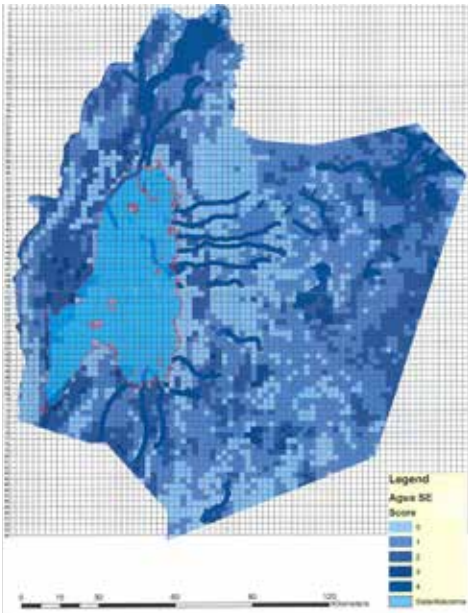
Box 15: Using ecosystem services maps to identify indigenous groups' needs and promote participation

The municipality of San Pedro de Atacama (MSPA) in northern Chile is an area of spectacular natural beauty, which also contains among the world's largest lithium deposits. The area has been home to the indigenous Licanantai people for over 10,000 years, many of whom still have a strong connection with the land. Previously, MSPA was one of the poorest regions in the country; starting in the late 1980s mining and tourism emerged as important economic activities, bringing major socio-economic and environmental change. Growth in these sectors has been accompanied by increasing conflict over access to and control over natural resources by various stakeholders, particularly water given its scarcity in the region.

Indigenous communities have expressed deep concern regarding the changes occurring within their territory, as well as a perceived lack of representation of their interests in economic development decisions.

Recognizing the importance of ecosystem services to local livelihoods on one hand, and the growing pressure on ecosystems that provide them on the other, ProEcoServ Chile has set out to achieve incorporation of ecosystem services considerations into policy and decision-making in MSPA. A key objective in this regard is the development of spatial decision support tools, which would allow authorities to explicitly recognize tradeoffs in ecosystem services provision likely to accompany specific interventions. The success of ProEcoServ in MSPA ultimately relies on its acceptance and support by all the major stakeholder groups, particularly the indigenous communities. This demands effective communication and outreach strategies. Maps have been indispensable tools for conveying key concepts relating to ecosystem services to local communities in MSPA.

In one workshop, maps were used in a participatory approach to show how tradeoffs in ecosystem services provision across space may occur under alternative development scenarios. A set of maps indicating important areas in terms of ecotourism and water provision (see example below) were produced. Participants were tasked with implementing a range of development scenarios involving the placement of several hotels and mines, where each attracted specific points (tourism or mining gains) and penalties (for the loss of an ecosystem service), related to the value of the area in which they were placed. The objective was to score as many points as possible, in the form of income generated through tourism and mining, while minimizing penalties incurred for the loss of pixels producing ecosystem services. Participants demonstrated critical analyses of the implications of their decisions in terms of tradeoffs in ecosystem services across the landscape, and benefitted from a deeper understanding of the concepts being conveyed, relative to what would have been possible in a passive approach and without access to maps as a teaching medium.



Source: ProEcoServ Chile (www.proecoserv.org)

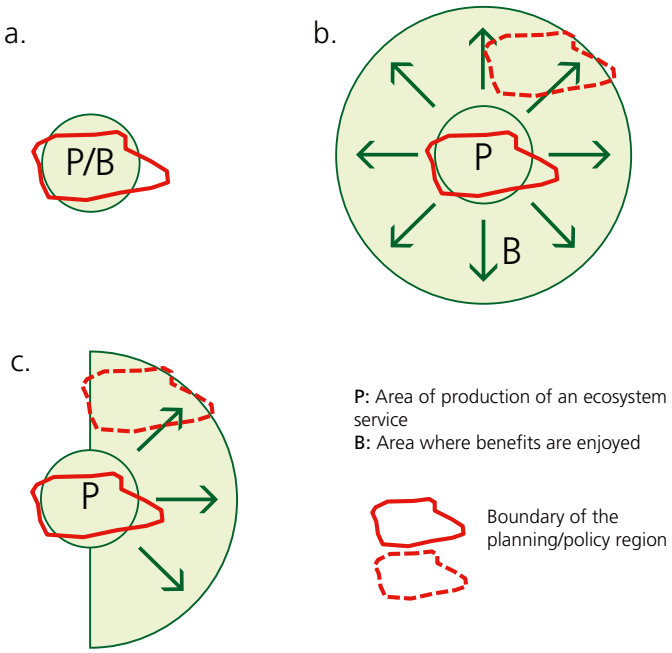
Spatial scales. Another key element for a successful identification of priority ecosystem services consists of addressing geographical relationships between the strategic action region, the area where the ecosystem services are produced, and the area where they are used by beneficiaries. A strategic action focuses on a geographically-bounded area, which typically correspond to a jurisdiction level (e.g. national, regional, municipal, etc). However, ecosystem services are supplied and used at different spatial scales, and those scales may be much broader than the boundaries of a particular jurisdiction. In SEA, a proper recognition of these spatial issues must be performed, in order to understand situations where, for example, benefits accrue at one scale, but costs are borne at another (Geneletti, 2011). As an illustration of this concept, **Box 16** describes possible spatial relationships and provides examples. The outcome of this analysis helps to refine the list of priority ecosystem services, but also to define the physical boundaries of the study area for the SEA (i.e. up to where should we assess the effects of the strategic action?). It can also be used to identify additional stakeholders to be engaged (e.g. inhabitants or authorities of different jurisdictions).

Box 16: Spatial relationships between ecosystem services production and fruition areas, and boundary of the strategic action

Ecosystem services are characterized by complex spatial relationships that need to be carefully addressed in SEA. The Figure below shows possible spatial relationships between areas of ecosystem services production, areas where benefits are captured, and two hypothetical boundaries for the strategic action region. Considering production and benefits, the following spatial relationships may occur (Fisher et al. 2009):

a) Production of the service and benefit occur in the same location (e.g. soil formation)
b) The service benefits the surrounding landscape omni-directionally (e.g. pollination)
c) The service has specific directional benefits (e.g. downhill areas benefit from water infiltration provided uphill, inland areas benefit from storm mitigation provided by coastal ecosystems).

Relationship (a) does not raise particular issues, as the strategic action has (or does not have) jurisdiction over both the production and fruition area of the service. On the contrary, relationships (b) and (c) may cause the strategic action to have jurisdiction where the service is produced, but not where it is used (see solid red line in the Figure below), or vice versa (dotted line). In these situations, coordination needs to be established with other strategic actions (e.g. land use plans of neighbouring regions) to ensure that a broader and truly ecosystem-based perspective is adopted in decision- making (as opposite to a perspective limited to administrative boundaries), and that an equitable distribution of costs and benefits is achieved.



Source: Geneletti, 2013c

Task 2.2: Assess baseline conditions and trends for priority ecosystem services

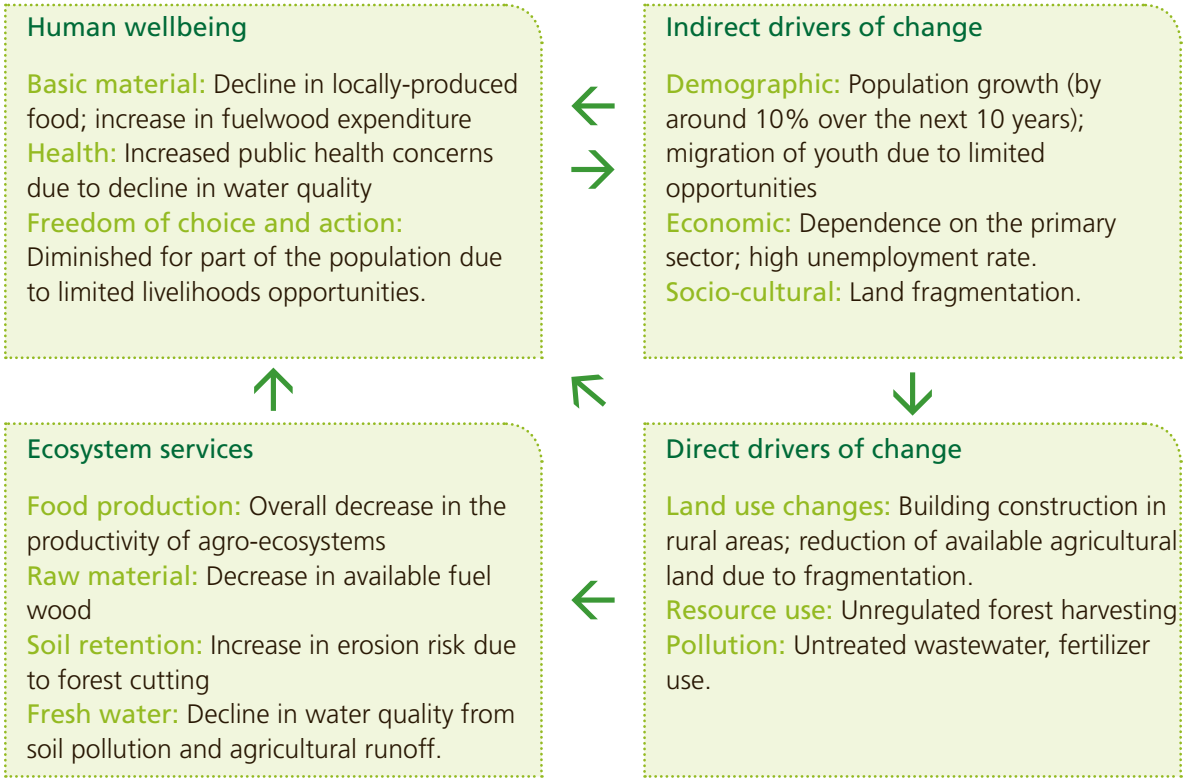
In this task, a detailed analysis of the current state of priority ecosystem services, as well as their likely evolution without the strategic action, is carried out. The output should provide as clear a picture as possible about:

- Current distribution of priority ecosystem services, and benefits provided to different groups of people
- Key direct and indirect driving forces
- Likely future trends, threats and opportunities

Basically, this implies filling up the conceptual framework previously developed (see **Task 1.1**) with further details, focusing on priority ecosystem services. Even though these frameworks are centered on the concept of ecosystem services, part of the information they require is typically collected also in more traditional approaches to SEA and planning/policy making (see example in **Box 17**). Guidance on methods to assess ecosystem services baseline conditions and trends by using the MA framework (or similar approaches) can be found in many available resources (e.g. Chapter 3 and 4 in Ash et al. 2010, and Chapter 3 in Ranganathan et al. 2008). The remainder of this section highlights critical issues of particular concern for SEA.

Box 17: Interactions between socio-economic and ecological systems in Partesh/Partes, Kosovo

During the SEA of the Municipal Development Plan (MDP) of Partesh/Partes (in southeastern Kosovo), a baseline study was carried out that describes current environmental conditions, and provides an overview of the main problems and opportunities. This baseline study focuses on environmental issues, and is broken down into the typical environmental components, such as water, air, soil, etc. Nonetheless, it contains many references to the socio-economic context and describes (although in non-explicit terms) the most important ecosystem services, the factors that are causing their degradation, as well as the risks for the population connected to such degradation processes. This information can be used to fill the key elements of the MA framework, by identifying the most important indirect and direct drivers of ecosystem changes, and their influence on human wellbeing, as shown in the figure below.



Source: The MDP and SEA processes for Partesh/Partes have been undertaken as part of the Municipal Spatial Planning Support Programme (MuSPP), implemented by UN-HABITAT (http://www.unhabitat-kosovo.org/en-us/Home). The diagram above has been drawn using the information contained in SEA report.

Purposes of SEA baseline. Assessing baseline conditions for ecosystem services can be challenging or overly time consuming. However, one must remember that baseline data in SEA essentially serve three purposes (adapted from Therivel, 2004):

- Identifying critical issues and opportunities related to ecosystem services to ensure that they can be addressed by the strategic action;
- Describe current conditions and expected trends so as to have a reference against which measuring the performance of the strategic action;
- Provide a basis for the prediction and assessment of the impact on ecosystem services.

These purposes should be kept in mind when deciding when to stop collecting and processing baseline data, and move on. A complete baseline is not necessarily needed to proceed with the SEA, and additional data should be collected only if they provide a relevant contribution to one of the purposes above.

Ecosystem services assessment methods. The assessment of ecosystem services can be conducted in qualitative or quantitative way. Quantitative assessments, in turn, can be based on monetary or non-monetary (e.g. biophysical) measures. The complementarity of different assessment approaches should be acknowledged in SEA practice. Monetary valuation offers many advantages (see examples in **Box 18** and **Box 19)**, but it may not be always appropriate or even possible (TEEB, 2013). The assessment of ecosystem services in their own term may be more meaningful for stakeholders than a monetary value (e.g. the recreational or spiritual value of a landscape feature). Hence, different types of assessment can be chosen for the different ecosystem services. The objective and scope of the SEA (including the foreseen interactions with stakeholders along the process), as well as the availability of data, time and resources, will play a key role in selecting the appropriate way to assess ecosystem services, as well as the specific methods.

Box 18: Valuation & Accounting of Natural Capital for Green Economy (VANTAGE)

An economic perspective on ecosystem management can support decision-makers invariably struggling with resource constraints and conflicting choices while designing and implementing the development policies. Tradeoffs amongst the ecosystem services and sometimes amongst the constituent of human wellbeing can potentially be better resolved by adopting an economic approach. Through the VANTAGE programme, the Ecosystem Services Economics Unit (UNEP-DEPI) aims to support efforts of Governments and other stakeholders in integrating the ecosystem service approach into their development planning and policy choices, by using scientifically robust but socially credible economic valuation of ecosystem services and biodiversity.

Valuation can strengthen SEA by:

- Capturing some of the 'out of market' services;
- Contributing to resolving tradeoffs and alternative courses of actions;
- Clearing the clouds of conflicting goals in terms of political, social and economic feasibility of the policies;
- Enabling integration of natural capital accounting;
- Making the appraisal criteria more acceptable, transparent and credible.

Source: www.ese-valuation.org

Box 19: Valuation of forest ecosystem services in Trinidad and Tobago

In the last 40 years (1970-2010), Trinidad and Tobago has experienced an 11% decline in total forest cover (around 30,000 hectares) resulting in significant increases in flood damage costs. Lower bound estimates of the value of forest ecosystem services indicate that these services are three times more valuable than agriculture annually (1.8% vs 0.6% of GDP). Forest ecosystem services such as erosion control, flood prevention, water purification, water regulation and sustainable timber production have an estimated value of between USD 387 and USD 672 million per year or between 1.8% and 3.2% of GDP. Between 1970 and 2010, Trinidad and Tobago has lost between USD 1.6 and USD 2.6 billion in ecosystem service delivery due to deforestation. The results of this study help the team to pilot the inclusion of ecosystem services in Trinidad and Tobago's national accounts.

Source: ProEcoServ Trinidad and Tobago (www.proecoserv.org)

A lot of guidance materials, as well as scientific publications, have recently become available on ecosystem services indicators and assessment. **Table 4** provides a flavor of possible indicators, whereas **Box 20** lists some key sources and references. A useful template and checklist of information needed for those beginning an ecosystem service mapping and assessment study can be found in Crossman et al. (2013). Examples of tools to support more systematic ecosystem services assessment are presented in **Table 5**. Further guidance on different assessment methods, and on their advantages and disadvantages, can be found in TEEB (2013).

Table 4: Examples of possible indicators (and relevant proxies) for the assessment of ecosystem services

Ecosystem service	Indicator	Proxies
Food crops	Yield of crop product	Area planted to crop
Livestock production	Offtake of animals ad their products	Turnover or gross profit in meat and dairy sectors
Fuelwood	Yield (MJ) of given energy product	% of biofuels in energy mix
Fresh water	m^3 of fit-to-use water	Per capita water use; Price of water; Cost of water purification; Depth to groundwater
Medicines	Harvest of known medicinal species (tons, or number of organisms)	Number of people using natural medicines
CO_2 sequestration	Net CO_2 flux out of atmosphere	Change in C stock
Flood attenuation	Height and duration of flood peak	Losses of life and property due to flooding
N,P, and S removal	Denitrification, P fixation, S precipitation	Downstream NO3, PO4 and SO4
Pest, pathogen and weed control	Intensity, duration, and extent of outbreaks of undesirable species	Expenditure on biocides Area occupied by alien species
Recreation	Recreational opportunities provided	Tourism sector turnover or gross profit, number of visitors
Aesthetic	Area of landscape in attractive condition	Visitor opinion polls Visits to beauty spots

Source: (Modified after Ash et al. 2010)"

Box 20: Key sources for ecosystem services assessment and mapping

- Burkhard, B., et al. eds. (2013). Mapping and Modelling Ecosystem Services for Science, Policy and Practice. Special Issue. Ecosystem Services, 4: 1-146.
- Alkemade, R. et al. (2013). Quantifying Ecosystem Services and Indicators for Science, Policy and Practice. Special Section. Ecological Indicators, 37: 161-265
- Crossman, N. et al. (eds) (2012). Quantifying and Mapping Ecosystem Services. Special Issue. International Journal of Biodiversity Science, Ecosystem Services and Management, 8 (1-2): 1-185.
- Egoh, B. et al. (2012). Indicators for mapping ecosystem services: A review. JRC Scientific and Policy Reports. Report EUR 25456 EN. Luxembourg: Publications Office of the European Union, Available online at http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/26749/1/lbna25456enn.pdf.
- UNEP-WCMC (2011). Developing ecosystem service indicators: Experiences and lessons learned from sub-global assessments and other initiatives. Secretariat of the Convention on Biological Diversity, Montréal, Canada. Technical Series No. 58, 118 pages. Available online at www.cbd.int/doc/publications/cbd-ts-58-en.pdf.
- Layke, C. (2009). Measuring Nature's Benefits: A Preliminary Roadmap for Improving Ecosystem Service Indicators. WRI Working Paper. Washington DC: World Resources Institute. Available online at http://www.wri.org/project/ecosystem-service-indicators.

Table 5: Examples of existing tools to support ecosystem services assessment

Tool	Description	URL
Integrated Valuation of Environmental Services and Tradeoffs (InVEST)	Open source ecosystem service mapping and valuation models (see **Box 30**)	http://www.naturalcapitalproject.org
Artificial Intelligence for Ecosystem Services (ARIES)	Open source modelling framework to map ecosystem service flows	http://www.ariesonline.org
Multiscale Integrated Models of Ecosystem Services (MIMES)	Open source dynamic modelling system for mapping and valuing ecosystem services	http://www.ebmtools.org/mimes.html
Co$ting Nature	Web-accessible tool to map ecosystem services and conservation priority areas	http://www.policysupport.org/costingnature
Social Values for Ecosystem Services (SolVES),	A GIS application for mapping social values for ecosystem services based on survey data or value transfer	http://solves.cr.usgs.gov
Ecosystem Valuation Toolkit	An appraisal tool to estimate the value of a specific area's ecosystem services.	http://www.esvaluation.org

Source: (Modified after Bagstad et al. 2013).

Drivers and trends. SEA is essentially "an exercise in futuring" (Duinker and Greig, 2007). Hence, it is fundamental for this task to include a dynamic component, by providing information not only about the current conditions, but also (and especially) about possible future trends. This will provide the basis for developing the strategic action in a way that it can adequately "fit" these trends (e.g. by reducing risks and exploiting opportunities related to ecosystem services). It will also provide the basis for assessing the impact of the action against the baseline conditions (see Stage 3). Analysing trends in ecosystem services requires the identification of key drivers that are influencing them. Drivers can be of a direct nature (e.g. physical interventions, such land use changes) or an indirect one (policies that may affect the way in which society makes use of ecosystem services, such as for instance the ones that regulate accessibility to recreation areas) (see examples of drivers in **Figure 4**). Climate change is an example of direct driver that needs to be considered systematically in SEA, particularly in the most vulnerable communities, sectors or geographical zones **(Box 21)**.

Once the main drivers of ecosystem services change are identified, possible future trends and trajectories can be formulated. Stakeholders' engagement can provide valuable insights into this task, by contributing to the identification of relevant drivers, and the discussion about possible future trends. **Figure 6, Table 6** and **Box 22** provide some examples. Operational guidance on the analyses of drivers and trends can be found in UNEP, 2009 and Ash et al. 2010.

Figure 6: Expected trends in the delivery and demand of ecosystem services from mangrove ecosystems in Sri Lanka for three alternative future scenarios (further expansion of aquaculture, expansion of coastal tourism development zones, and sustainable management of the coastal zone).

	Expansion of Aquaculture		Tourism development		Sustainable Management	
Ecosystem Service	Delivery	Demand	Delivery	Demand	Delivery	Demand
Fish Production	↗	–	↘	↗	↗	↗
Fruit Production	↘	–	↘	↗	↗	↗
Timber (for household use and handicrafts)	↘	–	↘	↗	↗	↗
Fuelwood	↘	↗	↘	↗	↗	↗
Vegetarian production	↘	↗	↘	↗	↗	↗
Biodiversity	↘	–	↘	↗	↗	↗
Primary production	↘	–	↘	–	↗	↗
Nutrient cycling	↘	↗	↘	–	↗	↗
Protection from storms, tidal surges, tsunamis	↘	↗	↘	↗	↗	↗
Flood control	↘	–	↘	↗	↗	↗
Carbon sequestration	↘	–	↘	↗	↗	↗

Key: direction of arrows indicate increase or decrease; arrow width specifies the intensity of such a process.

Source: Kallesøe et al. 2008.

Box 21: Mainstreaming climate change adaptation through SEA

SEA may provide a useful tool for applying a climate lens in the formulation of sectoral policies, strategies and plans, as well as for integrating climate change considerations into the formulation of sectoral programmes. Building climate change considerations into a SEA can help to identify whether sectoral strategies are viable and sustainable under different climate change scenarios. For example, in areas facing increasing water stress, SEA can help to assess different strategies for reform of the agricultural sector with different water requirements to identify which strategy is most sustainable under different climate change scenarios. In addition, SEA can help to analyse whether a sectoral strategy might lead to increased vulnerability of the sector where natural and human systems are affected by climate change, and thus prevent maladaptation. Finally, SEA provides a tool for identifying which adaptation interventions can enhance the resilience of the sector in the face of climate change.

Examples of how SEA has helped to account for climate change impacts in PPP development include a hydropower plan for a river basin in the Quang Nam province in Viet Nam, the land-use planning for the Nhon Trach district near Ho Chi Minh City, Viet Nam and Fiji's Tourism Development Plan.

Source: OECD, 2009.

Table 6: Key socio-economic drivers embedded in two scenarios to model future provision of ecosystem services in the Eastern Arc Mountains of Tanzania services in the Eastern Arc Mountains of Tanzania

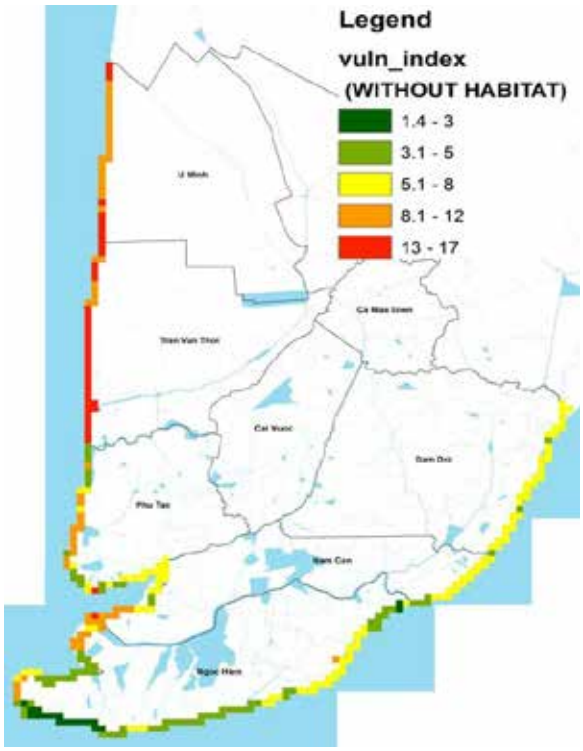
Driver	Optimistic scenario (2025)	Business-as-usual scenario (2025)
GDP per capita	US$1500 (growth rate of 6% per annum)	US$1100 (growth rate of 5% per annum)
Growth sectors	Tourism, mining, agriculture	Agriculture
Population	55 million (growth rate of 2% per annum)	60 million (growth rate of 3% per annum)
Access to electricity	40% of the population	20% of the population
Energy sources	Gas, coal, hydroelectric power increasingly important for electricity generation. Demand for biomass falling.	Gas, some coal and hydro-electric power. Biomass remains the main energy source.
Agricultural sector	Remains largest employer and largest component of GDP. Irrigation improves and productivity increases.	Remains largest employer and largest component of GDP. Productivity remains low and irrigated agriculture rare.
Global financing	International payments for carbon and PES schemes grow.	Payment schemes fail to be implemented in any significant manner.
Protected areas	Increasingly well monitored and managed. Encroachment and illegal timber harvesting are arrested.	Little capacity for monitoring and management. Encroachment and illegal timber harvesting continue.

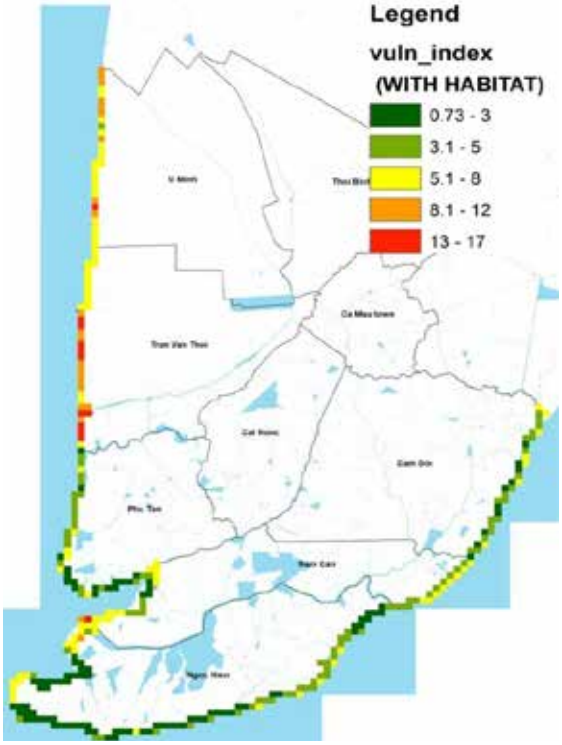
Source: (Modified after Swetnam et al. 2011).

Information gaps. During this Stage, as well as throughout the SEA, it is important to identify and acknowledge missing data, levels of uncertainty (is enough known to predict future trends and assess impacts?), technical deficiencies or lack of know-how. This is useful to steer further data collection during the next SEA stages, including during follow-up (see Stage 4). Additionally, keeping a record of missing information avoids being data-driven during the process (i.e. according importance to a given ecosystem service only because it is well documented).

Box 22: Drivers of changes for mangrove ecosystems in Ca Mau, Viet Nam

Between 1965 and 2010, the mangrove forests decreased from 87,100 hectares to 64,166 hectares in Ca Mau, Viet Nam), mainly due to the conversion to aquaculture and other land uses (e.g. wet rice, urban development, infrastructure). Mangrove forests play an important role in protecting coastal areas from wave, wind and disaster impacts. A coastal hazard analysis revealed that vulnerability has increased in the areas affected by the loss of mangroves (see figures below). These results are part of the information generated to integrate ecosystem services into land use decisions at the provincial level, as well as to contribute to the implementation of Viet Nam's National Green Growth Strategy.





Source: ProEcoServ Viet Nam (www.proecoserv.org)

Iterate!

- In principle, relevant ecosystem services are first identified, and then analysed more in depth by studying their baseline and trends. However, **Task 2.1** and **Task 2.2** are not necessarily sequential, but may require feedback and interaction. For example, it might be difficult to identify priority ecosystem services, without specific knowledge on current conditions, trends and driving forces.
- The outcome of this stage may suggest reiterating the analysis conducted during Stage 1. For example, the analysis of spatial interactions **(Box 16)** may suggest to identify the links with additional plans or policies **(Task 1.3)**.
- A complete baseline is not necessarily needed to proceed with the SEA, and additional data can be collected later on in the process, if they provide a relevant contribution to the study.
- The analysis illustrated in **Box 4.1** and **Box 16** might need to be repeated throughout the planning/policy-making process. In the preliminary stages, they are conducted considering the objectives of the strategic action. Later on, they can be performed by analysing the specific activities and regulations proposed to achieve such objectives. This iteration is important because objectives might be too broad or too vague to allow a proper understanding of their implications.

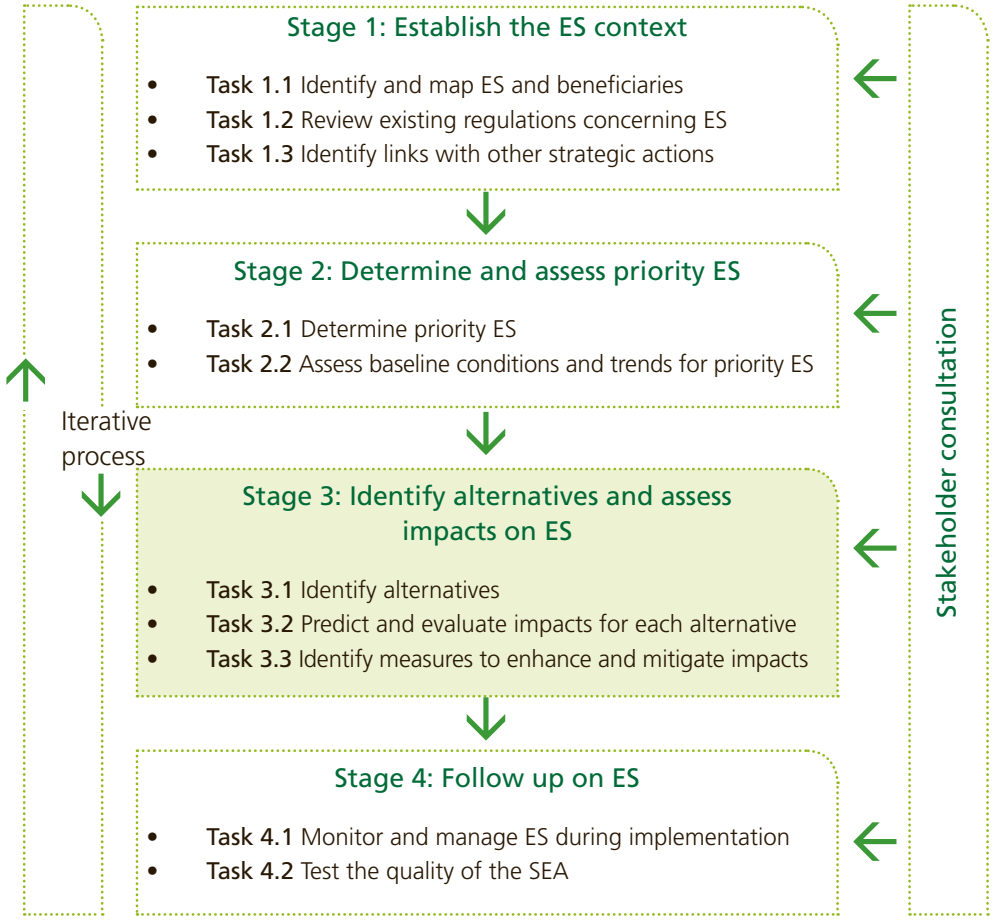
Photo Credit: © Huynh Lam

Photo Credit: © Lena Dempewolf

Stage 3:
Identify alternatives and assess impacts on ecosystem services

In this Stage, the strategic action is taking shape and specific alternatives are proposed to achieve its objectives. SEA has the purpose of contributing to the identification of the most suitable courses of action in order to enhance ecosystem services, or at least minimize negative effects on them. This can be achieved through the following tasks:

- **Task 3.1:** Identify alternatives
- **Task 3.2:** Predict and evaluate impacts for each alternative
- **Task 3.3:** Identify measures to enhance and mitigate impacts



Key messages

Task 3.1: Identify alternatives

- Consider an appropriate "hierarchy of alternatives", from the more strategic to the most operational ones.

Task 3.2: Predict and evaluate impacts for each alternative

- Determine which ecosystem services would benefit or be worse off, and which groups of people would win or lose, if a given alternative is selected.
- Predict impacts by describing the expected changes in the ecosystem services conditions due to the implementation of a given alternative.
- Evaluate impacts by describing the significance of the predicted changes for beneficiaries.
- Address cumulative effects, by considering all activities of the strategic action, as well as of other existing/foreseen actions.
- Make ecosystem services tradeoffs and synergies explicit.

Task 3.3: Identify measures to enhance and mitigate impacts

- Seek measures that, in order of priority:
  - Enhance ecosystem services
  - Avoid negative effects on ecosystem services
  - Reduce negative effects
  - Repair negative effects
  - Offset negative effects

Task 3.1: Identify alternatives

This task has the purpose of contributing to the identification of possible courses of action to enhance (priority) ecosystem services, or at least minimize negative effects on them. The analyses conducted in the previous two Stages and the information collected so far (including stakeholders' perceptions and values) is used to ensure that key ecosystem service-related issues are mainstreamed in the actual content of the strategic action. Alternatives can be generated as a reaction to proposals formulated by planners/policy makers (e.g. proposing infill development as opposed to urban expansion in areas that provide important water regulation services), or as a response to issues that emerged during the previous stages, and that need to be adequately addressed by the strategic action (e.g. proposing a constraint to landuse conversion in an area that proved to be essential in providing a priority ecosystem service). Alternatives developed during the SEA can be radically different in order to achieve a given objective, or can result from adjusting and fine tuning existing proposals (e.g. by suggesting better implementation details or location for a given activity). **Box 23** presents useful guiding questions to identify possible alternatives, while **Box 24** provides some examples of alternatives developed to enhance ecosystem services in different contexts.

Box 23: Useful guiding questions to identify possible alternatives

By considering the outcomes of the tasks performed in Stage 1 and Stage 2, can alternatives be identified that:

- Promote synergy (or at least are in line) with existing regulations on ecosystem services? (see **Box 7** and **Box 8**)
- Promote synergy (or at least do not conflict) with the objectives of other relevant strategic actions? (see **Box 9**, **Box 10** and **Box 11**) If conflicts are unavoidable, can we suggest ways to minimize them?
- Minimize their dependence on priority ecosystem services? (see **Box 4.1** and **Box 13**)
- Secure services on which an action depends (e.g. water supply by protecting upstream watersheds)?
- Enhance positive (and minimize negative) effects on priority ecosystem services? (see **Box 4.1** and **Box 13**)
- Increase desirable effects on drivers of ecosystem services change and better fit the trends in the supply and demand of ecosystem services? (see **Figure 6**, **Table 6** and **Box 17**)
- Generate a more equitable distribution of cost and benefits, particularly considering the poor or other vulnerable groups? (see **Box 14** and **Box 15**)

Box 24: Identifying alternatives to enhance and protect ecosystem services: two case studies

A project conducted in four wetlands within the Zambesi River Basin (in Zambia, Malawi, Namibia and Mozambique) identified the main goods and services, and provided estimates of their value by reviewing existing information and undertaking household and focus group surveys. Using a dynamic ecological-economic model, it was shown that the current unsustainable use of resources in the wetlands will erode their value in the future. The study then demonstrated the economic issues and tradeoffs involved in wetland management, by assessing the economic impacts of four management alternatives considered as the most realistic options for future development: maintenance of status quo, wise use and management, strict protection, and agricultural conversion. A further step was then taken, by proposing a zoning system that allows for management of different parts of a wetland for different purposes. In this way, the study "mixed and matched" the original alternatives, and developed new ones. It was concluded that the optimal management scenario of the wetlands is likely to include a combination of at least three of the original management options.

Source: Turpie et al. 1999.

The Heart of Borneo (HoB) is rich in natural capital with over 22 million hectares of intact tropical forest. A Green Economy in the HoB could support goals such as economic growth, poverty alleviation and energy and food security. Green economic activity, such as renewable energy generation, eco-tourism, forest carbon and ecosystem service markets could also attract foreign investment and improve the quality of the environment and the wellbeing of local inhabitants (UNEP, 2011). Recognizing the Green Economy opportunity in HoB, a scoping study was conducted to identify possible alternative interventions to contribute to the achievement of a green growth vision. Interventions included policies (e.g. targeted timber extraction volume), changes in practices (e.g. local adoption of certification standards) or development of new economic activities (e.g. selling REDD+ credits). The results of the study can support policy-making, by showing how different sets of interventions can be combined to produce alternative scenarios, which represent the outcomes that could be achieved through the successful implementation of the interventions. To ensure the scenarios are locally relevant and acceptable to different stakeholders, the potential interventions are to be generated and challenged through consultation with local stakeholders and subject matter experts.

Source: WWF and Pwc, 2011. Available online at http://awsassets.panda.org/downloads/pwc_report_green_economy_roadmap_1.pdf

In practice, alternatives are rarely developed in isolation by the SEA team: close collaboration with the planners/policy makers, as well as with relevant stakeholders is essential. However, SEA can initiate the process by bringing attention to specific issues, supporting them with relevant information and helping "make the case". Policy makers and stakeholders can then further developed those issues and formulate feasible policy options. Examples are provided in **Box 25**.

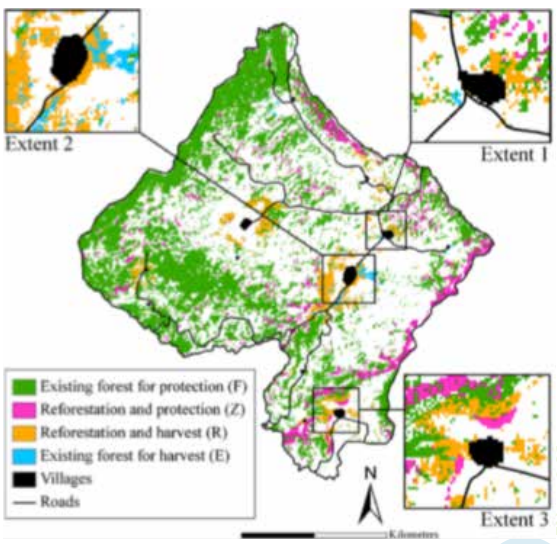
Box 25: Ecosystem services analyses to support the development of alternatives: two case studies

Knowledge of ecosystem services distribution and values can be used in this stage of SEA to draw attention to critical issues and propose strategies of intervention, which can be used by policy-makers (and stakeholders) to craft feasible policy options. An example is provided by the study conducted in Sumatra (Indonesia) aimed at assessing the current state and trends of natural resources, and associated ecosystem services. One of the outcomes of the study is a list of potential priorities for forest conservation interventions, produced by combining information on critical ecosystem services, such as forest and peat carbon, and biodiversity (Table below). However, the study acknowledges that identifying and prioritizing specific areas for immediate conservation interventions is not easy, particularly because not all values have the same priority for all decision-makers. Hence, presenting potential choices in one or two static maps without being able to give decision-makers a chance to "play" with the data is difficult. Ultimately, the actual weighting of the different values (e.g. macro-faunal diversity versus carbon stock) is up to decision-makers and stakeholders, who can use the outcomes of this study as a key input for alternative development.

Potential priorities for forest protection: areas with natural forest	ha	(%)
Forest carbon + Peat carbon +Mega-fauna diversity + Eco-floristic diversity	1,929,380	15,1
Forest carbon + Peat carbon +Mega-fauna diversity	19,438	0,2
Forest carbon + Peat carbon + Eco-floristic diversity	454,751	3,5
Forest carbon + Mega-fauna diversity + Eco-floristic diversity	1,217,843	9,5
Forest carbon + Peat carbon	51,180	0,4
Forest carbon + Mega-fauna diversity	8,071,425	63,0
Forest carbon + Eco-floristic diversity	148,112	1,2
Forest carbon	918,868	7,2
Total area with natural forest	12,810,997	100%

Source: WWF-Indonesia 2010.

A study conducted in Chiapas (Mexico) investigated possible forest management options in a degraded and fragmented landscape, by considering criteria related to forest biodiversity and regeneration potential, but also to key regulating services (e.g. soil retention) and provisioning services (access to timber and fuelwood, subsistence animal production and cropping). The figure below (left) Illustrates the conceptual approach followed for the development of forest management options, which consider also access to priority ecosystem services by villages' inhabitants. The study provided information on the opportunity cost of different management options, and its outcome can be used as a basis for developing restoration plans and policies. The figure below (right) shows one of the proposed forest management options (extends 1, 2 and 3 enlarge the area around the main villages).



Source: Orsi et al. 2011.

Hierarchy of alternatives. In SEA, different types of alternatives might need to be considered. To illustrate this concept, a hierarchy of alternatives has been proposed (**Box 26**). The hierarchy is as follows (modified after Therivel, 2004):

- Check whether the action is really necessary: Is it possible to obviate demand and needs? Is the no-action (or "zero") option a feasible solution?
- Explore different ways of providing for the needs or demand: How should it be done? What are the possible policies, methods or technologies?
- Decide about the location: Where should the development go? Where should a given policy be implemented?
- Decide about timing and implementation details: What details matter? What requirements should be made about them?

The first two tiers of alternatives are of a more strategic nature, hence generally more applicable for policies and for the national or regional level. The other two tiers are more operational, and in general more suitable for plans and programmes, especially at the local level. Hence, it may not be feasible to consider all alternatives in the hierarchy for all possible forms of SEA. In general, the "higher" alternatives (i.e. more strategic) are more proactive and offer greater sustainable development potential than the "lower" ones.

Box 26: Hierarchy of alternatives for a case study on ecosystem-based strategies for hazard mitigation

The "hierarchy of alternatives" concept is illustrated for an SEA of a hypothetical Regional Development Plan, where one of the problems to address is the exposure of population to natural hazards.

Need/demand: is it necessary?	Yes. Mudflows are causing significant damage to material assets and people during the rainy season, hence the Regional Development Plan needs to include actions to reduce exposure to hazard
Mode/process: how should it be done?	After having assessed the current and potential contribution of natural vegetation to stabilize mudflows, it is proposed to mitigate hazard through an ecosystem-based approach (reforestation interventions on slopes and hills), also because of the expected co-benefits (e.g., carbon storage)
Location: where should it go?	Possible locations have been compared by considering biophysical characteristics (e.g., soil, current land cover) and the expected benefits (e.g., in relation to population density, poverty level, infrastructures), leading to the identification of sites where reforestation interventions will be undertaken
Timing and detailed implementation: when and with what details?	By considering elements such as budgetary requirements, regeneration capacity of vegetation, vulnerability of the population, a phased plan of interventions is formulated and relevant details are identified (e.g., tree species)

Source: (The diagram on the left is modified after ODPM, 2005).

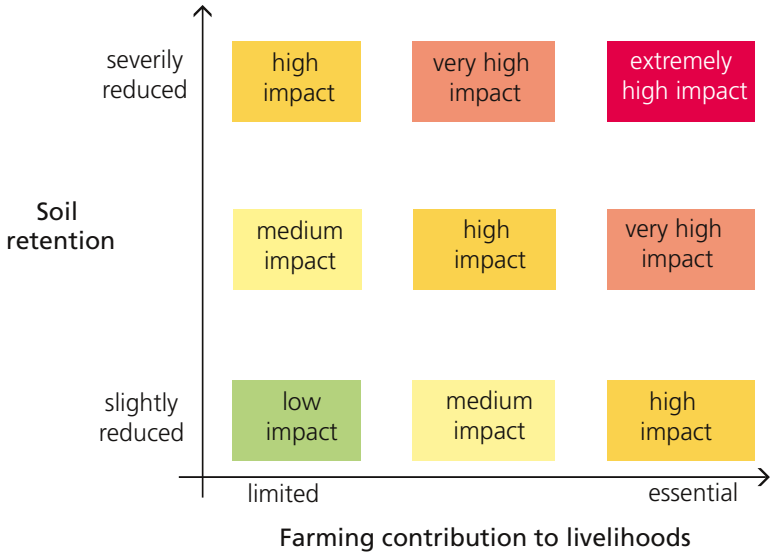
Task 3.2: Predict and evaluate impacts

This task has the purpose of providing information on which ecosystem services would benefit or be worse off, and which groups of people would win or lose, if a given alternative is selected. This information will provide the basis for discussions with stakeholders and planning/policy makers and for supporting the final decision-making process (which typically requires knowledge also on additional issues besides ecosystem services). The identified alternatives are compared in terms of their impact on ecosystem services, in order to suggest the options that enhance opportunities (e.g. for conservation of ecosystem services, improvement of quality/quantity of ecosystem service provision, increase in potential beneficiaries) and reduce risks (related, for example, to high level of dependence on ecosystem services, degradation, conflict in access and use).

Prediction and evaluation. Impacts are defined as the difference between the conditions of a given variable with and without the strategic action through time. Hence, impacts can be desirable (positive) or undesirable (negative) changes that result from the implementation of the strategic action. The purpose of impact prediction is to identify and describe these changes. Impact prediction answers the following question: What is going to happen? The purpose of impact evaluation is to describe the significance of the predicted changes, answering the question: How important are the predicted effects? **(Box 27)**. Prediction and evaluation should always be conducted in accordance with the precautionary principle **(Box 28)**.

Box 27: Predicting and evaluating impacts on ecosystem services

With respect to impacts on ecosystem services, the role of prediction and evaluation can be described as follows. Impact prediction informs about the consequences of the alternatives under consideration on the provision of a given service (e.g. change in quality/quantity of yield of crop, change in denitrification capability within a watershed; change in the area of landscape in attractive condition). Impact evaluation gives information on the importance of such changes for beneficiaries, by considering issues such as dependency and replaceability, poverty, vulnerability, access, etc. Hence, the overall significance of an impact is a function of both the magnitude of the change, and the importance of that change for the wellbeing of the affected people. In the example below, impact significance is estimated by combining the expected magnitude of change in the capability of ecosystems to prevent erosion (y-axis: soil retention), and the importance of well-preserved soil to the livelihoods of local villages (x-axis: contribution of farming to livelihoods). The highest impacts correspond to severe reductions in soil retention in areas where people rely on subsistence farming.



Source: Geneletti, 2013c

Box 28: Precautionary principle in ecosystem services impact assessment

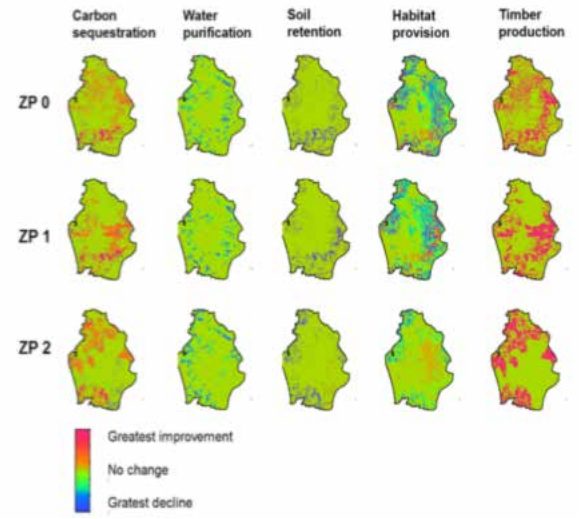
The Rio Declaration (Principle 15) states that "In order to protect the environment, the precautionary approach shall be widely applied by states according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation". According to Treweek et al. (2005), the precautionary principles should be applied particularly for impacts:

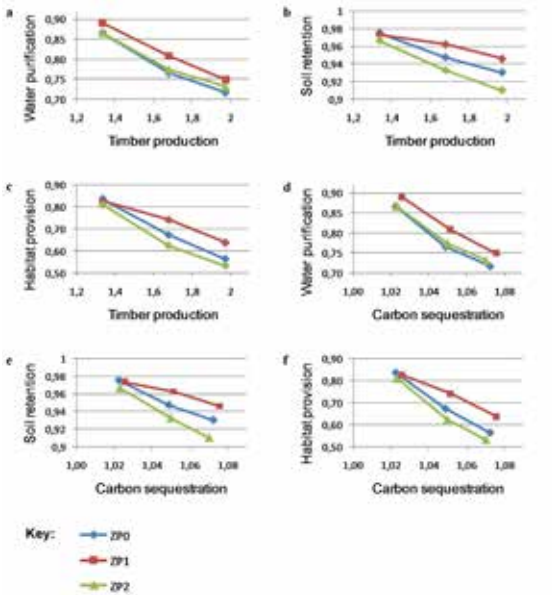
- that cannot be reversed or compensated for;
- that are of considerable or unprecedented intensity, magnitude, scale, extent, duration or frequency;
- that will bring ecosystems near system thresholds or critical points of transition;
- on sensitive, rare, unique or endangered components;
- on critical processes;
- on biodiversity for which there are no proven restoration techniques.

Performing impact prediction and evaluation requires knowledge of the relationship between ecosystems, ecosystem services and human wellbeing, which was gained in Stage 1 and Stage 2. In particular, the baseline and trends analysis **(Task 2.2)** provides the reference against which the performance of different alternatives can be measured (including the "do-nothing" alternative, if meaningful), and the basis for suggesting the alternative(s) that better fit the desirable future conditions that the strategic action is pursuing **(Box 29)**. In principle, the impacts to be addressed are the ones on the priority ecosystem services identified in Stage 2 (see **Box 4.1** and **Box 13**). However, typically the identification of priority services evolves throughout the process, according to changes in the content of the strategic action, and changes in the available knowledge about the biophysical and socio-economic context (including opinions and values of stakeholders and decision-makers). Hence, the identification of priority ecosystem services might need to be updated and revised several times.

Box 29: Comparing the effects of alternative land-use policies on ecosystem services

A case study conducted in The Araucanía (one of Chile's Administrative Regions) empirically assessed how the implementation of different land-use zoning policies will affect the future provision of ecosystem services. Zoning policies give spatial representation to regional development strategies, by specifying where the strategies' objectives are to be achieved and with which uses of land. Land-use scenarios associated to the different policies were generated, by considering different trends for a key driver: the rate of the most important land-use change processes. For each scenario, the provision of a set of ecosystem services (water purification, soil conservation, habitat for species, carbon sequestration and timber production) was modeled, and the results compared. The figures below show the results of the ecosystem service modelling in a spatially-explicit way for a given time horizon (left), and in a non-spatial way through time (right). Key: ZP0 represents the "business-as-usual" conditions; ZP1 and ZP2 are alternative land-use policies; Rate 1 and 2 refer to different rates of land-use change processes.





Source: Geneletti 2013b.

Qualitative and quantitative approaches. Several methods and techniques for impact prediction and evaluation can be used, according to the level of detail of the analysis and the way in which ecosystem services have been characterized in the baseline (e.g. models and quantitative analysis; expert opinion and qualitative descriptions; monetary evaluation; assessment of ecosystem services in their own terms; see Task 2.2). Generally in SEA qualitative impact prediction and evaluation are more common than quantitative ones, due to the inherently high uncertainty levels (in the data, in the way the strategic action will be implemented, in the future trends of key drivers, etc.), the complexity of the decisions, and the need to provide a useful input to decision making, within the time and resources constraints of the planning/policy making exercise. This applies especially to higher-level policies and plans. Less strategic and local-level plans and programmes might call for more quantitative data, especially if they provide for detailed regulations (e.g. a zoning scheme of an urban plan that identifies permitted/prohibited land use changes in each land unit, see example in **Box 29**).

Spatial and non-spatial approaches. Another important distinction is between impact prediction and evaluation methods that aggregate results in space (e.g. averaged over a spatial unit), and methods that provide spatially-explicit results (e.g. disaggregated by watersheds, administrative units, etc.). Whenever possible, the latter methods should be preferred because they offer a better understanding of the complex relationships between areas of ecosystem services production and use **(Box 16)**, and they may help to differentiate impacts by beneficiary groups (e.g. mountain versus lowland villages; wealthy versus disadvantaged neighbourhoods; different municipalities within a region). Spatial approaches are in general computationally more complex and need more data. However, most baseline data related to ecosystem services are typically available in map format, and new software tools are being developed that use relatively simple models with few input requirements **(Box 30)**. Qualitative spatial approaches (e.g. participatory mapping) can be particularly useful to engage stakeholders and communicate results (see **Box 5** and **Box 15**).

Box 30: A tool for integrating spatially-explicit information on ecosystem services in decision-making

The integration of ecosystem services into decisions relies on access to good scientific information showing where ecosystem services are provided and how they will be affected by alternative plans and policies. InVEST (Integrated Valuation of Environmental Services and Trade-offs) is a suite of ecosystem service models developed by the Natural Capital Project to provide such information (Kareiva et al. 2011). InVEST models are based on production functions that define how an ecosystem's structure and function affect the flows and values of ecosystem services. The models account for both service supply and the location and activities of people who benefit from services. Since data are often scarce, InVEST provides for different modelling tiers. The first tier offers relatively simple models with few input requirements. These models are best suited for identifying patterns in the provision and value of ecosystem services. With validation, these models can also provide useful estimates of the magnitude and value of services provided. The other tiers provide more complex, data intensive models for informing policies that require more certainty and specificity in results.

Source: The Natural Capital Project. Available online at www.naturalcapitalproject.org

Cumulative effects. Many problems related to the loss or degradation of ecosystem services result from the cumulative effects of human activities. Cumulative effects are the net impact from a number of different activities and can occur from the following situations (Cooper, 2004):

- Interaction of impacts from proposals and policies within a strategic action affecting the same ecosystem service. For example, proposals to build infrastructures, commercial premises and housing within a short period of time could result in cumulative loss of open space and attractive landscape for recreation. Analogously, a policy to encourage renewable biofuels cultivation and a land consolidation policy could result in a cumulative loss of subsistence cropping.
- Combined impacts of the strategic action with impacts of other actions affecting the same ecosystem service in a particular area. For example, proposals from urban and forest plans could interact and affect the regulation of local climate.

One of the main goals of SEA is the assessment of cumulative effects, given that individual impacts from a single project or development may not be significant on their own, but become significant in combination with other impacts. Hence, SEA cannot be limited to the analysis of individual elements of the strategic action, but needs to also carry out an overall assessment of the future conditions of priority ecosystem services, in the light of all the activities and policies that the strategic action includes **(Figure 7)**. Additionally, other past, present and reasonably foreseeable future actions within space and time boundaries that could contribute to cumulative effects on a given ecosystem service should be considered (Canter and Ross, 2010). The analyses conducted in Task 1.3 **(Box 11)** and Task 2.1 (**Box 4.1** and **Box 16**) help identify interactions that may cause cumulative effects. Cumulative effects can also be positive. For example economic incentives for planting hedgerows and trees in rural areas and policies to promote riverbanks restoration could cumulatively result in better nutrient retention and water filtration.

Figure 7: Example of a matrix to describe the cumulative effects of a strategic action on ecosystem services

Ecosystem service	Elements of the strategic action					Assessment of the cumulative effect
	1	2	3	4	5	
Climate regulation	+	–	+	+	0	Positive
Water filtration	– –	0	0	– –	–	Negative
Soil retention	0	0	0	0	0	No significant effect
Timber production	+	0	–	0	0	No significant effect

Tradeoffs and synergies. The MA demonstrated how actions to enhance the supply of some ecosystem services (typically provisioning services), have led to declines in other ecosystem services (mainly regulating and cultural services) (MA, 2005). SEA needs to explicitly address the interaction among ecosystem services, i.e. the fact that multiple services may respond to the same driver, causing ecosystem service tradeoffs or synergies. Tradeoffs arise when the provision of one service is enhanced at the expense of another service, and synergies arise when multiple services are enhanced simultaneously (Raudsepp-Hearne et al. 2010). Both tradeoffs and synergies "can be managed to either reduce their associated costs to society or enhance landscape multifunctionality and net human wellbeing" (Raudsepp-Hearne et al. 2010). For example, nutrient runoff from agriculture can be reduced by minimizing fertilizer use or maintaining riparian zones, which can be done without causing undue food-production losses. At the same time, enhancing one service, such as improving nutrient retention through the promotion of vegetated riparian zones, can also enhance landscape beauty and water quality, increasing the benefits provided to society (Raudsepp-Hearne et al. 2010). Tradeoffs and synergies can be studied in relation to both the supply of services, and the implications for different groups of beneficiaries (who wins and who loses?)

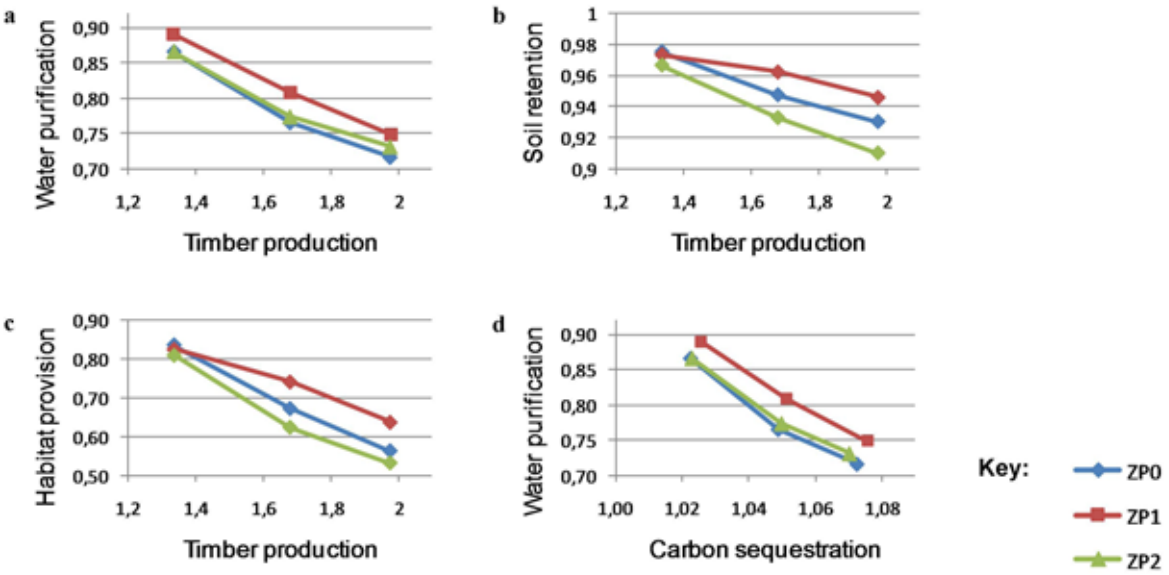
Table 7: Examples of policy decisions that cause ecosystem services tradeoffs in terms of gains and losses to the wellbeing of certain populations

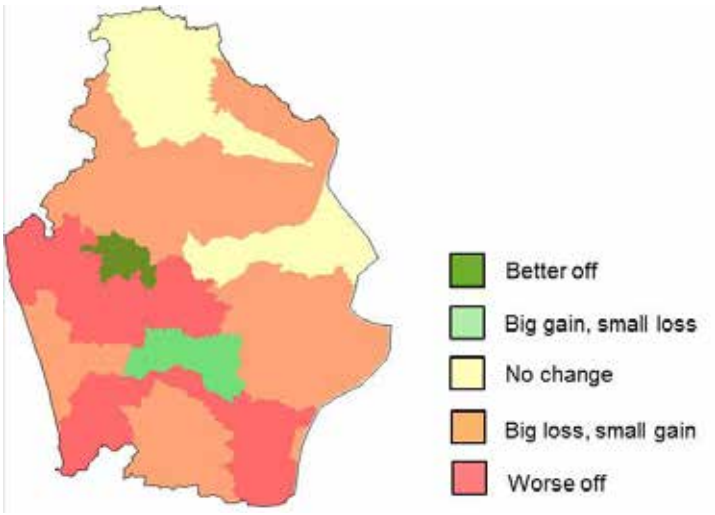
Decision	Goal	Example winners	Ecosystem services decreased	Example losers
Increasing one service at the expense of other services				
Draining wetlands for farming	Increase crops, livestock	Farmers, consumers	Natural hazard regulation, water filtration and treatment	Local communities including farmers 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: Ranganathan et al. 2008.

Box 31: Assessing tradeoffs and synergies in ecosystem services supply and benefits

During the assessment of the effects of different land-use policies on ecosystem services in The Araucanía (see **Box 29**), the analysis of the tradeoffs was conducted at two levels. Firstly, tradeoffs in the supply of services associated to the three policy scenarios (ZP0, ZP1 and ZP2) were assessed. As an example, the figure below (left) shows the tradeoffs between provisioning, and regulating and supporting services (diagrams "a" to "c"), and the tradeoff between regulating services at different scales (diagram "d"). Secondly, the implications for the actual benefits were assessed by combining the analysis of change in ecosystem service supply with spatially-resolved socioeconomic variables that estimate the appropriation of services by people (e.g. population density, livelihood systems, poverty indicators). This allowed representing tradeoffs in the actual benefits from ecosystem services enjoyed by people under the different policy scenarios. As an example, the figure below (right) considers the tradeoff between benefits associated to soil retention and water purification under policy scenario ZP1. The map shows areas where synergy occur and people will be better off (e.g. increased benefits from at least one ecosystem service and no decrease from the other), areas where people will be worse off (vice versa), and areas where people will experience a tradeoff in the benefits they receive (e.g. big loss from one ecosystem service, and small gain from the other. Further categories are possible than the one represented in the figure).





Source: Geneletti, 2013b; 2013c.

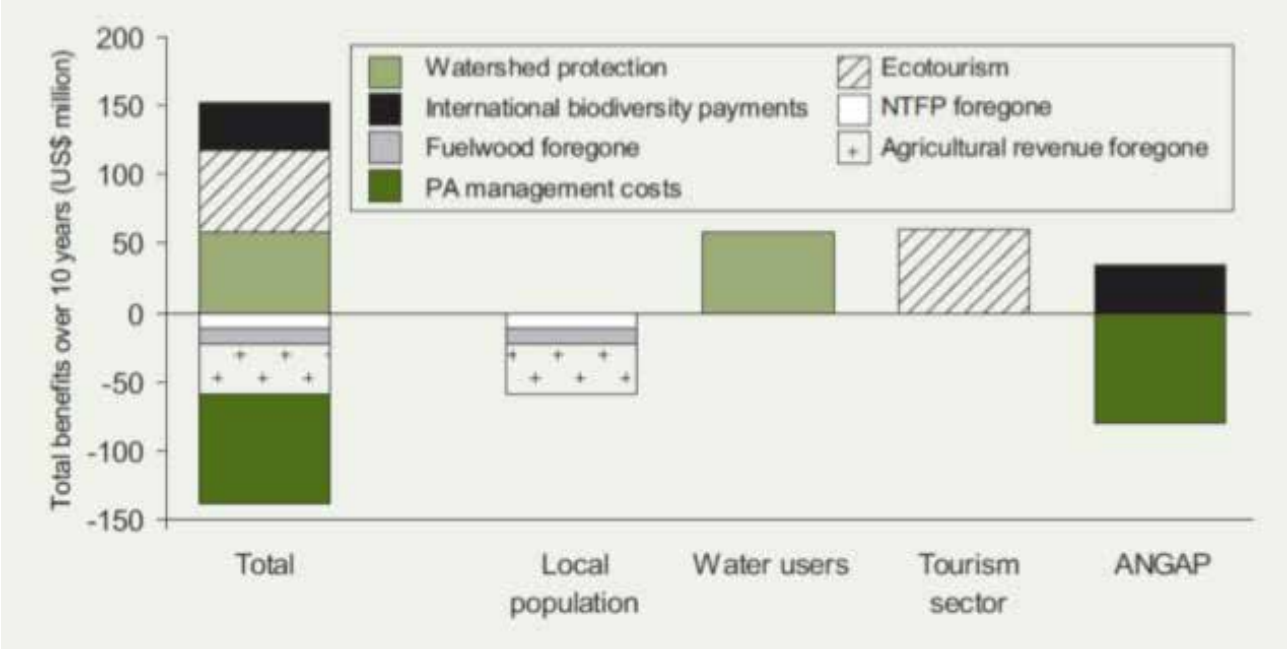
(**Table 7** and **Box 31**).

Equity. Through the analysis of tradeoffs and synergies, SEA can explicitly address equity concerns (which are central to many strategic decisions). The following guiding questions can be useful:

- Have tradeoffs and distributional impacts on different groups and areas been considered, made explicit and adequately addressed in decision making? (intra-generational equity).
- Have temporal tradeoffs and distributional impacts considered, made explicit and adequately addressed in decision-making? (inter-generational equity).

An example of analysis performed to provide an answer to the first question is presented in **Figure 8**. This figure shows the distribution of costs and benefits associated with the protected area system in Madagascar. Protected areas provide net benefits to the country (first column), but the breakdown for different stakeholders groups (remaining four columns) shows that these benefits are unevenly distributed, and that local communities bear the brunt of the cost. As to the second question, most decisions that affect biodiversity and ecosystem services require dealing with impacts over long time horizons and for different generations, and addressing the related ethical considerations. TEEB (2013) discusses the challenges associated to this, particularly when economical valuations of ecosystem services are undertaken.

Figure 8: Distribution of impacts associated with the protected area system in Madagascar for different stakeholders groups



Source: (Pagiola et al. 2004)

Task 3.3: Identify measures to enhance and mitigate impacts

This task aims at suggesting how to enhance positive impacts and opportunities connected to the implementation of the strategic action, and mitigate negative impacts and risks. Enhancement and mitigation measures may include changes to the strategic action (e.g. removal/addition/refinement of elements, such as policies or regulations), as well as guidelines for later decisions. The latter comprise, for example, recommendations for institutional adaptation or new regulations that should be taken on board in subsequent policies or plans and recommendations for project's EIA (e.g. ToR for future EIA of projects affecting a specific area or ecosystem service) (Partidario, 2012).

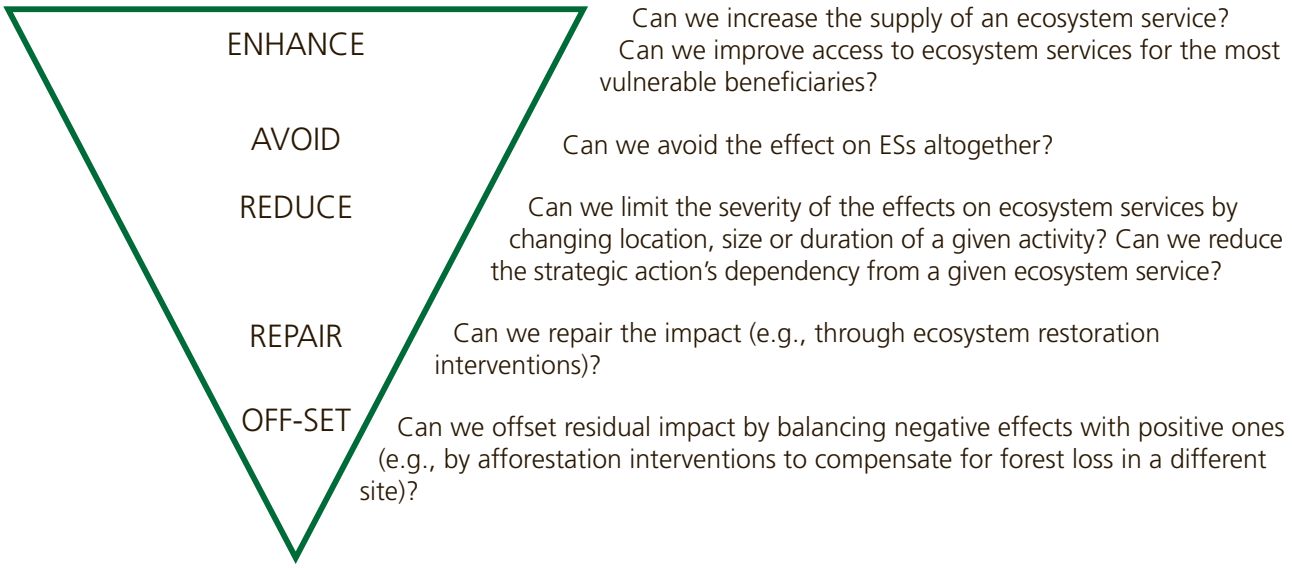
Following the revised mitigation hierarchy proposed by Bond et al. (2013), the SEA should seek measures that, in order of priority **(Figure 9)**:

- Enhance ecosystem services;
- Avoid negative effects on ecosystem services;
- Reduce negative effects;

- Repair negative effects;
- Off-set negative effects (see **Box 32**).

SEA provides for a wide range of possible enhancement and mitigation measures that are different in nature, including: fiscal, regulatory, educational, technical, procedural and spatial measures (Therivel, 2004). **Table 8** provides examples for each type in relation to ecosystem services.

Figure 9: The "mitigation hierarchy" and examples of guiding questions to identify measures for enhancement and mitigation of the strategic action's effects on ecosystem services



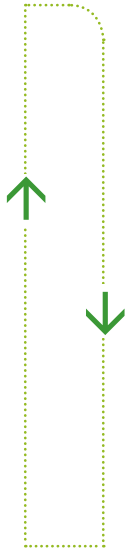
Box 32: The no net loss principle

The no net loss (NNL) principle requires the conservation of the current "stock" of ecosystems and the services they provide, in both qualitative and quantitative terms. It is consistent with the objectives of the Convention on Biological Diversity that aims at conserving and sustainably using biological diversity for the benefit of present and future generations. According to the NNL principle, further losses of ecosystem services are acceptable only if they are offset by adequate restoration, reclamation or mitigation efforts. The principle recognizes that some losses are possible, so long as the overall balance is maintained. However, the implementation of this principle is challenging, particularly given the complex nature of ecosystem services (e.g. does "no net loss" apply only to the supply of ecosystem services or also to the distribution of benefits? Does it allow substitution of an ecosystem service for another that contributes to the same constituent of wellbeing?) One of the most interesting initiatives on NNL of biodiversity and their services is currently being developed by the European Commission, as part of the actions to implement the EU Biodiversity Strategy to 2020. Updates on the EU NNL initiative can be found at http://ec.europa.eu/environment/nature/biodiversity/nnl/.

Table 8: Examples of different types of ecosystem service-related enhancement and mitigation measures that can be considered in SEA

Type of measure	Example
Fiscal	Subsidies and payment for ecosystem services (PES) schemes to promote conservation of vegetation buffers along streams in agricultural landscapes
Regulatory	Regulations prohibiting timber and fuelwood collection in forest areas that play an important role in reducing natural hazard
Educational	Educate farmers to control pollution and erosion by using vegetation strips, wind barriers, etc.
Technical	Requirements for wastewater treatment by reedbeds
Procedural	Compulsory public consultation of minority groups (e.g. indigenous communities) before permission is granted to certain land developments
Spatial	Constraints on permitted land-use changes within watersheds that are critical for water regulation

Iterate!



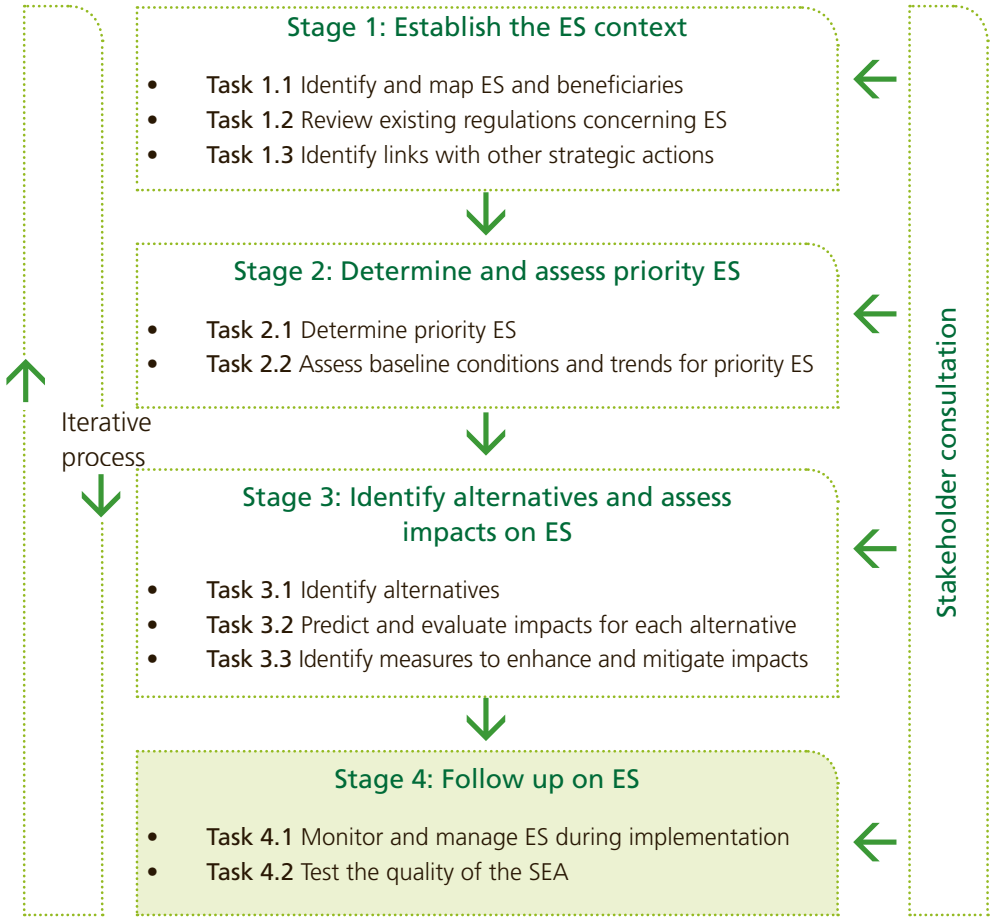
- **Task 3.1** and **Task 3.2** are not necessarily to be undertaken in a strict sequence, but may benefit from feedback and iteration. For example, new alternatives can be identified after having assessed the effects of the ones originally proposed (e.g. by "mix and match" proposed alternatives or combining "the best of all").
- Analogously, the identification of possible enhancement and mitigation measures **(Task 3.3)** may lead to propose new alternatives that benefit more from these measures.
- Interaction with previous stages is commonly required. For example, impact prediction and evaluation can lead to the identification of additional priority ecosystem services **(Stage 2)**. It is common to revise and update to set of priority ecosystem services during the process, giving that some issues might become clearer when the strategic action is more developed, or when additional data become available.
- The results of the impact prediction and evaluation may lead to substantial changes in the strategic action (e.g. revision of the objectives; changes in strategies), which may require reiterating (or updating) the analysis from Stage 1 onwards.

Photo Credit: © University of the West Indies

Stage 4:
Follow up on ecosystem services

This stage begins when all alternatives have been closed, and the strategic action has been approved. Follow up on issues related to ecosystem services entails the following tasks:

- **Task 4.1:** Monitor and manage ecosystem services during implementation
- **Task 4.2:** Test the quality of the SEA



Key messages

Task 4.1: Monitor and manage ecosystem services during implementation

- Collect evidence about contextual changes and actual impacts of the strategic actions on ecosystem services, and evaluate to what extent they differ from predictions.
- Propose management interventions and adjustments to the strategic action early enough to improve its overall performance in terms of ecosystem services.
- Communicate results and involve stakeholders in monitoring, evaluating and managing as appropriate.

Task 4.2: Test the quality of the SEA

- Test the process iteratively, to highlight shortcomings and limitations and propose changes when they can materially be used to improve the strategic action.
- Disseminate lessons learned from quality control checks to improve the future practice of integrating ecosystem services in SEA.

Task 4.1: Monitor and manage ecosystem services during implementation

This task is about ensuring continuity to the SEA process, after the approval of the related strategic action. It aims at understanding the effective progress in the implementation of the action, the actual impacts on ecosystem services, as well as relevant contextual changes. The ultimate purpose is to enable timely intervention and adjustments to the strategic action to address detected problems (e.g. unforeseen impacts, unexpected emerging issues, new policies or legislation, mitigation measures not implemented), and ensure protection and enhancement of ecosystem services. This task has also an important learning objective concerning the actual performance of the SEA with respect to outcomes for ecosystem services.

The task entails the following activities[1] :

- Monitoring: Collecting data about the state and trends of (priority) ecosystem services. A protocol should be established to identify the indicators and describe methods, frequency and responsibility for data collection. The indicators to be used during the follow-up should be consistent with the ones used to inform the previous SEA analyses (e.g. indicators used in Task 2.2), limited in number (to ensure viability of the monitoring system), and ideally easy to measure, interpret and communicate. This activity is also instrumental to filling the gaps in knowledge (e.g. quantification of some ecosystem services) that arose during the SEA, but could not be addressed for lack of time or resources.

- Evaluating: Appraising the conformity of the monitoring results with the expectations formulated during the SEA. Evidence needs to be collected about the actual impacts of the strategic actions on ecosystem services, in order to evaluate to what extent the observed impacts differ from the predictions performed in Stage 3. This activity may require substantial resources if it is not carefully scoped, hence it should be targeted at the most relevant issues only.

- Managing: Providing guidance on what can be done and what actions can be taken in response to issues arising from monitoring and evaluation activities, to ensure adequate protection and enhancement of ecosystem services. The responses should consider also changes in the context that may occur during the implementation of the action, affecting the supply, demand or use of ecosystem services. Changes that may have direct or indirect effects on ecosystem services can be related to the biophysical environment (e.g. climate trends, natural disasters), the social profile (e.g. migration patterns), the socio-economic situation (e.g. shift in livelihood systems), or the legislative and regulatory framework (e.g. designation of new protected areas; land reform policy). **Box 33** provides examples of guiding questions that can be used to detect changes that need to be brought to the attention of the people in charge of implementing or revising the strategic action.

- Communication and participation: Informing stakeholders about the progress of the action, and - where appropriate - involving them in the monitoring, evaluation and/or management activities.

[1] These activities are consistent with the key element of impact assessment "follow-up", as described by Morrison-Saunders and Arts, 2004.

The task should be ongoing for the duration of the implementation of the strategic action, or until such time as no new or unmanaged impacts are in evidence.

Box 33: Useful guiding questions to monitor changes in the ecosystem services context

- Have new formal regulations linked to ecosystems services been approved in the study region (e.g. designated areas, PES schemes)?
- Have other strategic actions or projects been approved or implemented that could affect the supply, demand or use of ecosystem services (e.g. energy policy, agricultural reform, urban plan)?
- Has the demand for a particular priority ecosystem service by stakeholders changed (e.g. due to droughts, change in trade policy, change in access to specific locations)?
- Has the supply of a particular priority ecosystem service changed (e.g. following a natural disaster)?
- Is there new evidence available concerning ecosystem services (e.g. ecosystem maps, economic valuations, surveys on users' needs)?
- Does this new evidence or knowledge suggest changes in the analysis carried out during the SEA (e.g. assessment of baseline conditions and future trends, impact prediction), hence in the final recommendations?

Task 4.2: Test the quality of the SEA

This task aims at checking if the SEA process has been carried out well, with respect to consideration of ecosystem services. Being the process that matters, and not so much the content of the SEA report, it is recommended to perform this analysis throughout the SEA, rather than only at the end of it. In this way, shortcomings and limitations can be highlighted, and integration proposed in a stage where they can materially be used to improve the strategic action under consideration. The lessons learned from quality control checks are also beneficial for future applications and can be used to improve the practice of integrating ecosystem services into SEA. This is currently a very important issue, given the lack of experiences and case studies in this field. **Box 34** provides a set of guiding questions that can be used to check the quality of the SEA, with specific reference to the generation and use of information of ecosystem services. Also this task has an important learning objective, specifically about the efficacy of SEA processes: by understanding and testing the quality of a SEA, the idea is to ensure that mistakes and weaknesses are not repeated in future practice whilst positive elements are repeated and enhanced.

Photo Credit: © Miguel Vieira

Box 34: Useful guiding questions to test the quality of SEA in terms of consideration of ecosystem services

Influence of SEA on the strategic action process and content

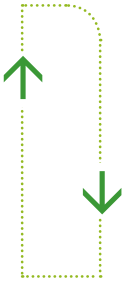
- Was the information on ecosystem services provided by the SEA process adequate and useful from the point of view of both decision-makers and stakeholders?
- Has there been effective cooperation on ecosystem services issues between the SEA team and those responsible for developing the strategic action?
- Was there effective stakeholder involvement on issues relevant to ecosystem services?
- Did the SEA lead to measures and outcomes that better reflect ecosystem services in the planning/policy-making process?
- Did the SEA succeed in integrating into the strategic action operational measures (e.g. budget allocation) for dealing with risks of depleting ecosystem services?
- What were the main strengths and weaknesses of the SEA process (in terms of availability of data on ecosystem services, analysis of ecosystem services relevance, stakeholder involvement, etc.)?
- Did the SEA improve the capacities of decision-makers and stakeholders to manage ecosystem services?
- Did the SEA enhance the transparency and accountability of the strategic-action decisions related to ecosystem services?
- Did the strategic action contribute to verifiable progress on ecosystem services protection/enhancement?

Content of the SEA analysis

- Did the SEA identify priority issues for ecosystem services, rather than all potentially significant issues?
- Have the substantial objectives related to ecosystem services conservation/enhancement been identified and described?
- Did the SEA identify and describe any conflicts that exist between these objectives and the strategic action?
- Did the SEA take into account alternative options, based on the way these alternatives affect ecosystem services?
- Did the SEA provide useful information on ecosystem service -related risks/opportunities related to the strategic action, and on mitigation measures/adaptive strategies that could be adopted?
- Were the impacts, and the methodologies for assessing impacts, on ecosystem services clearly described?

Source: Modified after OECD, 2006 and OECD, 2008.

Iterate!



- Well-planned and implemented follow-up activities make the SEA process cyclical, providing continuous feedback to planning/policy making.
- Monitoring data collected through **Task 4.1** (including public surveys or hearings) can contribute to fill the information gaps detected during the previous stages, allowing to update and improve the relevant analysis.
- The results of the quality control **(Task 4.2)** can be used to identify shortcomings and limitations affecting the SEA process, and to suggest possible correction and revision that may require reiterating previous tasks.

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Conclusion

This guide proposes an innovative approach for SEA to clarify the potential impacts of strategic decisions on the state of ecosystems and their services, so as to avoid unintended negative consequences and seize opportunities for improvement. The examples and case studies presented in the different tasks of the approach aim to provide a variety of resource material that can be used and adapted in different contexts, and for different types of strategic decisions and SEA processes.

The integration of ecosystem services has various benefits in terms of contributing to better design of policies and plans, but there are also critical issues that need to be recognized, such as the complexity of appropriately evaluating ecosystem services, and the lack of well-established indicators and assessing methods. These issues can be addressed by learning from the pilot applications and case studies that are being carried out around the world, as well as by taking advantage of the data, tools, and methods for ecosystem service representation and modelling that are becoming increasingly available in the scientific (and grey) literature.

Practitioners are faced with the challenge of including ecosystem services and showing their added value to decision-making, within the time and resource constraints of real-life planning and policy-making processes. Hopefully, the content of this guide will encourage and inspire practitioners to become committed to ensuring that ecosystem services are effectively addressed in the SEAs that they become involved with in the future. The proposed approach can be further improved as the wealth of experience increases. This guide is thus designed as a working document, with a view to encouraging feedback from practitioners to inform subsequent revision and strengthening of its content.

Annex I

Comparison between the classification of ecosystem services in the MA, TEEB and CICES systems

MA categories	TEEB categories		CICES (v4.3) groups[2]
Food (fodder)	**Food**	**Provisioning services**	Biomass [Nutrition]
			Biomass (Materials from plants, algae and animals for agricultural use)
Freshwater	**Water**		Water (for drinking purposes) [Nutrition]
			Water (for non-drinking purposes) [Materials]
Fibre, timber	Raw Materials		Biomass (fibres and other materials from plants, algae and animals for direct use and processing)
Genetic resources	Genetic resources		Biomass (genetic materials from all biota)
Biochemicals	Medicinal resources		Biomass (fibres and other materials from plants, algae and animals for direct use and processing)
Ornamental resources	**Ornamental resources**		Biomass (fibres and other materials from plants, algae and animals for direct use and processing)
			Biomass based energy sources
			Mechanical energy (animal based)
Air quality regulation	Air quality regulation	**Regulating services (TEEB) Regulating and supporting services (MA) Regulating and maintenance services (CICES**	[Mediation of] gaseous/air flows
Water purification and water treatment	**Waste treatment (water purification)**		Mediation [of waste, toxics and other nuisances] by biota
			Mediation [of waste, toxics and other nuisances] by ecosystems
Water regulation	Regulation of water flows		**[Mediation of] liquid flows**
	Moderation of extreme events		
Erosion regulation	Erosion prevention		[Mediation of] mass flows
Climate regulation	Climate regulation		Atmospheric composition and climate regulation
Soil formation	Maintenance of soil fertility		Soil formation and composition
Pollination	Pollination		Lifecycle maintenance, habitat and gene pool protection
Pest regulation	**Biological control**		Pest and disease control
Disease regulation			
Primary production Nutrient cycling (supporting services)	**Maintenance of life cycles of migratory species (incl. nursery service)**		Lifecycle maintenance, habitat and gene pool protection
			Soil formation and composition
			[Maintenance of] water conditions
	Maintenance of genetic diversity (especially in gene pool protection)		Lifecycle maintenance, habitat and gene pool protection
Spiritual and religious values	Spiritual experience	**Cultural services**	Spiritual and/or emblematic
Aesthetic values	Aesthetic information		Intellectual and representational interactions
Cultural diversity	**Inspiration for culture, art and design**		Intellectual and representational interactions
			Spiritual and/or emblematic
Recreation and ecotourism	Recreation and tourism		Physical and experiential interactions
Knowledge systems and educational values	**Information for cognitive development**		Intellectual and representational interactions

Source: Maes et al. 2013

[2] Explanatory information from CICES division level [between squared brackets] and from CICES class level (between parentheses).

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