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STRATEGIC ENVIRONMENTAL ASSESSMENT AND ECOSYSTEM SERVICES

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Preface

This is one in a series of Advisory Notes that supplement the *OECD DAC Strategic Environmental Assessment (SEA) in Development Practice: A Review of Recent Experience (2010).* The 2010 review provides a comprehensive overview of major SEA activities in developing countries and serves as a monitoring report of 2006 OECD DAC Guidance on Applying Strategic Environmental Assessment.

The Advisory Notes are not intended to provide exhaustive, in-depth guidance but rather supplementary advice and links to resources where more specialised information can be found.

Therefore, these Advisory Notes fall into one or more of the following categories.

1. applying SEA in particular situations or circumstances that will require unique sensitivity and awareness (*e.g.* post-conflict environments);
2. providing further perspective, information and guidance on emerging issues that may need to be more adequately integrated into an SEA. (*e.g.* climate risk or ecosystem services);
3. undertaking an SEA that focuses specifically on a key emerging issue or policy area that was not sufficiently addressed when the DAC SEA Guidance was prepared (*e.g.* biofuel development strategies, post-conflict reconstruction plans).

The target audience of the Advisory Notes are SEA practitioners (to help strengthen the quality of SEA) and specialists in the specific issues or circumstances under consideration (to introduce them to the added value of SEA to their work).

This specific Advisory Note discusses how to integrate the consideration of ecosystem services into SEAs of policies, plans and programmes (PPPs) at various levels. Furthermore, this Advisory Note is one of the SEA Advisory Note series focusing on providing thematic application of SEA. Other notes are available in the following topics:

- SEA and Adaptation to Climate Change
- SEA and Disaster Risk Reduction
- SEA and Post-Conflict Development

Strategic Environmental Assessment and Introduction and Ecosystem Services

1. Introduction

Ending poverty is the prime objective of the Millennium Development Goals (MDGs) and the overarching challenge for international development co-operation. Meeting the other MDGs, including 'ensuring environmental sustainability' (MDG 7), are essential to ensure the successful elimination of poverty. The environment matters greatly to the world's poor, especially to the rural poor who depend directly on natural resources and ecosystems for their livelihood. But too often the programmes and activities of donor agencies and their partners still do not give this critical linkage sufficient weight or emphasis. The Poverty-Environment Partnership[1] considers little progress has been made towards the goal of environmental sustainability, although this is seen as the foundation on which strategies for achieving all other MDGs must be built.

The UN Millennium Ecosystem Assessment (MEA) (2005)[2] found that the worldwide loss and degradation of ecosystem goods and services presents a serious threat to achieving development goals. In some forms, these effects concern everyone but they affect the rural poor hardest, undermining their primary and often only means of livelihood. Ecosystems are 'the wealth of the poor', and tapping their flow of goods and services on a sustainable basis is now recognised as a 'stepping stone that can move poor people beyond mere subsistence' (WRI, UNDP, UNEP and World Bank, 2005). Given their importance, the systematic evaluation of natural assets is a key to integrate the environment into strategies for poverty reduction, sustainable livelihoods and community-based development.

SEA is an important policy tool for this purpose. It is increasingly used by international development co-operation agencies and partner governments to evaluate the potential impact of strategic proposals and options. *OECD DAC Guidance on SEA* (2006) describes it as the family of approaches that can be flexibly applied and adapted to different policy and institutional contexts, including poverty alleviation. A recent supplement describes how SEA is particularly suited to address key linkages between ecosystem services and development policies and strategies (OECD DAC 2008). This initiative is an important step towards redressing the apparent neglect of MDG 7, and aligns it more firmly with the other MDGs. This Advisory Note describes how SEA can be used to analyse and reflect ecosystem services in support of sustainable development and poverty reduction.

What are ecosystem services?

Ecosystem services are the benefits people obtain from ecosystems (examples are listed in Table 1). Some of these, such as the provisioning services (or goods) like food, timber and fresh water, are well-known and routinely included in assessments. Others, such as the regulating services of carbon storage and sequestration, watershed protection, storm protection, pollination, or the cultural services of recreation and spiritual values, are often overlooked in policies, plans and programmes (PPP) preparation because they are not traded in the market and internalized in traditional cost-benefit analyses.

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1 The Poverty Environment Partnership (PEP) was established in 2002 as an informal network of donor agencies, multilaterals and some research-focused international NGOs which is attempting to mainstream environment in development aid, in support of national and sector development planning in developing countries (see http://www.pvertyenvironment.net/pep/)

2 The Millennium Ecosystem Assessment involved more than 1 360 experts worldwide. Their findings provide a state-of-the-art scientific appraisal of the condition and trends in the world's ecosystems and the services they provide and options for sustaining ecosystem services.

Table 1. Definitions of ecosystem services

(Adapted from WRI, 2008a)

Service	Subcategory	Definition	Examples
Provisioning services: The goods or products obtained from ecosystems such as food, timber and fiber.			
Food	Crops	Cultivated plants or agricultural produce that are harvested by people for human or animal consumption as food	· Grains · Vegetables · Fruit
	Livestock	Animals raised for domestic or commercial consumption or use	· Chicken · Pigs · Cattle
	Capture fisheries	Wild fish captured through trawling and other nonfarming methods	· Cod · Crabs · Tuna
	Aquaculture	Fish, shellfish, and/or plants that are bred and reared in ponds, enclosures, and other forms of freshwater or saltwater confinement for purposes of harvesting	· Shrimp · Oysters · Salmon
	Wild foods	Edible plant and animal species gathered or captured in the wild	· Fruit and nuts · Fungi · Bushmeat
Fiber	Timber and other wood fiber	Products made from trees harvested from natural forest ecosystems, plantations, or nonforested lands	· Industrial roundwood · Wood pulp · Paper
	Other fibers (*e.g.*, cotton, hemp, silk)	Nonwood and nonfuel fibers extracted from the natural environment for a variety of uses	· Textiles (clothing, linen, accessories) · Cordage (twine, rope)
Biomass fuel (wood fuel)		Biological material derived from living or recently living organisms—both plant and animal—that serves as a source of energy	· Fuelwood and charcoal · Grain for ethanol production · Dung
Freshwater		Inland bodies of water, groundwater, rainwater, and surface waters for household, industrial, and agricultural uses	· Freshwater for drinking, cleaning, cooling, industrial processes, electricity generation, or mode of transportation
Genetic resources		Genes and genetic information used for animal breeding, plant improvement, and biotechnology	· Genes used to increase crop resistance
Biochemicals, natural medicines, and pharmaceuticals		Medicines, biocides, food additives, and other biological materials derived from ecosystems for commercial or domestic use	· Echinacea, ginseng, garlic · Paclitaxel as basis for cancer drugs · Tree extracts used for pest control
Regulating services including supporting services: Regulating services are the benefits obtained from an ecosystem's control of natural processes such as climate, disease, erosion, water flows, and pollination, as well as protection from natural hazards. Regulating services normally include also Supporting services, i.e. the natural processes such as nutrient cycling and primary production that maintain the other services.			
Air quality regulation		Influence ecosystems have on air quality by emitting chemicals to the atmosphere (i.e., serving as a "source") or extracting chemicals from the atmosphere (i.e., serving as a "sink").	· Lakes serve as a sink for industrial emissions of sulfur compounds · Vegetation fires emit particulates, ground-level ozone, and volatile organic compounds
Climate regulation	Global	Influence ecosystems have on global climate by emitting greenhouse gases or aerosols to the atmosphere or by absorbing greenhouse gases or aerosols from the atmosphere	· Forests capture and store carbon dioxide · Cattle and rice paddies emit methane
	Regional and local	Influence ecosystems have on local or regional temperature, precipitation, and other climatic factors	· Forests can impact regional rainfall levels · Lakes regulate humidity levels and influence frequency of frosts, important for agriculture
	Carbon sequestra-tion	The extraction of carbon dioxide from the atmosphere serving as a sink	· Expanding areas of boreal forests, increases the sink · Deforestation in the tropics, decreases the sink · Ocean carbon sequestration

Service	Subcategory	Definition	Examples
Water regulation		Influence ecosystems have on the timing and magnitude of water runoff, flooding, and aquifer recharge, particularly in terms of the water storage potential of the ecosystem or landscape	- Permeable soil facilitates aquifer recharge - River floodplains and wetlands retain water—which can decrease flooding during runoff peaks—reducing the need for engineered flood control infrastructure
Erosion regulation		Role vegetative cover plays in soil retention	- Vegetation such as grass and trees prevents soil loss due to wind and rain and siltation of waterways - Forests on slopes hold soil in place, thereby preventing landslides
Water purification and waste treatment		Role ecosystems play in the filtration and decomposition of organic wastes and pollutants in water; assimilation and detoxification of compounds through soil and subsoil processes	- Wetlands remove harmful pollutants from water by trapping metals and organic materials - Soil microbes degrade organic waste, rendering it less harmful
Disease regulation		Influence that ecosystems have on the incidence and abundance of human pathogens	- Some intact forests reduce the occurrence of standing water—a breeding area for mosquitoes—which lowers the prevalence of malaria
Pest regulation		Influence ecosystems have on the prevalence of crop and livestock pests and diseases	- Predators from nearby forests—such as bats, toads, and snakes—consume crop pests
Pollination		Role ecosystems play in transferring pollen from male to female flower parts	- Bees from nearby forests pollinate crops
Natural hazard regulation		Capacity for ecosystems to reduce the damage caused by natural disasters such as hurricanes and to maintain natural fire frequency and intensity	- Mangrove forests and coral reefs protect coastlines from storm surges - Biological decomposition processes reduce potential fuel for wildfires
Nutrient cycling		Role ecosystems play in the flow and recycling of nutrients (*e.g.*, nitrogen, sulfur, phosphorus, carbon) through processes such as decomposition and/or absorption	· Decomposition of organic matter contributes to soil fertility
Cultural services: The nonmaterial benefits obtained from ecosystems such as recreation, spiritual values, and aesthetic enjoyment.			
Recreation and ecotourism		Recreational pleasure people derive from natural or cultivated ecosystems	- Hiking, camping, and bird watching - Going on safari
Spiritual, religious and ethical values		Spiritual, religious, aesthetic, intrinsic, "existence," or other values people attach to ecosystems, landscapes, or species	- Spiritual fulfilment derived from sacred lands and rivers - Belief that all species are worth protecting regardless of their utility to people—"biodiversity for biodiversity's sake"
Aesthetic values		The beauty and aesthetic values of nature in all its appearances.	- Beauty of nature, from a molecule to a flower to a forest

Degrading ecosystem services are impacting development

Global degradation of ecosystem services is increasingly jeopardizing development goals. The MEA (Box 1) found that, of twenty-four ecosystem services evaluated globally[3], fifteen are degraded and only four have been enhanced. The MEA concluded that degradation of these services presents a significant barrier to achieving development goals, including the MDGs.[4] Degradation can also be the principal factor causing poverty and social conflicts and will likely become significantly worse over the next fifty years. Changes in climate also impact on biological diversity and thereby an ecosystem's ability to deliver services for human well being. Moreover, ecosystem services play a central role in both adaptation (*e.g.* mangrove forests protect coastal zones against weather-related catastrophes) and mitigation (*e.g.* reducing deforestation is a cost-effective way of reducing carbon dioxide emissions) of climate change.[5]

Box 1. **The Millennium Ecosystem Assessment (MEA)**

The MEA framework (Figure 1) distinguishes between direct and indirect drivers of change and their respective impacts on ecosystem services, human well being and poverty reduction. The framework increases our ability to identify, map, measure, and value the benefits provided by ecosystems. It links the condition of ecosystems to human well being and can help to show how achieving a PPP depends on ecosystem services and identify how a PPP affects them. Using the framework helps to address the risks and opportunities related to ecosystem services and to identify groups of people who rely on these services. Furthermore, the MEA framework can identify ecosystem service trade -offs in decision-making and help target responses by the most effective level of governance (local to global). Both MEA and SEA incorporate formal scientific information and traditional or local knowledge and use similar tools such as indicators and environmental systems models. They both assess the use and effectiveness of a range of options for responding to the need to sustainably use, conserve and restore ecosystems and the services they provide.

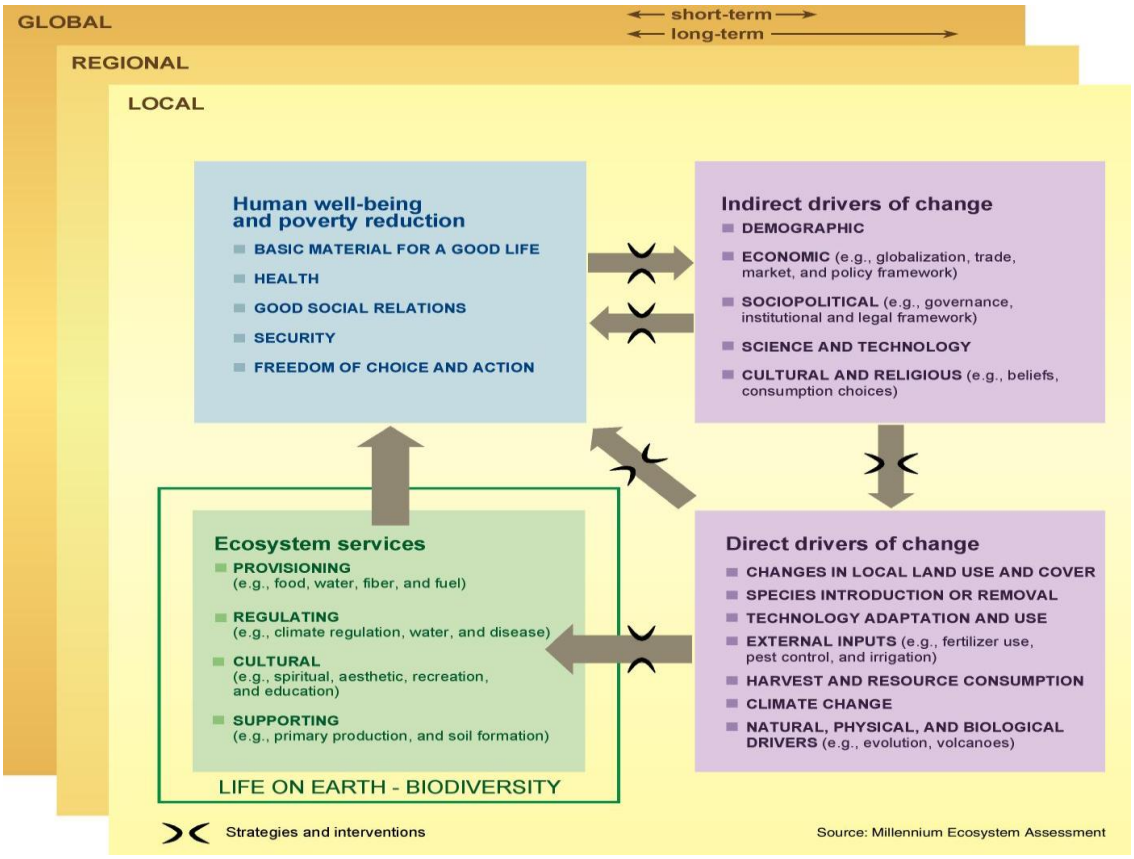
The framework also distinguishes between different spatial and temporal scales short term (days, weeks or months), medium term (months to years) and long- term (decades to centuries). Spatial scales may be local, national, regional, or global.

3 Supporting services, such as soil formation, photosynthesis, and nutrient cycling, were not assessed directly by MA since they are not directly used by people.

4 Recently, under MDG Goal 7 to Ensure environmental sustainability, a new target has been endorsed "Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss" in accordance with decisions under World Summit on Sustainable Development (WSSD) and the Convention on Biological Diversity (CBD). The importance of biodiversity for maintaining a resilient ecosystem, that can deliver ecosystem services for human well-being, is generally considered to be high.

5 See also Advisory Note on SEA and Adaptation to Climate Change.

Figure 1. The MEA conceptual framework



Source: Millennium Ecosystem Assessment (2005).

Box 2 describes a case of using the MEA framework for ecosystem assessment in Rwanda.

Box 2. The Pilot integrated ecosystem assessment of Bugesera, Rwanda

In Rwanda, the UNEP-UNDP Poverty-Environment Initiative (PEI) supported a pilot integrated ecosystem assessment (IEA) in Bugeresa region in 2006. It was conducted as part of building capacity to mainstream environment into the national development framework, principally the Economic Development and Poverty Reduction Strategy. The government commissioned the IEA to deepen understanding of the complex links between poverty, human well being and environment.

The Bugesera region, once one of the main food producing areas, has faced chronic food insecurity since 1999, due mainly to unpredictable rainfall and prolonged drought. The ecosystems' capacity to produce a range of food has changed, triggering changing consumption patterns and livelihood strategies.

The approaches and methods used for the IEA were based on the MEA framework (Figure 1). It entailed in-depth interviews and discussions with stakeholders, household surveys, literature reviews as well as geographic information systems and spatial data analysis. The main focus was on three core ecosystem services (food, water and fuel wood/energy) identified during the national stakeholders workshop and through ranking by local stakeholders. The IEA showed that land fragmentation has made it difficult to use modern farming techniques (such as mechanisation), leading to sub-optimal production.

Source: IEA report available at *http://www.unpei.org/PDF/Bugesera-Rwanda.pdf.*

Managing ecosystem to fight poverty: how can SEA help

The case for linking poverty reduction and environmental sustainability in international development co-operation is not new. For example, the MDGs and strategic policy actions to realise 'win-win' opportunities in integrating poverty and environment were identified in joint report to the World Summit on Sustainable Development (WSSD) from UK Department for International Development (DFID), European Commission Directorate General for Development (EC/DGD), United Nations Development Programme (UNDP) and World Bank (DFID et al 2002). However, progress has been slower than many hoped at the time of the WSSD and renewed calls have been made for integrated, cross-sectoral approaches and tools to put environmental sustainability at the heart of development programmes and poverty reduction strategies.

SEA is well positioned to help mainstream environmental sustainability across the full range of pro-poor and other international development policies and programs that are implemented by donor agencies. SEA is widely used already for this purpose. The reach and value of SEA is magnified through the lens of the MEA framework, which relates ecosystem conditions to human well-being and change agents that affect both (see Figure 1). Some ecosystem services, notably provision of environmental goods, are well-known and routinely included in SEA already, *e.g.* the impact of development proposals on forest or fishery resources that are harvested commercially or used by local communities. Impacts on regulating or cultural services, such as loss of wetlands that provide flood protection or damage to areas of spiritual value, also have been addressed in SEA, particularly when they increase the vulnerability of poor or indigenous peoples. But, to date, many other ecosystem services have been either overlooked or discounted in value in traditional and pro-poor development planning and SEA analysis.

The MEA findings make it very clear why a complete assessment and accounting of the impacts and losses to all categories of ecosystem services is important, particularly for the poor who are dependent on them and disproportionately harmed by their loss and degradation. As suggested in Figure 1, key elements of this framework can be used to organise information collection, analysis and synthesis of potentially significant environmental risks and opportunities of development and poverty reduction strategies that are subject to SEA. Specifically, this process can be applied to identify the potential impacts of proposed interventions on ecosystem services and on the people who use and depend on them, thereby clarifying key trade–offs and their implications for undermining or supporting MDG 7.[6] In doing so, SEA provides a means to integrate the criteria for 'managing ecosystems to fight poverty' into development co-operation decision making, proposal by proposal.

Equally, the focus on ecosystem services can bolster the potential of SEA as an instrument for environmental sustainability assurance, i.e. applied to safeguard critical resources and ecological functions under conditions of uncertainty or limited understanding of the likely effects of development and poverty reduction strategies.[7] Some additional, risk-oriented concepts and decision-support tools that can be used to aid this approach are shown in Figures 2 and 3. Figure 2 highlights four main categories of ecosystem services and three classes of ecosystem risks, reflecting different functional conditions. A coding scheme

6 MDG Goal 7, to ensure environmental sustainability, has three targets: "Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources; Halve by 2015 the number of people without sustainable access to safe drinking water and basic sanitation; and Have achieved by 2020 a significant improvement in the lives of at least 100 million slum dwellers" (United Nations, 2000). Additional targets for maintaining biodiversity and fisheries, which augment the call to reverse the loss of environmental resources, were endorsed in the WSSD Plan of Implementation; e.g. achieve, by 2010, a significant reduction in the current rate of loss of biodiversity (paragraph 44).

7 Environmental sustainability assurance (ESA) means that the critical resources and ecological functions must be safeguarded; it requires depletion and deterioration of sources and sinks to be kept within acceptable levels or 'safe margins' and any significant loss or deterioration of natural capital must be made good through an appropriate form of 'impact compensation' or offset for residual damages (*i.e.* which cannot be otherwise mitigated) (Sadler, 1999).

(different colour warning signs) is superimposed on this matrix to flag the levels of relative risk associated with given conditions (which may be read as a statement of sustainability) and the potential consequences of continuing loss or deterioration of their capacity to support human needs and development goals (*e.g.* as a result of adverse impacts of proposed development policies or plans).

In cases where the environmental effects of development proposals are potentially serious or irreversible, there is a clear obligation under international law and policy to consider the implications for future generations.[8] Figure 3 identifies the implication on decision making, SEA application and the use of a precautionary approach under different risk weightings. When there are warning signs of serious degradation of an ecosystem that supports subsistence livelihoods, development decision making should be subject to strict application of the precautionary principle, rigorous assessment and a stringent level of environmental due diligence. These standards may be correspondingly relaxed when the risks of significant or irreversible loss of ecosystem services and benefits associated with development plans or programs are relatively moderate or low and margins of are greater.

Figure 2. Risk matrix for screening impacts on ecosystem services

Ecosystem Service	Enhanced / Low Risk	Mixed / Moderate Risk	Degraded / High Risk
Provision - the goods or products obtained from ecosystems, such as food, water, timber and fiber			
Regulation - the benefits obtained from the regulation of ecosystem processes, such as climate, flood, disease, waste and water quality			
Culture - the nonmaterial benefits people obtained from the regulation of ecosystem processes, such as recreational, aesthetic and spiritual benefits			
Support - the process such as photosynthesis and nutrient cycling that are necessary for production of all other benefits			

Source: Adapted from MEA (2005), colour codes and risk categories are added to the original version.

For all risk weightings, SEA of development co-operation policies and plans should be applied to identify the positive as well as adverse impact on ecosystem services, *e.g.* opportunities for resource conservation or restoration that support sustainable livelihoods or increase the environmental income of the poor. Many development co-operation agencies focus their actions on securing sustainable livelihoods, particularly for the poorest and most vulnerable people. Sustainable livelihoods encompass the range of means by which the rural poor provide for themselves, materially and culturally, without undermining the natural resource base on which they critically depend. In this context, SEA provides an important diagnostic and planning tool that can link development impacts on ecosystem services and the livelihood goals of the poor; for example by identifying natural assets, community strengths and vulnerabilities and the governance institutions and policies that constrain or assist natural resource access, use and management.

[8] In this context, the Rio Declaration on Environment and Development (1992) is frequently cited, notably in Principle 15: "In order to protect the environment, the precautionary approach shall be widely applied by States. Where there are threats of a serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental damage. This principle also finds expression in many other international agreements and development co-operation policies

.Figure 3. Risk weighted strategy for environmental sustainability assurance

Decision Instruments	Low Risk	Moderate Risk	High Risk
Environmental Management	Subject to existing policies, standards and procedures	Subject to established framework plus SEA terms and conditions	Subject to stringent due diligence to prevent significant hard or loss
SEA Focus and Approach	Routine, apply in compliance with requirements to ensure environmental considerations are taken into account	Appropriate, apply in accordance with good practice guidance to establish safeguards and measures to maintain or enhance resource potentials / opportunities	Rigorous (fail safe), apply in accordance with no net loss (strong sustainability) criteria to safeguard critical ecosystem services and keep natural capital intact
Use of Precautionary Principle	Weak version, use to integrate environment into development and poverty reduction strategies	Moderate version, use to ensure safe margins and offsets for residual losses and damages	Strict version, use to avoid significant adverse impacts on critical or irreplaceable resources

Source: Adapted from Sadler, B. (2006).

2. Key considerations and checklists for integrating ecosystem services in SEA

Table 2 indicates possible links to ecosystem services for each of the SEA entry points listed in the OECD DAC SEA Guidance (see Box A1.1 in Annex 1). Stakeholders that are dependent on the ecosystem services should be identified and engaged in the decision making process for all key entry points. The main connecting points between SEA and ecosystem services are:

- The activities resulting from a PPP have direct biophysical consequences: connection is provided by direct drivers of change, applies to *e.g.* sectoral PPPs.
- A PPP starts with a spatial focus: a geographically known area provides knowledge on opportunities and constraints with respect to ecosystem services, and allows for identification of sensitivity to specific drivers of change.
- A PPP results in indirect drivers of change: results in a more complex linking to ecosystem services through economic and societal processes, *e.g.* applies to policies having an influence on economy, consumption and trade patterns and behaviour of people, etc.

Table 2. Linking ecosystem services with key SEA entry points

Key entry points	Possible ecosystem services perspective
(A) SEAs led by partner country governments	
National overarching strategies, programmes and plans, policy reforms and budget support programmes Lead Authorities: National Government and Cross-Sector Ministries (*e.g.* Ministry of Finance/Planning)	• May affect ecosystem services predominantly through ***indirect drivers of change*** (see Figure 1 for examples). • Ecosystem services underpin development, but may also be affected, intentionally or unintentionally by development policies. • Sustaining ecosystem services may require specific investments in management and monitoring through national and local budgets. • National plans (such as a Poverty Reduction Strategy) should consider/map ecosystem services dependency. • National programmes should consider their impacts on ecosystem services and how this may affect other development goals.
National sectoral policies, plans or programmes, *e.g.* energy or health sector reform Lead Authorities: Sector or Line Ministries (*e.g.* Mining, Health or Agriculture)	• May affect ecosystem services through ***direct drivers of change*** where it concerns physical interventions, or through indirect drivers where a policy may affect the way in which society consumes, depends on, or makes use of ecosystem services (see fig 1 for examples). • Ecosystem services underpin development, but may also be affected, intentionally or unintentionally, by PPPs. Sector PPPs should consider how their impact on ecosystem services may affect goals of other sectors.
Infrastructure investments plans and programmes Lead Authorities: Ministries of Transport, Energy, Water, Sanitation	• Infrastructure investment affects ecosystems through ***direct drivers of change***, and may thus impact on ecosystem services in the area under influence of these drivers (*e.g.* downstream in a watershed, or in a zone of influence along linear infrastructure). • The planning process eventually results in a choice of location(s) or alternatives, thus providing a detailed view on affected ecosystem services at these locations, and potentially affected beneficiaries of these services.
National and sub-national spatial development plans and programmes Lead Authorities: Sub National, Regional and Local Governments	• Spatial planning affects geographically- defined areas. An assessment of ecosystem services such areas, including their social, economic and ecological importance, can inform the planning process about development opportunities and constraints. It can also provide an overview of sensitive areas to specific drivers of change.
Trans-national plans and programmes Lead Authorities: International/ Transboundary Agencies	• All of the above may apply. • The cross-boundary character of many ecosystems and their services (watersheds, groundwater aquifers, climate regulation, etc.) makes the ecosystem services approach particularly useful for transboundary plans. • Attention needs to be paid to differences in legal regulations, institutional arrangements and monitoring systems with respect to ecosystems and their services.

Key entry points	Possible ecosystem services perspective
(B) SEAs undertaken in relation to donor's own processes	
Donors' Country assistance strategies and plans Lead Authorities: International (multilateral and bilateral) Development Agencies	• Focus on: (a) the role of ecosystem services in supporting human well being in the country; (b) ecosystem services which the poor depend on for well-being and livelihoods (with their participation); (c) existing drivers of change and expected future trends; and (d) decide with stakeholders what measures to take as a result of such analysis.
Donors' partnership agreements with other agencies Lead Authorities: As above.	• Create procedural guarantees so that ecosystem services and their stakeholders will be taken into account in planning and execution.
Donors' sector-specific policies (e.g. water and sanitation, agricultural development) Lead Authorities: As above.	• See above. *e.g.* check existing in-country EIA/SEA regulations, other relevant regulations, and capacity of the sectors to determine whether they make provision for considering linkages between the policy and ecosystem services.
Donor-backed public private infrastructure support facilities and programmes Lead Authorities: As above.	• See above.
(C) SEAs in related circumstances	
Independent review commissions (*e.g.* Extractive Industries Sector Review, World Commission on Dams) Lead Authorities: Independent Review Commissions	• It is important to include experts on ecosystem services as well as representatives with local ecosystem knowledge and perspectives in the review commission. • Experts should be familiar with the MA conceptual framework and the institutional requirements to implement an ecosystem services-based approach that addresses how a PPP depends on and affects ecosystem services.
Major private sector-led projects and plans Lead Authorities: Private sector	• Currently, companies mainly assess their environmental impacts in terms of pollution, resource consumption and possible interference with protected biodiversity. They usually overlook their dependence and impact on ecosystem services such as water filtration or pollination. • Corporate environmental management systems also typically focus on risks and do not identify opportunities to provide new products or services to mitigate impacts on ecosystem services.[9]

Source: Adapted from Beukering and Slootweg (2008).

Many development policies or plans have national or sectoral wide applications that are not spatially defined. They may have connections to and implications for large scale, long term ecosystem change (e.g. trade liberalisation policy, agricultural expansion programme). As indicated in Figure 1 (the MEA framework), key trends and drivers of ecosystem change are both direct (proposals that will cause land use conversion, habitat loss) and indirect (proposals that will influence or lead eventually to direct changes, e.g. through demographic or technological shifts). The discussion on biodiversity triggers and their application to SEA in CBD draft guidance is also helpful in identifying when and how these impacts should be considered (see Figure 4).

[9] Performing a Corporate Ecosystem Services Review can help managers address these gaps by assessing corporate dependence and impact on ecosystem services and the resulting business risks and opportunities. (WRI, 2008b)

Figure 4. Examples of biodiversity triggers and their application on SEA

Biodiversity triggers	When to consider biodiversity issues?	How to address biodiversity issues?
Proposed strategy is focused on area of known ecological value	Is the proposal likely to affect current resource uses or potential regulatory function or culturally important ecosystem services; protected areas or species; or biodiversity hot spots?	Area-wide focus, e.g. by conservation-based spatial planning, ecosystem services mapping, linking services to stakeholders
Proposed strategy is for sector known to have biophysical effects but is not spatially delineated	Is the proposal likely to lead to changes known to significantly affect ecosystem services (*e.g.* land conversion, water quality and quantity) including through demographic or cultural transmission?	Sector focus on direct drivers of change and links to potential ecosystem effects, e.g. by identification of aggregate and net changes to the resource base, cumulative emissions and loadings to air or soil
Proposed strategy may affect indirect drivers of change without direct biophysical effects	Is the proposal likely to affect economic or social behaviour *(e.g.* in production or consumption of goods or services, energy, housing or transportation use and demand)	Structural focus to identify links between indirect and direct changes, *e.g.* by adapting the MEA framework and methodology (see Figure 1) to an impact assessment purpose

Source: Adapted from Guidance on biodiversity-inclusive SEA (CBD COP Decision VIII/28 2006 Annex II). Note: in this version, the focus of the original table has been simplified in certain respects and additional examples are introduced.

2.1 Key questions for SEA at the policy level

- What are the main ecosystem services that the country's economy relies on?
- How will the proposed policy/strategy depend on ecosystem services?
- How will the proposed policy/strategy change the indirect and direct drivers affecting these ecosystem services? What will be the impact of the change in drivers on the ecosystem services? (see Figure 1 for examples of common drivers).
- What is known about the status and trends of these services?
- Under what conditions will it be appropriate to quantify the economic and societal values of ecosystem services? What methods are available to estimate these values? How will economic development and human well-being be affected by a decline in the quality and delivery of ecosystem services and, conversely, what opportunities do ecosystem services provide to improve economic development and human well being? And for which groups or stakeholders? (see Annex 2 for more on economic valuation).
- How can future ecosystem service changes be explored?
- How can ecosystem service risks and opportunities be incorporated into the development strategy?
- What policies can help sustain ecosystem services?
- What capacity development is needed?
- Have important ecosystem services been mapped?

- Are the quantity and quality of ecosystem services included in the monitoring scheme? If a baseline includes ecosystem services, indicators of these services can be used as "key performance indicators" in the Poverty Reduction Strategy Paper (PRSP) or development strategy of a country.

Section 3 discussed institutional dimension that are also relevant for the policy level, and some of the questions listed in sections 2.2 may also be relevant.

2.2 Key issues and steps for SEA at the plan/programme level

The following sub-sections relate to the key stages of the SEA process defined in the DAC SEA Guidance.

(a) Establishing the context of SEA

Screening

Consider which ecosystem services the plan/programme *depends* on or *affects* (see Table 1 for list of examples of ecosystem services).

- The plan or programme *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 PPP. For example, a coastal development plan may depend on the storm protection services provided by wetlands or mangroves.
- The plan or programme *affects* an ecosystem service if actions associated with it alter the quantity or quality of a service. For example, a coastal development plan may also affect the storm protection services provided by wetlands or mangroves. The PPP impacts might influence one or more of the direct or indirect drivers of change. Impacts can be positive (enhance the quality or quantity of a service) or negative (decrease the quantity or quality of a service).

Based on this screening to document which ecosystem services the plan/programme depends on or affects and the types of drivers involved. Identify capacity to analyze these ecosystem services and drivers. Consider the linkages between the results from the screening exercise and existing commitments to meet international agreements such as the MDGs and Convention on Biological Diversity.

Setting the objectives of the SEA

Use the results from the screening:

- How can the ecosystem service analysis and valuation (see example in Box 3) inform the SEA process?
- Can ecosystem service targets or objectives be identified upfront for the plan/programme?
- Are National Biodiversity Strategy and Action Plan available that provides relevant objectives and information with respect to ecosystem services?

Box 3. **Informing policy choices by valuing ecosystem services: The Aral Sea Wetland Restoration Strategy, Karakalpakstan, Uzbekistan**

Reduced availability of water, considerable loss of biodiversity, loss of vegetation and fisheries, the occurrence of salt and dust-laden winds and deteriorating health conditions because of salinisation of groundwater, all these negative impacts together contributed to the worsening environmental conditions in the deltas of the Amudarya and Syrdarya Rivers. In 1995, about 10% of the original wetlands remained in the delta.

An SEA was integrated into the process to develop a restoration strategy, requested by the Interstate Council on the Aral Sea. It started with a baseline study on major environmental, hydrological and social-economic issues in the region. Five alternative strategies were developed and compared in a participatory manner, making use of local knowledge, aimed at providing relevant social, economic and environmental information for decision-making on the future development of the Amudarya delta. The strategies differed in the surface area of wetlands to be restored, the amount of water allocated to each watershed, and in mixed or separate use of river discharge and (saline) drainage water from the irrigation schemes. The Amudarya delta ecosystem services were assessed for three situations: (a) the former natural state with 90% of the delta flooded during summer; (b) the present state, with only 10% of the original wetland area, artificially maintained; and (c) restoration potential with the presently available quantity of water. Social, economic and ecological values derived from wetland ecosystem services were assessed in semi-quantitative terms. Values referred to estimated numbers of beneficiaries, jobs, or production levels of various land use forms (Table 3).

Table 3. Simplified ecosystem services-values matrix for Amudarya wetlands

Wetland services	Social values	Economic values	Ecological values
Recharge of groundwater	Fundamental function for the maintenance of all other ecological processes		
Prevention of dust/salt transport by wind	Living conditions/health	Protection of irrigation schemes	
Maintenance of biological diversity		Genetic reservoirs (wild ancestors/medicinal plants)	Many red listed/threatened species
Fish spawning/nursing		Fisheries and canning plant	Survival of aquatic organisms
Pastures		Cattle raising	
Reedlands		Processing industry	
Water supply		Agriculture, aquaculture	
Muskrat, waterfowl	Local hunting for meat and skins	Fur and meet industry	
Liquorice production and other wood resources	Fire and construction, wood for local use	Liquorice roots for export. Dried plants for fodder.	

The matrix provided immediate insight into the social, economic and ecological consequences of interventions. Presenting this for the former, present and possible future restored situations provided a very strong communication tool to convince decision makers of the values of wetlands. It proved to them that restoration of natural wetland services might be a better option than the continued construction of water retention and irrigation works. The latter approach focuses on maximising one service (irrigation) at the cost of other services, even denying the existence of these other services. Yet, multifunctional wetlands can cope better with the seasonal and inter-annual dynamics of a delta system and play a key role in stopping further land degradation.

Sources: Euroconsult and The Wetland Group (1996); Schutter, J. de (2002).

Identify stakeholders and make a plan for continuous consultation with them

The stakeholders should include:

- Groups of people that use or depend on the ecosystem services affected by the plan/programme and/or formal or informal organisations that represent these direct stakeholders. Identifying property and tenure rights (rights to access, use, transfer, manage and profit) related to ecosystem services is part of this exercise.
- Sectors and levels of government which are responsible for managing the identified ecosystem services and the drivers affecting them.
- Institutions or enterprises that use or depend on the ecosystems affected by the plan/programme (*e.g.* water-supply enterprises, hotels using the touristic interest of protected areas).

Box 4 provides an example of the successful use of ecosystem services assessment and involving stakeholders to influence a large-scale plan.

Box 4. **Stakeholder analysis: SEA for Spatial Planning in Papua Province, Indonesia**

In many developing countries, public involvement in SEA process must confront socio-economic and political realities that constrain the application of standards of good practice. The SEA to assist Papua province to develop a spatial plan illustrates some of the challenges.

Papua is said to be 'a paradox in its under-development' as a mining revenue-rich Indonesian province that is characterised by poor infrastructure, limited government capacity, low quality health and education services and high endemic poverty. At the same time, it is rich natural resources with biodiversity values of global importance. There is intense competition among different sectors and factions for control over these resources, both product and cause of political tension and an independence movement.

As part of the SEA to assist spatial planning, a stakeholder analysis was undertaken. It was based on an interview survey of some 40 stakeholders (including donors, federal and state agencies, parliamentary bodies, business and NGOs) to identify and analyse: key interest groups and their power to influence development; impacts on communities and groups under different development scenarios; and levels of vulnerability to adverse changes (focusing on indigenous groups). With supplementary consultations, it helped to identify social priorities (e.g. for health, education, protection of sacred sites, acknowledgement of traditional land rights) and to develop a range of scenarios for spatial development (although without achieving consensus at a concluding workshop). This process was curtailed due to funding constraints and much still remains to be done to facilitate multi-stakeholder consultations and buy in to the plan.

Sources: Papuan Civil Society Strengthening Foundation and Nordic Consulting Group (2008).

(b) Implementing the SEA

Scoping in dialogue with stakeholders

Prioritise among the ecosystem services identified in the screening step[10]. Priority ecosystem services are those on which the plan/programme and other stakeholders depend heavily and those impacted that have the largest value for society. When answering these questions it is important to consider different

[10] If formal screening has not taken place, use the questions listed in under the screening step in section 3.1 and those in this section to prioritize.

stakeholders' dependency, tenure and property rights related to the ecosystem service. Ecosystem service dependencies and impacts can be prioritized by applying the following questions:

Ecosystem service *dependencies*:

- Does the ecosystem service have a cost-effective substitute? If not, prioritize the ecosystem service for further analysis.

Ecosystem service *impacts* (positive answers may indicate that the ecosystem service should be prioritized for further analysis):

- Would the plan/programme limit the ability of others to benefit from this ecosystem service?
- Would it enhance the ability of others to benefit from this ecosystem service?
- Would its impact on the ecosystem service contribute to conflict among users who depend on this service?
- Will economic development and human well-being, for different stakeholders, in the district/region/country be affected by a decline or decrease in the ecosystem service? Values of ecosystem services can be expressed and quantified in social, ecological, and economic terms. For further guidance, see Annex 2 and Box 5.
- Is the ecosystem service already degraded? Does the plan/programme reinforce the main drivers that contribute to the degradation of the ecosystem service?

Box 5. **Addressing conservation-development conflicts through ecosystem services valuation: The case of uMhlathuze municipality, South Africa**

Biodiversity issues in the South African City of uMhlathuze have led to various conflict situations in the recent years. Here, there was a classic "development" versus "conservation" situation, with the local municipality mostly in favour of development as a result of the poor socio-economic climate that exists in Kwazulu-Natal. The area was, however, identified as a biodiversity hotspot and, in order to alleviate the conflict and time delays that arise during EIAs, the municipality opted to undertake a Strategic Catchment Assessment. Instead of identifying and declaring conservation-worthy areas as "no-go", the study stressed the "ecosystem services" that the environment provides free of charge to this Municipality.

Table 4 and 5 show the annual value of each of the key ecosystem services supplied by the municipality's natural assets. Nutrient cycling and waste management, water supply, water regulation, and flood and drought management are some of the most highly valued services.

Table 4. Annual value of ecosystem services in uMhlathuze municipality
(Figures in Rand)

Ecosystem Services	Estimated annual value (millions)	Ecosystem services	Estimated annual value (millions)
Atmosphere regulation - CO2, etc	R 23,39	Pollination - legume and fruit crops	R 1,53
Climate regulation - urban heat sinks	R 0,00	Disease and pest control	R 9,74
Flood and drought management	R 244,11	Refugia - for wildlife and nursery for fisheries	R 15,90
Water regulation - timing, rate	R 137,39	Food production	R 30,18
Water supply - volume	R 297,92	Raw materials - housing, medicinals, craft	R 20,90
Erosion control	R 16,10	Genetic resources - chemicals	R 2,33
Soil formation	R 0,65	Recreation	R 37,73
Nutrient cycling	R 714,90	Cultural	R 67,20
Waste treatment - assimilation and dilution	R 137,74	**Annual total value (millions)**	**R 1,757,72**

The valuation of services provided by individual ecosystems (Table 5) allowed understanding of the total value of the ecosystems supporting the Municipality. Water-related habitats generate some of the greatest values in terms of service delivery. Wetlands have a particularly high value, relating to the high costs of trying to replace a vital but finite resource.

Table 5. Annual value of services provided by individual ecosystems
(Figures in Rand)

Value of services per ecosystem	Estimated annual value (millions)	*Value of services per ecosystem*	Estimated annual value (millions)
Dams & lakes	R 162,54	Rivers & streams	R 49,47
Floodplains – disturbed	R 32,54	Sandy beaches & foredunes	R 1,67
Floodplains - undisturbed	R 27,42	Thicket – alien plants	R 3,53
Forest – coastal	R 34,12	Thicket	R 3,90
Forest – dunes	R 37,36	Wetlands – estuarine	R 433,47
Forest - riparian and swamp	R 29,62	Wetlands	R 570,89
Grasslands – primary	R 9,37	Savanna/woodlands	R 9,52
Grasslands – utility	R 0,06	Nearshore ocean	R 347,62
Grasslands – secondary	R 4,62	**Total annual value (millions)**	**R 1,757,72**

The total value of environmental services was estimated at R1,7 billion (nearly 200 million US$) per annum. Politicians reacted negatively to the term "biodiversity", but more positively once they realized that ecosystem services have an economic value.

Conclusions

1. Identification and valuation of ecosystem services can inform a local spatial planning process on development constraints and opportunities.
2. Monetization of ecosystem services puts environmental considerations on the decision makers' agenda.

Source: Van der Wateren et al. (2004).

Collecting baseline data

Assess each priority ecosystem service identified in scoping. The following questions can guide this assessment:

- Is data available regarding ecosystem services prioritized under the scoping step? These data may come from sources such as local knowledge, expert opinion, ecological models, inventories of resources, remote sensing, or geographic information systems. Identify information gaps.
- What are the conditions and trends of the services?
- What are the major indirect and direct drivers affecting the observed trends in the service?
- How would the plan/programme affect the drivers identified? How are these drivers affected by other plans/programmes?
- What thresholds or irreversible changes have been observed in the ecosystem services?

Identifying alternatives and their impacts

The MEA framework can be used to develop different scenarios shaped by the drivers of change arising as a consequence of the plan/programme. Identify alternatives or scenarios for the plan/programme that take into account impacts and dependencies on ecosystem services:

- build scenarios including climate change scenarios, for short- and long-term development regarding ecosystem services, one of them preferably for a 50-year time horizon;
- when relevant, present a zero alternative as a reference, *i.e*. the expected changes in the priority ecosystem services if the PPP is not implemented.

Identifying options for mitigation and compensation

Incorporate ecosystem service risks and opportunities.

- Consider how to reduce or manage impacts of PPP on ecosystem services, and how to reduce dependence of PPP on ecosystem services or increase the supply of ecosystem services. The MEA framework can be used for mapping of stakeholders and also to assess whether compensation is needed.
- Review the legal framework and policy options for conservation and management of ecosystem services that are available. Applicable laws include those that govern ownership, taxation and use of land, water and other natural resources. Policy options are, for example, establishing protected areas, shifting subsidies from provisioning services to regulating services, using funds to pay for maintenance of ecosystem services or compensate those who lose ecosystem services, funding research into improved valuation methods, and strengthening local community rights to use and manage ecosystem services.
- Based on this review, choose appropriate policies using criteria including legal authority, likely effectiveness, equity among stakeholders, political and economic viability, and institutional capacity.
- Take a learning approach to implementation. For example, create a multi-stakeholder forum for joint problem-solving and making course corrections. (See section (c) below).

Review and quality assurance of the SEA

The following questions should help in evaluating whether an SEA has effectively integrated ecosystem services considerations.

- Did the SEA lead to measures and outcomes that better reflect ecosystem services in the planning process?
- What were the main strengths and weaknesses of the SEA process (in terms of availability of data on ecosystem services, projections of quality of ecosystem services delivered, stakeholder involvement, etc.)?
- 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 services risks/opportunities of the plan/programme, and on mitigation measures/adaptive strategies that could be adopted?
- Did the SEA improve the capacities of decision-makers, civil servants and other stakeholders to understand ecosystem services issues and management? If so, how?
- Did the SEA enhance the transparency and accountability of decision-making processes on ecosystem services issues in general and those specifically related to the PPP? If so, how?
- Did the SEA succeed in integrating into the national budget the financial needs for assessing and dealing with risks of depleting ecosystem services?
- Are there any indications that the plan/programme caused adverse impacts on ecosystem services delivered? Were these anticipated?
- Did the plan/programme contribute to verifiable progress on ecosystem services and specific development issues?
- Did the MA framework contribute to the SEA process in order to make it comprehensive and participative? Did it influence decision-making? Did it contribute to more efficient environmental integration?

Reporting

Results and rationale for conclusions need to be reported in an understandable manner, with a summary for a wider audience.

(c) Informing, influencing and making recommendations with stakeholders

This step is important for mitigating risks to ecosystem services and enhancing opportunities to sustain them in carrying out the plan/programme:

- take into account how different stakeholders depend on and use ecosystem services and consider how this influences their perspective on recommendations;
- consider adopting tools such as tax incentives, public funds for maintenance of ecosystem services, clarification or strengthening of local community rights to use and manage ecosystem services, or establishing protected areas;
- identify and remove policies and incentive mechanisms that degrade ecosystem services, *e.g.* economic and fiscal incentives that inadvertently create incentives to degrade ecosystems services, or perverse subsidies;
- consider using valuation of ecosystem services to inform the identification of risks and opportunities associated with the plan/programme (see Annex 2);

- consider the possibility to include payment for ecosystem services to ensure social and economic benefits for poor and marginalized groups;
- outline financial needs for carrying out proposed policy measures and develop a strategy for incorporating them in the plan/programme.
- consider the possibility to apply the precautionary principle[11] in cases where impacts may be irreversible but knowledge is insufficient to provide clarity, taking into account a reasonable balance between the stringency of the precautionary measures, including associated costs, and the seriousness and irreversibility of the potential threat;
- suggest capacity development measures that are needed, in order to enhance management of ecosystem services.

(d) Monitoring and evaluation

This should include monitoring decisions taken on the plan/programme and implementation, and evaluation of both the SEA and the plan/programme.

Where the potential impacts on ecosystem services and stakeholder dependence on these services have been identified, this information can provide a baseline and indicators for monitoring and evaluating the SEA as well as the progress achieved by the plan/programme in the longer term. Questions from the review and quality assurance of the SEA (see above) can also be used.

The step by step SEA process is summarized in Figure 5. Furthermore, SEA of development plans and programmes is also required to anticipate and mitigate cumulative and secondary (indirectly induced) effects of multiple actions and their linkages to ecosystem functions and benefit flows. The application of an ecosystem approach is widely endorsed as an appropriate framework rather than individual impacts and synthesise knowledge from different disciplines under various conditions of uncertainty.[12] This framework is endorsed, for example, as a means of managing ecosystems as the wealth of the poor (WRI et al 2005) and to implement the objectives of the Biodiversity Convention (CBD Decision V/6 2001). Principles of the ecosystem approach and their application are variously expressed but for present purposes they can be organised into two main categories for environmental sustainability assurance. On the resource or supply side, the focus is on maintaining carrying capacity by protection and conservation of critical and essential ecosystem attributes. On the demand or regulatory side, it is based on the application of the precautionary principle to risk-assured decision-making and the polluter pays principle to trigger mitigation and compensation measures consistent with principle of the no net loss of productive capacity.

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11 "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" (Rio Declaration, 1992, Principle 15).

12 In general terms, an ecosystem approach aims to provide a comprehensive, holistic understanding of how a particular (geographically specified) system works. This approach focuses on the interrelations among component parts (organisms, their habitat and the physical environment) and the processes that govern overall dynamics. From a practical standpoint, the concern in impact assessment is to assess the cumulative impacts and consequences of human activities and develop adaptive management strategies and responses.

Figure 5. SEA application to take account of ecosystem impacts

SEA stages and steps	Ecosystem issues and considerations
(I) Establishing the context • Screening • Setting objectives • Identifying stakeholders	• Identify which ecosystem services a proposal depends on or affects. • Establish targets for ecosystem services identified in screening. • Identify key users and stakeholders and mode(s) of consultation.
(II) Implementing the SEA • Scoping (stakeholder dialogue) • Collect baseline data • Consider alternatives • Enhancement/ mitigation options • SEA review and quality assurance • Report preparation	• Prioritise ecosystem services in terms of stakeholder dependencies • For each priority service and assess against key trends and drivers • Identify alternatives in relation to ecosystem impacts and dependencies • Assess measures to improve benefit flows or reduce vulnerability • Evaluate if SEA has effectively addressed ecosystem considerations • Describe findings and their implications for decision-making and stakeholders (in an appropriate form)
(III) Informing and influencing decision-making	Emphasise mitigating risks to ecosystem services, enhancing opportunities and stakeholder dialogue in implementing proposals
(IV) Monitoring and evaluation	Monitor for significant impacts on ecosystem services and effectiveness of mitigation and enhancement measures; evaluate their outcomes in terms of stakeholder benefits and losses

Box 6. Pilot SEA of the cumulative impact of 6th hydropower development plan on biodiversity, Vietnam

This pilot assessment was undertaken as a demonstration project to test a strategic approach to identify the cumulative impact of plans for hydroelectric power development on biodiversity as a key indicator of ecosystem health and integrity. It focussed on the hydropower component of the draft 6th Vietnam Power Development Plan (to 2020), which includes 73 major dam projects, most located in nine major river basins, 13 of which are operational already. By any standard, this scale of development is impressive; it also has profound implications for biodiversity hot spots in Vietnam, which are also of global significance.

The SEA applied the principles and elements of OECD DAC *Good Practice Guidance on Applying SEA in Development Co-operation.* It resulted in a methodology and set of tools for assessing biodiversity effects of hydropower at the strategic and regional levels. It also assisted in the identification of geographic areas and groups of projects in the 6th PDP, which require more intensive appraisal and mitigation to minimise their adverse effects on biodiversity and on social and economic well-being. The SEA also provided a policy brief on strategic issues of hydropower and biodiversity management for Government of Vietnam.

Key SEA recommendations made were for the need to take a more cautious, adaptive approach to hydropower development in Vietnam given the many uncertainties, which remain with respect to the risks to natural, social and economic systems. Given the massive scale of hydropower development, the precautionary principle should be applied supported by protective and mitigation measures to safeguard ecosystem functions and biodiversity values in existing protected areas, which are potentially threatened by hydropower development. In most cases, these are important to rural populations, many of which are ethnic minorities, for their livelihoods.

Source : Sadler B et al. (2007). Note that the findings, interpretations and conclusions expressed in the report are those of authors and do not necessarily represent the views of the World Bank or the Government of the Socialist Republic of Vietnam.

3. Addressing the institutional dimension of SEA

The institutional dimension is critical for SEAs at all levels for all key entry points. Drivers of change in ecosystem services as well as impacts, stakeholder dependence, and associated trade-offs occur at different spatial and temporal scales. Similarly, institutions operate at different scale in line with their mandates and jurisdictions. Countries generally have separate institutions for the management of key sectors and resources such as agriculture, forestry and water, which have different focuses. In many cases, institutions responsible for supply or irrigation tend to focus on building physical structures and fail to recognise the critical role of ecosystems (*e.g.* forests and wetlands) in capturing/releasing or moderating the quality of water.

An SEA needs to take this into account and address where institutional capacity might need strengthening (*e.g.* to identify, assess, and make trade-offs among ecosystem services). For example, an SEA for the water, power or agricultural sector may need to build links among institutions from local to international levels and perform analysis over different time scales. It might recommend institutional changes such as the introduction of co-management of water resources with national and local authorities providing overall plans and limits. It might point to the need to strengthen the capacity of ecosystem service institutions to collect information, identify trade-offs, and propose measures to sustain a range of ecosystem services. Additionally an SEA can help provide experience to national planning and development ministries in working with environmental and resource ministries.

The questions below suggest how the SEA process can help build institutional links and strengthen governance to take into account changes in ecosystem services across a range of spatial and temporal scales and also help coordinate decision-making among economic and environmental and resource agencies.

(i) Institutional and governance assessment

- How do legislation, government agencies and institutions integrate consideration of ecosystem services?
- What are the existing policies and incentive mechanisms that degrade ecosystem services (*e.g.* economic and fiscal incentives that inadvertently create incentives to degrade ecosystems services, or perverse subsidies)? And which policies and incentive mechanisms enhance ecosystem services (*e.g.* adoption of tools such as tax incentives, public funds for maintenance of ecosystem services, or establishment of protected areas)?
- What mechanisms are in place for holding decision makers accountable for ecosystem services management?
- What are the needs for capacity development concerning to increase knowledge and address ecosystem services consideration in the country or sector?
- How can awareness be improved amongst decision-makers and planners about how SEA can address ecosystem services considerations?
- How can the concept of ecosystem services be integrated into educational curricula?
- How can the institutional use of SEA be reinforced so as to mainstream the consideration of ecosystem services in strategic policy-making processes

(ii) Institutional and governance strengthening

- How can accountability regarding ecosystem services management be improved (*e.g.* an ombudsman, legislative hearings, free media, and functioning judiciary)?

- What institutionalization processes are needed to embed SEA's findings concerning ecosystem services in government policies and processes?
- Are there any feedback mechanisms within particular organizations that can enhance internal and continuous learning about ecosystem services management?

4. Conclusion

SEA is widely recognised as an important policy tool for addressing the impact of development proposals on ecosystem goods and services, particularly in the context of meeting MDG 7 for 'ensuring environmental sustainability'. Biodiversity loss and ecological degradation are now pervasive, disproportionately affect the rural poor who are directly dependent on them and threaten to undermine their livelihoods and derail the fight to end world poverty. Yet donor agencies still have much to do to mainstream these issues into their own SEA practices, and to help build the capacity of partner countries to consider biodiversity and ecosystem effects in their development plans and decisions.

As discussed in this chapter, the use of the Millennium Ecosystem Assessment framework, which relates ecosystem conditions to human well being, facilitates a more systematic approach to SEA of development proposals. Other risk-based tools also can help to frame and focus this approach to support efficient application of SEA, and address biodiversity and ecological issues that matter in relation to a particular development proposal. Key steps and considerations in this type of SEA are exemplified with reference to three questions: When to give attention to impacts on ecosystem services in SEA of development plans or policies? Who should be involved in this type of SEA? How to assess impacts on ecosystem services?

Looking ahead, the interaction between climate change and biodiversity impacts will need to be taken into account in adapting development co-operation policies and programmes to new emerging realities. Of specific concern is the migration of habitats and species due to climate warming and the subsequent effects on ecosystem service flows, which will have consequences for human well-being. In many developing countries, these shifts are likely to have profound implications for food security, sustainable livelihoods and poverty reduction. SEA can provide a means of risk-proofing development initiatives by recognising the role of ecosystems in both climate change adaptation (*e.g.* mangrove forests protect coastal zones against weather-related catastrophes) and mitigation (*e.g.* reducing deforestation is a cost-effective way of reducing carbon dioxide emissions). The poor depend heavily on ecosystem services for their survival. The development community must now mobilze to apply SEA to provide vulnerable populations with better options for resilience that are grounded in functioning and healthy ecosystems.

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Annex 1: The OECD DAC Guidance on SEA

Strategic Environmental Assessment (SEA) supports the principles of the Paris Declaration on Aid Effectiveness in terms of ownership, alignment, harmonisation, managing for development results and mutual accountability. In this Declaration, both donors and development country partners made a commitment to "develop and apply common approaches for 'strategic environmental assessment' at the sector and national levels".

In response to this commitment, the OECD DAC Network on Environment and Development Co-operation (ENVIRONET) has developed SEA Guidance: *Applying Strategic Environment Assessment – Good Practice Guidance for Development Co-operation* (OECD DAC 2006), hereafter called the *OECD DAC SEA Guidance.* The Guidance provides a commonly agreed and shared framework for developing appropriate, fit-for-purpose applications of SEA in diverse areas. To enhance the SEA Guidance, ENVIRONET is developing a series of Advisory Notes to link SEA to key topical challenges. This Advisory Note bridges Strategic Environmental Assessment and disaster risk reduction. Others address climate change adaptation, ecosystems services and post-conflict development.

The *OECD DAC SEA Guidance* defines SEA as "*analytical and participatory approaches that aim to integrate environmental considerations into policies, plans and programmes and evaluate the inter linkages with economic and social considerations*". Hence, SEA is not a single, fixed and prescriptive approach, but rather an umbrella approach using a basket of analytical and participatory tools. It is largely principles-based and adaptive, focused on strengthening institutions and governance, and tailored to a specific context. The core of the OECD DAC SEA Guidance is organized around 12 broad entry points for the application of SEA to different areas of strategic decision making (Box A1.1).

In 2010, a *Review of SEA Experiences in Development Co-operation* is produced (OECD DAC 2010). It provides a comprehensive review of major SEA activities in developing countries. The Review covers nine developing countries – Benin, Bhutan, Ghana, Honduras, Mauritius, Montenegro, Namibia, Sierra Leone and Vietnam. It serves as a monitoring report of the 2006 Guidance.

Box A1.1**: Key entry points for sea in development co-operation**

(A) For SEA led by partner country governments

1. National overarching strategies, programmes and plans
2. National policy reforms and budget support programmes
3. National sectoral policies, plans or programmes
4. Infrastructure investments plans and programmes
5. National and sub-national spatial development plans and programmes
6. Trans-national plans and programmes

(B) For SEA undertaken in relation to donor agencies' own processes

7. Donors' country assistance strategies and plans
8. Donors' partnership agreements with other agencies
9. Donors' sector-specific policies
10. Donor-backed public private infrastructure support facilities and programmes

(C) For SEA in other, related circumstances

11. Independent review commissions
12. Major private sector-led projects and plans

Source: OECD DAC (2006).

The approaches SEA applied to policies and to plans/programmes are likely to differ, with the former focusing much more on the institutional dimension (key steps are shown in Box A1.2).

Box A1.2: Key steps in SEA

SEA can be undertaken across the hierarchy of strategic decision-making levels from the policy-level to the plan and programme level, and the approach required at these different levels will vary.

(I) SEA at the policy level

Typical steps are difficult to codify or prescribe as the processes of policy-making vary considerably and, ultimately, are political. Compared to project-level EIA, SEA undertaken at the policy level demands a thorough understanding of political economy factors and institutional settings (see III below). Proponents of SEA can take advantage of windows of opportunity as leverage points for mainstreaming environment in policy processes and persuade decision-makers to use the SEA process to integrate environmental issues. In practice, there are still relatively few examples of SEAs being undertaken at this level.

(II) SEA at the plan/programme level

1. Establish context:
   - Assess the need for the SEA, set objectives, identify stakeholders and develop a communication plan.
2. Implement the SEA:
   - Collect baseline data, scope in dialogue with stakeholders, identify alternatives and their impacts, identify options for mitigation and compensation, arrange quality assurance of the assessment.
3. Inform/influence decision making:
   - Make recommendations in dialogue with stakeholders.
4. Monitor:
   - Monitor implementation and evaluate.

(III) Addressing the institutional dimension of SEA

1. Institutional and governance assessment:
2. Review the country's environmental management and governance systems, covering:
   - Systems in place to address the environmental linkages with key policy goals and issues, particularly capacity to manage uncertain/unexpected environmental impacts or take advantage of environmental opportunities.
   - Institutions, incentives and processes that support improved governance and public and private sector engagement.
   - Environmental governance mechanisms for ensuring/reinforcing social accountability.
3. Review analytical capacity (in government, research and academic institutions, civil society organisations and private sector).
4. Gain access to decision-making – exploit opportunities to mainstream environment issues in policy formulation.
5. Institutional and governance strengthening:
   - Support mechanisms that increase social accountability and improve governance.
   - Assist countries in adaptive learning – ensuring continuity in SEA processes.

Annex 2: Economic valuation of ecosystem services

(Adapted from WRI, 2008a)

Economic valuation involves assigning quantitative economic values to ecosystem services, including those not currently valued in the marketplace (for instance, regulating services such as coastal protection and erosion control). Table 6 provides an overview of methods that can be used to quantify the values associated with ecosystems. Economic valuation can serve a number of purposes:

- ***Communicating the value of ecosystem services by highlighting their economic contributions to societal goal*** (see, for example, Box 5).
- ***Comparing the cost-effectiveness of investments***. New York City compared the cost-effectiveness of maintaining natural ecosystem-based water purification services with constructing and operating a filtration plant and selected the ecosystem-based option.
- ***Evaluating the impacts of policies***. Ecosystem service costs of a proposed development might include habitat conversion, runoff, or pollutant discharge. (see, for example, Box 3)
- ***Building markets for ecosystem services***. Global carbon markets and payment for ecosystem services are examples of markets based on the economic valuation of ecosystem services.

Table A2.1. Common economic valuation methods from ecosystem services: A guide for decision-makers

Method	Approach	Applications
Effect on productivity	Trace impact of change in environmental condition on the produced goods	Any impact that affects produced goods (*e.g.*, declines in soil quality affecting agricultural production)
Cost of illness, human capital	Trace impact of change in environmental services on morbidity and mortality	Any impact that affects health (*e.g.*, air or water pollution)
Replacement cost	Use cost of replacing the lost good or service	Any loss of goods or services (*e.g.*, previously clean water that now has to be purified in a plant; shoreline protection once provided by mangroves or reefs)
Travel cost	Derive demand curve from data on actual travel costs to estimate recreational use value	Recreation, tourism
Hedonic prices	Extract effect of environmental factors on price of goods that include those factors	Air quality, scenic beauty, cultural benefits (*e.g.*, the higher market value of waterfront property, or houses next to green spaces)
Avoided damages	Model comparison of the damages avoided by having protection against natural disaster events such as earthquakes, hurricanes, and flooding	Shoreline protection services, erosion reduction, etc.
Contingent valuation	Ask respondents directly their willingness to pay for a specified service	Any service (*e.g.*, willingness to pay to keep a local forest intact); can be used to estimate consumer surplus (the benefit above actual expenditure), social value, and existence value
Choice modelling	Ask respondents to choose their preferred option from a set of alternatives with particular attributes	Any service
Benefits transfer	Use results obtained in one context in a different context (*e.g.*, estimating the value of one forest using the calculated economic value of a different forest of a similar size and type)	Any service for which suitable comparison studies are available

Source WRI (2007).

The following suggestions can improve the usefulness of economic valuations and increase the likelihood that decision makers will accept and take the resulting values into account.

- Engage local stakeholders in the process. Building local capacity to undertake valuations or use the results of a valuation can contribute to greater understanding of the value of ecosystems to society and inform more robust development strategies.

- Conduct the analysis using a clear and fully disclosed method. Be clear from the start on the assumptions used and limitations of the results (*e.g.*, period of valuation and discount rate, whether non-marketed services are included).

- Develop estimates based on existing data and information systems whenever possible. Making use of information routinely collected by existing institutions increases the likelihood of similar valuations being implemented in the future, allowing examination of change over time. Surveys can provide valuable information, but are somewhat subjective, and may be one-time events, unless there is capacity to repeat the survey in the future.

- Strive for realistic and accurate results. If uncertainties exist because of incomplete understanding of complex environmental processes (for example, how much forest is required to provide sufficient flood regulation or water filtration for a population) be explicit about these when communicating the values. If results prove smaller than expected, document the reasons, and clearly note what is included and what is not. Inflating results will discredit the effort and reduce the likelihood that they will be used by decision makers.

About the OECD, DAC and ENVIRONET

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The OECD was founded in 1961and its members now comprise 33 democratic nations with advanced market economies. It has active relationships with some 70 other countries, NGOs and civil society. The OECD's work covers economic and social issues from *macroeconomics*, to *trade, education, development* and *science and innovation*, and it is best known for its *publications* and its *statistics*. Its basic aim is to promote policies to: (a) achieve the highest sustainable economic growth and employment and a rising standard of living in member countries, while maintaining financial stability; (b) contribute to sound economic expansion in all countries; and (c) contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

The OECD Development Assistance Committee (DAC) (*www.oecd.org/dac)* is one of the key forums in which the major bilateral donors work together to increase the effectiveness of their common efforts to support sustainable development. The Committee holds an annual *High Level Meeting* in which participants are ministers or heads of aid agencies. Much of the detailed work is undertaken through subject-specific working parties and networks such as ENVIRONET (the DAC Network on environment and development co-operation). The work of the DAC is supported by the *Development Co-operation Directorate*, (DCD), one of some dozen directorates in the OECD. The DCD is often referred to as the DAC Secretariat because of this key function.

DAC members are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Korea, Luxembourg, Netherlands, New Zealand, Portugal, Norway, Spain, Sweden, Switzerland, United Kingdom, United States, Commission of the European Communities. The International Monetary Fund (IMF), the United Nations Development Programme (UNDP), and the World Bank participate in the work of the DAC as observers.

The ENVIRONET

The DAC Network on Environment and Development Co-operation (ENVIRONET) focuses on environmental issues at the interface of development co-operation and environment. Its mandate is to:

- contribute to the formulation of coherent approaches to sustainable development in the context of the OECD cross-sectoral approach to sustainable development;

- formulate specific guidance for development co-operation efforts in support of environment and sustainable development; and provide its members with a policy forum for sharing experience and disseminating good practice with regard to the integration of environmental concerns in development co-operation.