Guidelines on biodiversity-inclusive Strategic Environmental Assessment (SEA)

Abbreviations

CBD	:	Convention on Biological Diversity
EIA	:	Environmental Impact Assessment
IAIA	:	International Association for Impact assessment
MA	:	Millennium Ecosystem Assessment
MGDs	:	Millennium Development Goals
NBSAP	:	National Biodiversity Strategy and Action Plan
SEA	:	Strategic Environmental Assessment

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Points of departure and target audience of these Strategic Environmental Assessment (SEA) guidelines:

- SEA is now commonly applied, and an increasing number of countries have integrated, or are in the process of integrating, SEA into their national procedures for environmental assessment. These guidelines are intended to assist in better incorporating biodiversity during this process. The target audience of this document consequently are those involved in the process of establishing SEA systems. These typically are national authorities but can also include regional authorities or international agencies. The generic nature of these guidelines implies that further elaboration of their practical application is needed to reflect the ecological, social-economic, cultural and institutional conditions for which the SEA system is designed. The focus of the guidelines is on how to guarantee a biodiversity-inclusive SEA process. The guidelines do not intend to provide a technical manual for practitioners on how to carry out a biodiversity-inclusive assessment study.

- This document is not structured according to a procedure (as with the EIA guidelines). The principal reason for this is that good practice SEA should ideally be fully integrated into a planning (or policy development) process. Since planning processes differ widely, there is, by definition, no typical sequence of procedural steps in SEA. Moreover, there is no general agreement on what a typical SEA procedure might be. This document therefore aims to provide guidance on how to integrate biodiversity issues into the SEA, which in turn should be integrated into a planning process. Because the planning process may vary between countries, the SEA is not described as separate process but as an integral component of the applicable planning process.

- Situations in which SEA is applied and the scope of the assessments are varied. The SEA process therefore needs to be structured to reflect the specific situation. SEA is not a mere expansion of an EIA and it does not usually follow the same stages as an EIA. This difference is reflected in the use of more conceptual language in this document.

- The guidelines are fully consistent with the Ecosystem Approach. They focus on people-nature interactions and the role of stakeholders in identifying and valuing potential impacts on biodiversity. For the identification of stakeholders and the valuing of biodiversity, the concept of ecosystem services as elaborated by the Millennium Ecosystem Assessment (MA) provides a useful tool. It translates biodiversity into (present and future) values for society. It provides a mechanism to 'translate' the language of biodiversity specialists into language commonly understood by decision makers. The guidelines are consistent with the MA conceptual framework and terminology.

- The guidelines intend to facilitate the ability to contribute to Goal 7 of the Millennium Development Goals, i.e. to '*ensure environmental sustainability*', and its target 9 to '*integrate the principles of sustainable development into country policies and programs and reverse the loss of environmental resources'.*

1 SEA, a family of tools

Strategic Environmental Assessment (SEA) has been defined as '*the formalized, systematic and comprehensive process of identifying and evaluating the environmental consequences of proposed policies, plans or programmes to ensure that they are fully included and appropriately addressed at the earliest possible stage of decision-making on a par with economic and social considerations*'. [1]/ Since this original definition the field of SEA has rapidly developed and expanded, and the number of definitions of SEA has multiplied accordingly. SEA, by its nature, covers a wider range of activities or a wider area and often over a longer time span than the environmental impact assessment of projects. SEA might be applied to an entire sector (such as a national policy on energy, for example) or to a geographical area (for example, in the context of a regional development scheme). SEA does not replace or reduce the need for project-level EIA (although in some cases it can), but it can help to streamline and focus the incorporation of environmental concerns (including biodiversity) into the decision-making process, often making project-level EIA a more effective process. SEA is nowadays commonly understood as being proactive and sustainability-driven, whilst EIA is often described as being largely reactive.

SEA vs. integrated assessment

SEA is a rapidly evolving field with numerous definitions and interpretation in theory, in regulations, and in practice. SEA is required by legislation in many countries and carried out informally in others. There are also approaches that use some or all of the principles of SEA without using the term SEA to describe them. However, practices in SEA and related approaches show an emerging continuous spectrum of interpretation and application. At one end of the continuum, the focus is mainly on the biophysical environment. It is characterized by the goal of mainstreaming and up-streaming environmental considerations into strategic decision-making at the earliest stages of planning processes to ensure they are fully included and appropriately addressed. The 2001 SEA Directive of the European Union and SEA Protocol to the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991) are examples of this approach. At the other end of the spectrum is an approach, which addresses the three pillars of sustainability and aims to assess environmental, social and economic concerns in an integrated manner. Depending on the needs of SEA users and the different legal requirements, SEA can be applied in different ways along this spectrum using a variety of methodologies.

Accordingly, SEA is referred to as 'a family of tools that identifies and addresses the environmental consequences and stakeholder concerns in the development of policies, plans, programmes and other high level initiatives.'[2] In more specific terms, the Netherlands Commission for Environmental Impact Assessment[3] describes SEA as a tool to:

1. structure the public and government debate in the preparation of policies, plans and programs;
2. feed this debate through a robust assessment of the environmental consequences and their interrelationships with social and economic aspects;
3. ensure that the results of assessment and debate are taken into account during decision making and implementation.

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[1]/ Based on Sadler and Verheem, 1996.

[2] OECD Development Assistance Committee Network on Environment and Development Cooperation – Task Team on Strategic Environmental Assessment.

[3] Netherlands Commission for Environmental Impact Assessment: Strategic Environmental Assessment - Views and Experiences (fact sheet at http://www.eia.nl/nceia/products/publications.htm)

This means that **stakeholder involvement**, **transparency** and **good quality information** are key principles. SEA is thus more than the preparation of a report; it is a tool to enhance good governance. SEA can be a formal procedure laid down by law (e.g. the SEA Directive of the European Union) or used flexibly/opportunistically.

Parallel to or integrated within a planning process?

SEA is designed in accordance with the national context and the characteristics of the planning processes in which SEA is applied. Traditionally, SEA is often applied as a stand-alone process parallel to planning, intended to support the decision making at the end of the planning process. More recently, SEA has been further developed into its most effective form: integrated into the planning process, bringing stakeholders together during key stages of the planning process and feeding their debate with reliable environmental information (see figure 1). In some cases, where planning procedures are weak or absent; SEA may structure or effectively represent the planning process.

Ideally, SEA is integrated throughout the development process of a specific legislation, policy, plan or programme, starting as early as possible. However, even when decisions have already been taken, SEA can play a meaningful role in monitoring implementation - for example, to decide on necessary mitigating actions or to feed into future reviews of decisions. SEA may even take on the form of a sectoral assessment used to set the agenda for future policies and plans.

There is no typical sequence of procedural steps to define an SEA process. By definition SEA is situation-specific.

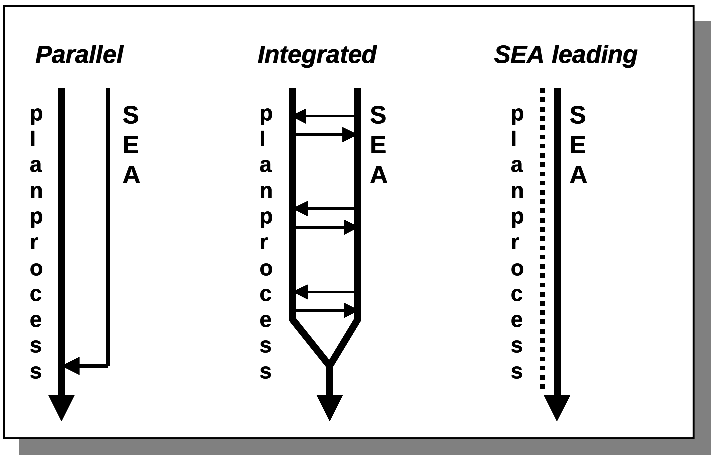

Figure 1: Combinations of SEA and planning process

Steps in the SEA process

SEA aims at better strategies, ranging from legislation and country-wide development policies to sectoral and spatial plans. In spite of the wide variation in application and definitions, all good practice SEAs comply with a number of performance criteria and with common procedural principles.[4] When a decision on the need for an SEA has been taken, 'good practice SEA' can be characterized by the following phases[5]:

[4] See IAIA Strategic Environmental Assessment Performance Criteria. IAIA Special Publications Series No. 1, January 2002

[5] OECD Development Assistance Committee Network on Environment and Development Cooperation – Task Team on Strategic Environmental Assessment.

- **Phase 1: Create transparency**

  - Announce the start of the SEA and ensure that relevant stakeholders are aware that the process is starting.

  - Bring stakeholders together and facilitate development of a shared vision on (environmental) problems, objectives, and alternative actions to achieve these.

  - Examine, in cooperation with all relevant agencies, whether the objectives of the new policy or plan are in line with those in existing policies, including environmental objectives (consistency analysis).

- **Phase 2: Technical assessment**

  - Elaborate terms of reference for the technical assessment, based on the results of stakeholder consultation and consistency analysis.

  - Carry out the actual assessment, document its results and make these accessible . Organize an effective quality assurance system of both SEA information and process.

- **Phase 3: Use information in decision-making**

  - Bring stakeholders together to discuss results and make recommendations to decision-makers.

  - Make sure any final decision is motivated in writing in light of the assessment results.

- **Phase 4: Post-decision monitoring and evaluation**

  - Monitor the implementation of the adopted policy or plan, and discuss the need for follow-up action.

SEA is flexible, i.e. the scope and level of detail of the above steps can differ depending on time and resources available: from rapid (2-3 months) to comprehensive (1-2 years). The extent of documentation is also highly variable – in some SEAs, particularly where decision-makers are involved throughout, the process is of paramount importance, whilst in others reporting assumes greater importance.

2 <u>WHY</u> special attention to biodiversity in SEA and decision making?

Important reasons to pay attention to the effective incorporation of biodiversity in environmental assessment are summarized below:

Legal and international obligations. A reason to pay particular attention to biodiversity in SEA is a legal or international obligation to do so. A number of legal obligations can be distinguished:

- <u>Protected areas and protected species</u>: ecosystems, habitats and species can have a form of legal protection, ranging from strictly protected to restrictions on certain activities.
- <u>Valued ecosystem services</u> can be subject to some form of regulation triggering the need for environment assessment. Examples are fisheries and forestry activities, coastal protection (by dunes or forested wetlands), water infiltration areas for public water supply, recreational areas, landscape parks, etc. (See figure 2 and box 1 on ecosystem services in legal context).

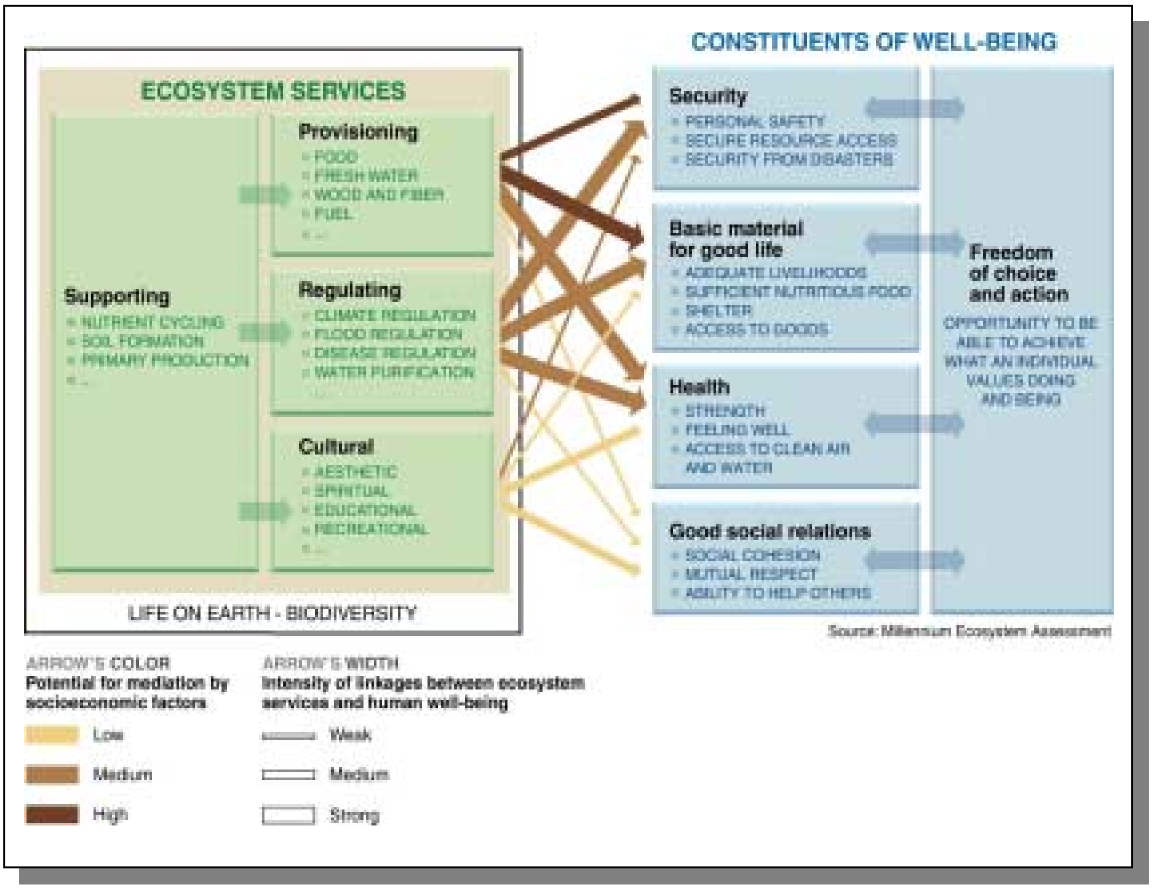

Figure 2: Consequences of ecosystem change for human well-being[6]

- <u>Lands and waters traditionally occupied or used by indigenous and local communities</u> represent a special case of ecosystem services.
- <u>International treaties, conventions and agreements</u> such as the World Heritage Convention, Ramsar Convention, or the UNESCO Man and Biosphere Programme. By becoming a Party to

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[6] source: Millennium Ecosystem Assessment Findings, 2005; http://www.millenniumassessment.org

these agreements, countries agree to certain obligation to manage these areas according to internationally agreed principles.

Facilitation of stakeholder identification. The concept of biodiversity-derived ecosystem services provides a useful tool to identify potentially affected groups of people. Ecosystems are multifunctional and provide multiple services. By taking an ecosystem approach and focusing on ecosystem services in describing biodiversity, directly and indirectly affected stakeholders can be identified and, as appropriate, invited to participate in the SEA process.

Safeguarding livelihoods

The identification of stakeholders through recognition of ecosystem services can lead to a better understanding of how the livelihoods of people who depend on biodiversity will be affected. In many countries, especially in developing countries, a large proportion of rural society is directly dependent on biodiversity. As these groups may also belong to the poorer and less educated strata of society, they may go unnoticed as they are not always capable to participate meaningfully in an SEA process (see Box 2).

Sound economic decision making. Ecosystem services such as erosion control, water retention and supply, and recreational potential can be valued in monetary terms, thus providing a figure on potential economic benefits and/or losses caused by the implementation of planned activities.

Cumulative effects on biodiversity are best anticipated at a strategic level. By applying the principles of the ecosystem approach the cumulative effects of activities on those ecosystem services which support human well-being can be addressed. At the same time, it is appropriate to define levels of acceptable change or desired levels of environmental quality at the strategic (ecosystem or catchment) level.

Maintaining the genetic base of evolution for future opportunities

The conservation of biodiversity for future generations is one important aspect of sustainability. It seeks to maintain options for the wealth of yet unknown potential uses of biodiversity. Moreover, maintaining the capacity of biodiversity to adapt to changing environments (e.g. climate change) and to continue providing viable living space for people is critical to human survival. Any long-term sustainability assessment has to make provisions for safeguarding that capacity.

Box 1: Ecosystem services in legal context

SEA provides information on policies, plans and programmes for decision makers, including their consistency with the legal context.

It is important to realise that ecosystem services often have formal recognition by some form of legal protection. Legislation often has a geographical basis (e.g. protected areas) but this is not necessarily always the case (e.g. species protection is not always limited to demarcated areas). Of course, the legal context in any country or region is different and needs to be treated as such.

Some examples of ecosystem services linked to formal regulations:

Ecosystem service: preservation of biodiversity

- Nationally protected areas/habitats, protected species;
- International status: Ramsar convention, UNESCO Man and Biosphere, World Heritage Sites
- Subject to national policies such as the U.K. Biodiversity Action Plans (BAP), the Netherlands Ecological Network (NEN), or the European Natura 2000 Network.
- Marine Environmental High Risk Areas (sensitive areas prone to oil pollution from shipping)·
- Sites identified and designated under international agreements, eg OSPAR Marine Protected Areas
- Sites hosting species listed under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals)
- Sites hosting species listed under the Bern Convention (Annex 1 and 2 of the Convention on the Conservation of European Wildlife and Natural Habitats, 1979)

Ecosystem service: provision of livelihood to people

- Extractive reserves (forests, marine)
- Areas of indigenous interest
- Touristic (underwater) parks (service: maintaining biodiversity to enhance tourism)

Ecosystem service: preservation of human cultural history / religious sites

- Landscape parks
- Sacred sites, groves
- Archaeological parks

Other ecosystem services, in some countries formally recognised

- Flood storage areas (service: flood protection or water storage)
- Water infiltration areas (service: public water supply)
- Areas sensitive to erosion (service: vegetation preventing erosion)
- Coastal defences (dunes, mangroves) (service: protecting coastal hinterlands)
- Urban or peri-urban parks (service: recreational facilities to urban inhabitants)

Box 2: Stakeholders and participation

Impact assessment is concerned with (i) information, (ii) participation and (iii) transparency in decision making. Public involvement consequently is a prerequisite for effective impact assessment and can take place at different levels: informing (one-way flow of information), consulting (two-way flow of information), or "real" participation (shared analysis and assessment). In all stages of the process public participation is relevant. The legal requirements for and the level of participation differ among countries, but it is generally accepted that public consultation at the scoping and review stage are minimally required; participation during the assessment study is generally acknowledged to enhance the quality of the process.

With respect to biodiversity, three groupings of stakeholders can be distinguished. (N.B: note that the categories represent three levels, each higher level encompassing the earlier category):

- **Beneficiaries** of the project - target groups making use of or putting a value to known ecosystem services which are purposefully enhanced by the project;
- **Affected (groups of) people** – i.e. those people that experience, as a result of the project, intended or unintended changes in ecosystem services that they value;
- **General stakeholders:**
  - National or local government institutions having a formal government responsibility with respect to the management of defined areas (town & country planning departments, etc.) or the management of ecosystem services (fisheries, forestry, water supply, coastal defence, etc.);
  - Formal and informal institutions representing affected people (water boards, trade unions, consumer organisations, civil rights movements, ad hoc citizens committees, etc.);
  - Formal and informal institutions representing (the intrinsic value of) biodiversity itself (non-governmental nature conservation organisations, park management committees, scientific panels, etc.).
  - The general audience that wants to be informed on new developments in their direct or indirect environment (linked to transparency of democratic processes).
  - Stakeholders of future generations, who may rely on biodiversity around which we make decisions. Formal and informal organisations are increasingly aware of their responsibility to take into account the interests of these '*absent stakeholders'.*

In general it can be observed that the role of institutionalised stakeholders becomes more important at higher strategic levels of assessment; at lower level the actual beneficiaries and affected people will become more important.

There is a number of potential constraints to effective public participation. These include:

- Poverty: involvement means time spent away from income-producing tasks;
- Rural settings: increased distances make communication more difficult and expensive;
- Illiteracy: or lack of command of non-local languages, can inhibit representative involvement if print media are used;
- Local values/culture: behavioural norms or cultural practice can inhibit involvement of some groups, who may not feel free to disagree publicly with dominant groups (e.g. women versus men);
- Languages: in some areas a number of different languages or dialects may be spoken, making communication difficult;
- Legal systems: may be in conflict with traditional systems, and cause confusion about rights and responsibilities for resources;
- Interest groups: may have conflicting or divergent views, and vested interests;
- Confidentiality: can be important for the proponent, who may be against early involvement and consideration of alternatives.

3 WHAT biodiversity issues are relevant to SEA

3.1 Biodiversity in SEA – different perspectives

The spectrum of SEA ranging from those with a focus on the biophysical environment to broadly sustainability-oriented SEA focussed on the social, economic and biophysical environments, results in different perspectives on biodiversity in SEA. Although the Convention text is very clear on how biodiversity should be interpreted, day-to-day practice shows widely different interpretations. Some prominent differences are discussed below:

Biodiversity conservation as nature conservation. SEA traditionally focuses on the biophysical environment. Other instruments are used to represent the economic and social interests of stakeholders. Biodiversity therefore tends to be considered from a nature conservation perspective in which protection rather than sustainable or equitable use of biodiversity is highlighted. In this manner nature conservation becomes segregated from, and potentially conflicting with, economic and social development.

The problem with the sectoral approach in conventional impact assessment is that responsibility for biodiversity is divided between a number of sectoral organizations. For example the exploitation of fish or forest resources, agriculture, water quality and quantity management all have to do with (sustainable) use of biodiversity, but regulations and policies are defined by different entities that do not refer to their activities as sustainable use of biodiversity.

Biodiversity for social and economic well-being. In recent years, environmental assessment practices have been adopted in most developing countries. In these countries the biophysical environment, including biodiversity, is not only looked at from a nature conservation perspective, but as the provider of livelihoods. Especially in rural areas the main objective of development is the social and economic improvement of the situation of poor communities. Both social/economic and biophysical environments are seen as complementary and consequently an integrated assessment approach has been developed in many of these countries. Biodiversity conservation and sustainable use are equally important issues in SEA; decision makers have to deal with the equitable sharing of benefits derived from biodiversity in societies characterized by unequal distribution of wealth. Such integrated approaches reflect a broad perspective on biodiversity in accordance with the Convention and the Millennium Development Goals.

Merging perspectives. Both the integrated and sectorally divided approaches are converging as it is being realized that the environment, including its biodiversity components, provides goods and services that cannot be assigned to a sector (biodiversity provides multiple goods and services simultaneously) or a geographically defined area (goods and services are not limited to protected areas only). At the same time it is generally recognized that certain parts of the world are of such importance for the conservation of biodiversity, that these areas should be safeguarded for the future and require strict protective measures.

Time and space. From a biodiversity perspective spatial and temporal scales are of particular importance. In conventional SEA the planning horizon is often linked to economic planning mechanisms with planning horizons of around 15 years. Assessing the impacts on biodiversity generally requires a longer time horizon. Biophysical processes such as soil formation, forest (re)growth, genetic erosion and evolutionary processes, effects of climatic changes and sea level rise, operate on far longer time scales and are rarely taken into account in conventional SEAs. A longer time horizon is required to address the fundamental processes regulating the world's biological diversity.

Similarly, flows of energy, water and nutrients link the world's ecosystems. Effects in an area under assessment may have much wider biodiversity repercussions. The most visible example is the linkage of ecosystems on a global scale by migratory species; on a continental or regional scale ecosystems are linked by hydrological processes through rivers systems and underground aquifers; on a local scale pollinators, on which important commercial species depend, may have specific habitat needs beyond the boundaries of an SEA. Biodiversity considerations may consequently require a geographical focus that exceeds the area for which an SEA is carried out.

Opportunities and constraints versus cause-effect chains. Biodiversity underpins ecosystem services on which human well-being relies. Biodiversity thus represents a range of opportunities for, and constraints to, sustainable development. Recognition of these opportunities and constraints as the point of departure for informing the development of policies, plans and programmes at a strategic level enables optimal outcomes for sustainable development. The question at SEA level is therefore "how does the environment affect or determine development opportunities and constraints?" This approach contrasts with the largely reactive approach adopted in project EIA, where the key question being asked is "what will the effect of this project be on the environment?"

Two broad approaches can be used in SEA: the reactive cause-effect chain approach where the intervention is known and the cause-effect chain are fairly clear (comparable to EIA), and the 'bottom up' opportunities and constraints of the natural environment approach where the environment effectively shapes the policy, programme or plan. The latter is most often used in land use planning/spatial planning where interventions are potentially wide-ranging and the objective is to tailor land uses to be most suited to the natural environment.

3.2 Biodiversity in this document

The way in which biodiversity is interpreted in this document has been described in detail in the accompanying information document (see Information document to accompany EIA and SEA guidelines). The most important features are summarized below:

- In SEA, biodiversity can best be defined in terms of the ecosystem services provided by biodiversity. These services represent ecological or scientific, social (including cultural) and economic values for society and can be linked to stakeholders. Stakeholders can represent biodiversity interests and can consequently be involved in an SEA process. Maintenance of biodiversity (or nature conservation) is an important ecosystem service for present and future generations but biodiversity provides many more ecosystem services (see appendix 2 of the draft EIA Guidelines).
- Direct drivers of change are human interventions (activities) resulting in biophysical and social effects with known impacts on biodiversity and associated ecosystem services (see Box 3).
- Indirect drivers of change are societal changes, which may under certain conditions influence direct drivers of change, ultimately leading to impacts on ecosystem services (see Box 4).
- Aspects of biodiversity: To determine potential impacts on ecosystem services, one needs to assess whether the ecosystems providing these services are significantly impacted by the policies, plans or programmes under study. Impacts can best be assessed in terms of changes in composition (what is there), changes in structure (how is it organised in time and space), or changes in key processes (what physical, biological or human processes govern creation and/or maintenance of ecosystems). Appendix 2 provides case examples.

Box 3: Direct drivers of change are human interventions (activities) resulting in biophysical and social/economic effects with known impacts on biodiversity and associated ecosystem services.

Biophysical changes known to act as a potential driver of change comprise:

- Land conversion: the existing habitat is completely removed and replaced by some other form of land use or cover. This is the most important cause of loss of ecosystem services.
- Fragmentation by linear infrastructure: roads, railways, canals, dikes, powerlines, etc. affects ecosystem structure by cutting habitats into smaller parts, leading to isolation of populations. A similar effect is created by isolation through surrounding land conversion. Fragmentation is a serious reason for concern in areas where natural habitat are already fragmented.
- Extraction of living organisms is usually selective since only few species are of value, and leads to changes in species composition of ecosystems, potentially upsetting the entire system. Forestry and fisheries are common examples.
- Extraction of minerals, ores and water can significantly disturb the area where such extractions take place, often with significant downstream and/or cumulative effects.
- Wastes (emissions, effluents, solid waste), or other chemical, thermal, radiation or noise inputs: human activities can result in liquid, solid or gaseous wastes affecting air, water or land quality. Point sources (chimneys, drains, underground injections) as well as diffuse emission (agriculture, traffic) have a wide area of impact as the pollutants are carried away by wind, water or percolation. The range of potential impacts on biodiversity is very broad.
- Disturbance of ecosystem composition, structure or key processes: appendix 3 of the EIA guidelines contains an overview of how human activities can affect these aspect of biodiversity.

Some social changes can also be considered to be direct drivers of change as they are known to lead to one of the above-mentioned biophysical changes (non-exhaustive):

- Population changes due to permanent (settlement / resettlement), temporary (temporary workers), seasonal in-migration (tourism) or opportunistic in-migration (job-seekers) usually lead to land occupancy (= land conversion), pollution and disturbance, harvest of living organisms, and introduction of non-native species (especially in relatively undisturbed areas).
- Conversion or diversification of economic activities: especially in economic sectors related to land and water, diversification will lead to intensified land use and water use, including the use of pesticides and fertilizers, increased extraction of water, introduction of new crop varieties (and the consequent loss of traditional varieties). Change from subsistence farming to cash crops is an example. Changes to traditional rights or access to biodiversity goods and / or services falls within this category.
- Conversion or diversification of land-use: for example, the enhancement of extensive cattle raising includes conversion of natural grassland to managed pastures, application of fertilizers, genetic change of livestock, increased grazing density. Changes to the status, use or management of protected areas is another example.
- Enhanced transport infrastructure and services, and/or enhanced (rural) accessibility; opening up of rural areas will create an influx of people into formerly inaccessible areas.
- Marginalisation and exclusion of (groups of) rural people: landless rural poor are forced to put marginal lands into economic use for short term benefit. Such areas may include erosion sensitive soils, where the protective service provided by natural vegetation is destroyed by unsustainable farming practices. Deforestation and land degradation are a result of such practices, created by non-equitable sharing of benefits derived from natural resources.

- Three levels of biodiversity are distinguished: genetic, species, and ecosystem diversity. In general, the ecosystem level is the most suitable level to address biodiversity in SEA. However, situations with a need to address lower levels exist. Examples are provided in appendix 2.

3.3 Biodiversity 'triggers' for SEA

To be able to make a judgement if a policy, plan or programme has potential biodiversity impacts, two elements are of overriding importance: (i) affected area and ecosystem services linked to this area, and (ii) types of planned activities that can act as driver of change in ecosystem services.

When any one or a combination of the conditions below apply to a policy, plan or programme, special attention to biodiversity is required in the SEA of this policy, plan or programme.

1. Important ecosystem services. When an area affected by a policy, plan or programme is known to provide one or more important ecosystem services, these services and their stakeholders should be taken into account in an SEA. Geographical delineation of an area provides the most important biodiversity information as it is possible to identify the ecosystems and land-use practices in the area, and identify ecosystem services provided by these ecosystems or land-use types. For each ecosystem service, stakeholder(s) can be identified who preferably are invited to participate in the SEA process. Area-related policies and legislation can be taken into account (see Box 1).
2. Interventions acting as direct drivers of change. If a proposed intervention is know to produce or contribute to one or more drivers of change with known impact on ecosystem services (see Box 3), special attention needs to be given to biodiversity. If the intervention area of the policy, plan or programme has not yet been geographically defined (e.g. in the case of a sector policy), the SEA can only define biodiversity impacts in conditional terms: impacts are expected to occur in case the policy, plan or programme will affect certain types of ecosystems providing important ecosystem services. If the intervention area is known it is possible to link drivers of change to ecosystem services and its stakeholders.
3. Interventions acting as indirect drivers of change. When a policy, plan or programme leads to activities acting as indirect driver of change (e.g. for a trade policy, a poverty reduction strategy, or a tax measure), it becomes more complex to identify potential impacts on ecosystem services (see Box 4). In broad terms, biodiversity attention is needed in SEA when the policy, plan or programme is expected to significantly affect the way in which a society:
   - (i) consumes products derived from living organisms, or products that depend on ecosystem services for their production;
   - (ii) occupies areas of land and water; or
   - (iii) exploits its natural resources and ecosystem services.

Box 4: indirect drivers of change are societal changes, which may under certain conditions influence direct drivers of change, ultimately leading to impacts on ecosystem services

The performance of ecosystem services is influenced by drivers of change. In the Millennium Ecosystem Assessment (MA) conceptual framework, a "driver" is any factor that changes an aspect of an ecosystem. A direct driver unequivocally influences ecosystem processes and can therefore be identified and measured to differing degrees of accuracy. In the case of activities that have no obvious biophysical consequences it becomes more complex to define impacts on ecosystem services. The MA conceptual framework provides a structured way of addressing such situations.

Activities without direct biophysical consequences exert their influence through indirect driver of change. These operate more diffusely, often by altering one or more direct drivers, and its influence is established by understanding its effect on a direct driver.

Indirect driver of change can be:

- *Demographic*: e.g. population size and rate of change over time (birth and death rates), age and gender structure, household distribution by size and composition, migration pattern, level of educational attainment;
- *Economic* (macro): e.g. global economic growth and its distribution by country;
- *Socio-political*: e.g. democratisation and participation in decision making, decentralisation, conflict resolution mechanisms, privatisation;
- *Scientific and technological processes*: e.g. rates of investment in R&D, rate of adoption of new technologies, changes in productivity and extractive capabilities, access to and dissemination of information;
- *Cultural and religious values*: values, beliefs and norms influences behaviour with regard to the environment

Actors can have influence on some drivers (endogenous driver), but others may be beyond the control of a particular actor or decision-maker (exogenous drivers).

4 <u>HOW</u> to address biodiversity in SEA?

4.1 The assessment framework

Figure 3 depicts the conceptual framework used in these guidelines. It integrates the MA conceptual framework with a more detailed integrated impact assessment framework, describing pathways of activities to impacts. It positions the biodiversity triggers, i.e. (1) affected ecosystem services, and activities producing direct (2) or indirect (3) drivers of change in ecosystem services.

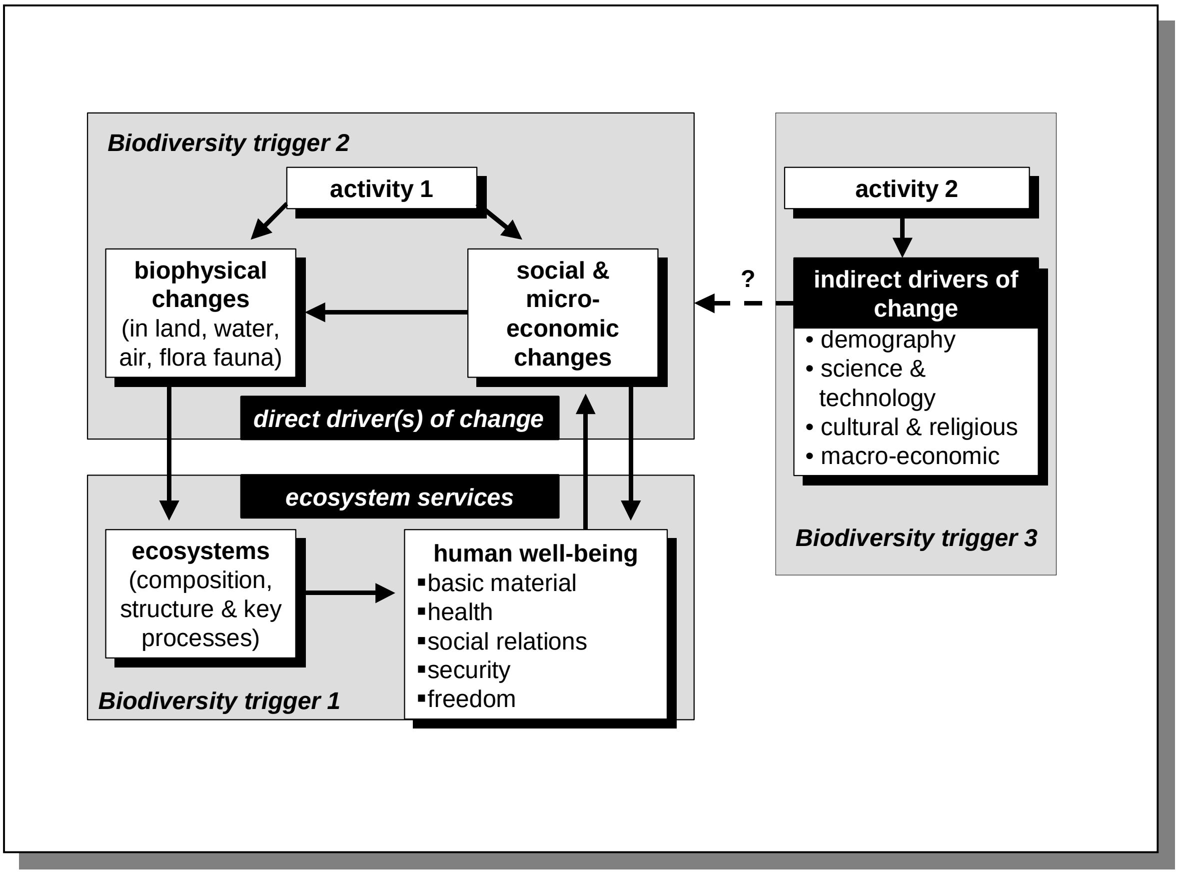

Figure 3: Assessment framework (explanation in main text)

Activities resulting from a policy, plan or programme lead to biophysical changes and/or social/economic changes (activity 1 in figure 3). Social/economic changes influence human well-being directly, but some of these changes may in turn also lead to biophysical changes (for example in-migration of people leads to occupation of land). Within their spatial and temporal range of influence, biophysical changes may influence the composition or structure of ecosystems, or influence key processes maintaining these ecosystems. Activities resulting in this type of biophysical changes are referred to as direct drivers of change. The ecosystem services provided by impacted ecosystems may be affected, thus affecting groups in society who depend on these services for their well-being. People may respond to changes in the value of ecosystem services and act accordingly, thus leading to new social/economic changes. Good participatory scoping and application of the best available scientific and local knowledge results in the identification of most relevant impacts and associated cause-effect chains that need further study in the SEA.

Identifying impacts on ecosystem services resulting from indirect drivers of change (activity 2 in figure 3) is a more challenging task. As the figure shows, the links between indirect and direct drivers of change have not yet been fully established. The scenario development under the MA provides further elaboration of the linkages between indirect and direct drivers of change in biodiversity.

4.2 Identifying potential biodiversity impacts through biodiversity triggers

Trigger 1: The area influenced by the policy, plan or programme provides important ecosystem services

Focus: Area-oriented policies, plans or programmes without precisely defined activities. Biodiversity can be described in terms of ecosystem services providing goods and services for the development and/or well-being of people and society. The maintenance of biodiversity (for future generations or because biodiversity is considered to have an intrinsic value) is often emphasized as a special ecosystem service, described in terms of conservation status of ecosystem, habitats and species, possibly supported by legal protection mechanisms.

This trigger is often associated with the 'bottom up' opportunities and constraints of the natural environment approach, as may be used in land use planning/spatial planning where interventions are potentially wide-ranging and the objective is to develop suitable land uses in line with the natural conditions.

Summary of procedure:

- Identify ecosystems and land-use types in the area to which the policy, plan or programme applies (human land-use can be considered as an attempt by humankind to maximize one or few specific ecosystem services, for example productivity in agriculture, often at the cost of other services). Identify and map ecosystem services provided by these ecosystems or land-use types.
- Identify which groups in society have a stake in each ecosystem service; invite such stakeholders to participate in the SEA process. Identification and valuation of ecosystem services is an iterative process initiated by experts (ecologists, natural resources specialists) but with stakeholders playing an equally important role.
- For absent stakeholders (future generations), identify important protected and non-protected biodiversity which is representative of species, habitats and/or key ecological and evolutionary processes (for example by applying systematic biodiversity planning or similar approaches – see appendix 2 for examples).
- Ecosystem services identified by experts but without actual stakeholders can be regarded as development opportunity. Similarly, ecosystem services with conflicting stakeholders may indicate overexploitation of this service representing a problem that needs to be addressed.

Trigger 2: The policy, plan or programme is concerned with interventions producing direct drivers of change.

Focus: As explained earlier, interventions resulting from a policy, plan or programme can directly, or through socio-economic changes, lead to biophysical changes that affect ecosystems and services provided by these ecosystems. Impacts on ecosystem services can only be defined as potential impacts, since the location of the intervention or the area where its influence is noticed may not be known.

This trigger is often associated with policies, plans or programmes without defined geographical area of intervention, such as sectoral policies, or policies, plans or programmes producing social/economic drivers of change which cannot be geographically demarcated.

Summary of procedure:

- Identify drivers of change, i.e. activities leading to biophysical changes known to affect biodiversity (see Box 3).
- Within the administrative boundaries (province, state, country) to which the policy, plan or programme applies, identify ecosystems sensitive to the expected biophysical changes. Within these administrative boundaries sensitive ecosystem can be identified. The SEA needs to develop a mechanism to avoid, mitigate or compensate potential negative impacts to these ecosystems.

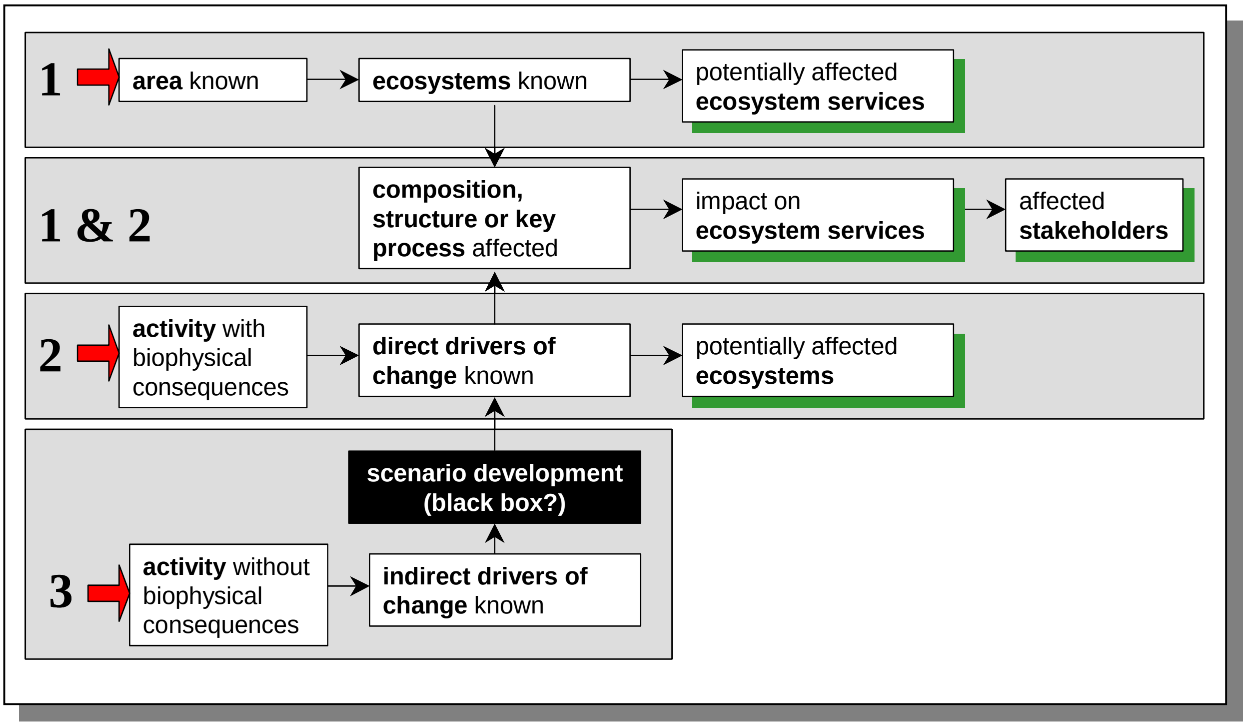

Figure 4: Summary overview of procedure to define biodiversity impacts starting with one or a combination of biodiversity triggers.

Triggers 1 and 2 combined: The policy, plan or programme concerns activities producing direct drivers of change in an area with important ecosystem services

Focus: Knowledge of the nature of interventions and the area of influence allows relatively detailed assessment of potential impacts by defining changes in composition or structure of ecosystems, or changes in key processes maintaining ecosystems and associated ecosystem services.

This combination of triggers is often associated with SEAs carried out for programmes (resembling complex, large-scale EIAs). Examples are detailed spatial plans, programme level location and routing alternatives or technology alternatives.

Summary of procedure:

The procedure is a combination of the procedures for trigger 1 and 2, but the combination allows for greater detail in defining expected impacts:

- Identify direct drivers of change and define their spatial and temporal range of influence.
- Identify ecosystems lying within this range of influence (in some cases species or genetic level information may be needed).

- Describe effects of identified drivers of change on identified ecosystems in terms of changes in composition or structure of biodiversity, or changes in key processes responsible for the creation or maintenance of biodiversity.
- If a driver of change significantly affects either composition, or structure, or a key process, there is a very high probability that ecosystems services provided by the ecosystem will be significantly affected.
- Identify stakeholders of these ecosystem services and invite them to participate in the process. Take into account the absent (future) stakeholders.

Trigger 3: The policy, plan or programme is concerned with interventions producing indirect drivers of change

This trigger is explained with an example case. The EU applies sustainability impact assessments to its trade agreements. The approach is to project effects of trade measures on consumer and producer behaviour, and hence on production systems. Baseline conditions, trends and characteristics of the production and socio-economic systems determine whether indirect consequences will affect biodiversity. This SEA works with a combination of economic modelling studies, empirical evidence from literature, case study analysis and causal chain analysis. Biodiversity impact is described in very broad terms, mainly as changes in surface area and species richness. Groupings of countries with comparable characteristics are studied in further detail by selecting one country per grouping in which an in-depth case study is carried out. The difficulty in the identification of biodiversity-related impacts lies in the definition of impact mechanism.

More research and case material is needed to elaborate this biodiversity trigger. The MA methodology is potentially valuable to identify linkages between indirect and direct drivers of change. The scenarios working group considered the possible evolution of ecosystem services during the twenty-first century by developing four global scenarios exploring plausible future changes in drivers, ecosystems, ecosystem services, and human well-being. The reports on global and sub-global assessments may also provide suitable material.

Box 5: When NOT to focus on biodiversity

A question of great concern to all those involved in impact assessment is when NOT to further study certain issues. Impact assessment can only be effective if it focuses on real issues of societal concern; impact assessment should not end up in endless data gathering exercises with little added value to decision making.

Each human activity leads to biophysical changes (by our very existence we continuously change our environment), but not all biophysical changes lead to relevant biodiversity impacts. Approaches which may be of help in limiting biodiversity-related assessment to only the significant issues are:

- **Absence of biodiversity triggers:** the area does not provide any important ecosystem services and/or the PPP does not lead to direct drivers of change known to affect biodiversity.
- **Stakeholder involvement** – if there is no stakeholder interested in speaking on behalf of an issue, there is no issue (taken that specialists are involved in identifying all potential ecosystem services and all potential stakeholders are invited in the process, including those speaking on behalf of future generations).
- **NBSAP -** Use the National Biodiversity Strategy and Action Plan to focus attention.
- **Identify threats or opportunities related to biodiversity**, do not make an exhaustive report of all biodiversity components in an area (ecosystem, species, genotypes).
- **Limits of potential impact** – limit the study area, based on knowledge of the bio-physical changes that can be expected, to pick up all biodiversity that might be affected. Similarly the study area should encompass all people who depend on biodiversity within an affected area.
- **Level of protection given to species** – if a species, expected to be influenced, is not recognised as a protected species or is not included under any international list (such as the IUCN Red List), there is no issue.
- **Limits of acceptable change, threshold of potential concern:**

- *Limits of acceptable change* (LOAC) is a planning system used by the USA Forest Service in wilderness planning and management. It uses limits of acceptable change, determined through participation and ideally consensus, to guide planning and use, tied into a system of indicators and monitoring to enable adaptive management. Use has in recent years extended beyond parks planning to sensitive area planning and managing tourism development (South Africa uses it in some of its park planning and management).
- *Thresholds of potential concern* is another term used, in particular by managers of river systems. The threshold of potential concern has a hierarchy of targets for managing biodiversity, rather than just defining the desired final outcome or endpoint (like the limits of acceptable change system above). This hierarchy builds in an ‘amber light’ system of warning of negative trends, enabling timely adaptive management.

A combination of the above system could have application in SEA. After defining threshold(s), the most likely and/or ‘worst case’ situation in terms of likely biophysical change would have to be determined, and weighed against the thresholds. If near an ‘exclusionary threshold’ or ‘limit of acceptable change’ then full attention to biodiversity in SEA would be essential; if near an ‘amber light’ threshold, some level of investigation or at least use of indicators and monitoring would be needed; if there is a wide safety margin before reaching the ‘amber light’, biodiversity wouldn’t have to be included. Setting thresholds could draw on societal values (reflected in various ecosystem-services related laws, policies, strategies, biodiversity conservation targets, etc) as well as local stakeholder values. It would also need reliable and sufficient information on ecosystem status and valued ecosystem services.

Appendix 1: Summary overview of when and how to address biodiversity in SEA

Biodiversity triggers in policy, plan or programme	*When is biodiversity attention needed*	*How to address biodiversity issues*
Trigger 1 Area known to provide important ecosystem services	*Does the policy, plan or programme influence:* - Important ecosystem services, both protected (formal) or non-protected (stakeholder values) - Areas with legal and/or international status; - Important biodiversity to be maintained for future generations	<u>*Area focus*</u> Systematic Biodiversity Planning for non-protected biodiversity. Ecosystem services mapping. Link ecosystem services to stakeholders. Invite stakeholders for consultation.
Trigger 2 policy, plan or programmes producing direct drivers of change (i.e. biophysical and non-biophysical interventions with biophysical consequences known to affect ecosystem services)	*Does the policy, plan or programme lead to*: - Biophysical changes known to significantly affect ecosystem services (e.g land conversion, fragmentation, emissions, introductions, extraction, etc.) - Non-biophysical changes with known biophysical consequences (e.g. relocation / migration of people, migrant labour, change in land-use practices, enhanced accessibility, marginalisation*).*	<u>*Focus on direct drivers of change and potentially affected ecosystem*</u> Identify drivers of change, i.e. biophysical changes known to affect biodiversity. Within administrative boundaries to which the policy, plan or programme applies, identify ecosystems sensitive to expected biophysical changes.
Combined triggers 1 & 2 Interventions with know direct drivers of change affecting area with known ecosystem services	Combination of triggers 1 and 2 above	<u>*Knowledge of intervention and area of influence allows prediction of impacts on composition or structure of biodiversity or on key processes maintaining biodiversity*</u> Focus on direct drivers of change, i.e. biophysical changes known to affect biodiversity. Define spatial and temporal influence. Identify ecosystems within range of influence. Define impacts of drivers of change on composition, structure, or key processes. Describe affected ecosystems services and link services to stakeholders. Invite stakeholders into SEA process. Take into account the absent (future) stakeholders.
Trigger 3 policy, plan or programmes producing indirect drivers of change, but without direct biophysical consequences	Are indirect drivers of change affecting the way in which a society: - produces or consumes goods, - occupies land and water, or - exploits ecosystem services?	<u>*More research and case material needed!!*</u> MA methodology potentially valuable to identify linkages between indirect and direct drivers of change.

Appendix 2: How biodiversity issues have been treated in practice

This chapter discusses a number of issues in some more detail, making use of the case material, which has been collected in the process of preparing these guidelines.

1. Biodiversity trigger 1: The policy, plan or programme affects an area with known ecosystem services

Two case studies, both from South Africa have been analysed as examples of this category. The first case provides evidence of the economic and social sense it makes to maintain biodiversity for the services it provides. It shows a good example of mapping and monetisation of ecosystem services in a known geographical area as an input for informed decision making on priorities for interventions. It strongly emphasises the value of the concept of ecosystem services as a means to translate biodiversity information into spatial planning and the language of decision makers.

- An SEA has been carried out for the planning of open space in UMhlathuze, a rapidly developing and urbanising municipality in South Africa. River catchments provided an effective environmental entity for assessing synergistic impacts of urban development. A strategic catchment assessment had to provide criteria for measures of protection and planning of development in non-developed lands. It accounted for the balance between supply of environmental goods and services provided by the natural environment and the demand for these goods and services by people. A status quo report of each catchment indicated required management actions where needed. Important benefits derived from ecosystem services included water supply and regulation, flood and draught management, nutrient cycling and waste management; these ‘free’ ecosystem services provided a calculated economic benefit of R 1.7 billion annually. Monetisation of ecosystem services made decision makers react much more openly to the need for conservation measures, even when reputed for not listening to biodiversity arguments[7].

The second case provides a mechanism to focus on maintenance of biodiversity as an ecosystem service to future generations. Unique and important biodiversity needs to be preserved in a situation of overwhelming presence of non-protected biodiversity, without jeopardizing the need of the country to develop.

- Since 2000 municipalities in South African have to prepare Spatial Development Frameworks and carry out associated SEAs. In two regions systematic biodiversity planning was applied to support this process in an attempt to improve effective consideration of biodiversity in Environmental Assessment. Most biodiversity in South Africa, including priority areas for conservation, does not fall within existing protected areas. Changing land use patterns have a major impact on biodiversity. Under such conditions sound SEA in land-use planning is critical to decision making. Systematic biodiversity planning aims at conserving a representative sample of species / habitats and key ecological and evolutionary processes. The focus on priority areas allows for recognition of competing land uses and development needs. It sets target for conservation and defines limits of acceptable change within which human impacts have to be kept. Although driven by conservation objectives, the process is very similar to SEA and outputs are easily integrated in the SEA process[8].

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[7] Van der Wateren, Thea, Diederichs, Nicci, Mander, Myles, Markewicz, Tony and O’Connor, Tim (2004) Mhlathuze Strategic Catchment Assessment, Richard bay, South Africa. Case study compiled for the drafting of CBD guidelines on Biodiversity in SEA. UMhlathuze Municipality

[8] Brownlie, S., de Villiers, C., Driver, A., Job, N. And Von Hase, A. (2005). Systematic Biodiversity Planning in the Cape Floristic Region and Succulent Karoo, South Africa: Enabling Sound Spatial Development Frameworks and Improved Impact Assessment. Journal of Environmental Assessment Policy and Management Special Edition on SEA and Biodiversity.

The combination of the two South African cases provides an excellent example on how to combine conservation of biodiversity and its ecosystems services for future generations when protection is largely lacking, with present-day sustainable use of biodiversity derived ecosystem services.

Translating biodiversity into ecosystem services is an effective means to make biodiversity tangible in impact assessment. Services represent ecological, social and economic values for society and can consequently be linked to stakeholders. Stakeholders can speak on behalf of biodiversity and can consequently be involved in an SEA process. A case from the U.K. shows that by taking an ecosystem services approach with active involvement of stakeholders, an important contribution to the definition of viable SEA alternatives was made.

- The availability of Biodiversity Action Plans (B.A.P.s) and Species Action Plans (S.A.P.s) provided biodiversity objectives for an SEA on a local flood management strategy in the UK. Within the wetland ecosystem, priority habitats and priority species have been defined in the B.A.P. Furthermore, ecosystem services were considered an important economic asset of the region, with biodiversity based tourism as most important sector. Opportunities to use wetlands for flood attenuation provided additional important benefits. Flood management was considered to be a key driver of change, as flooding is a key ecological process in wetlands. The study area was defined on the basis of likely limits of impacts. For the assessment it was considered appropriate to identify risks and the main ecological processes likely to affect outcomes for biodiversity in relation to objectives for the area. Public participation was action-oriented, focussed on identifying preferred changes to achieve outcomes compatible with stakeholder interests; local knowledge was an important source of information. Biodiversity specialists were able to provide effective flood control alternatives based on optimisation of flood attenuation as an ecosystem services[9].

A case from the Waddensea in the Netherlands shows that natural ecosystems provide multiple services. Exploitation of one service leads to potential impacts on others when key ecosystem processed are affected. Stakeholder involvement reoriented the SEA study to be more focussed on these key processes, in stead of looking at the exploited ecosystem service only.

- The Netherlands national policy on large-scale extraction of shells in marine environment required an SEA. Shell mining also takes place in protected areas, representing important international ecosystem services for the maintenance of pathways of migratory birds and breeding grounds of North Sea fish, tourism, etc. Focus of the permitting procedure was on whether shell deposits (the ecosystem service) was not overexploited; in other words the natural regeneration of shell deposits was studied in relation to exploitation pressure. However, the mining process itself also influences key ecological processes essential to other ecosystem services. Bottom morphology and related bottom life were consequently included in the SEA study. Stakeholder contributions highlighted the lack of knowledge on the function of shells and shell banks in the ecosystems. As a result more alternatives were included in the study. The study concluded that natural re-growth fully compensates mining; it was concluded however that key ecological processes should define mining conditions. Potential mining locations were ranked according these conditions. In small parts of the area the precautionary principle was applied because too little was known on the function of shell banks and mining was prohibited. An interesting equity discussion erupted. Shell mining was a monopolised business; the SEA process triggered a discussion on public tender procedures for other interested operators. This request was granted[10].

A case from the Scheldt river in Belgium shows that restoration and conservation of biodiversity was sought after as a means to optimise other ecosystem services provided by the river, representing social

[9] Jo Treweek (2004). United Kingdom: Strategic Environmental Assessment of the Lower Parrett and Tone Flood Management Strategy, Somerset, England. Case study compiled for the drafting of CBD guidelines on Biodiversity in SEA.

[10] Marlies van Schooten (2004) The Netherlands: SEA for the National Policy Plan on Shell mining. Case study compiled for the drafting of CBD guidelines on Biodiversity in SEA. SevS consultants.

and economic values, in this case safety from flooding and navigability and accessibility of the Antwerp harbour.

- The Sigma plan intends to guarantee safety against inundations in the valley of the Scheldt river and its tributaries. The study area incorporates over 250 kilometers of river valley. Most of it is subject twice-daily tides and much of the valley would be inundated every day were it not for the presence of dikes. The freshwater tidal areas are unique to Northwestern Europe. Construction of dikes resulted in considerable loss of the original biodiversity and its flood retention capacity as an ecosystem service. Partial restoration of this biodiversity and its associated flood retention function is still feasible. Nature conservation was an important element in the SEA. However, nature conservation is not seen as an end in itself, but as a way to obtain a “solid and robust” ecological system in the estuary, capable of supporting intense shipping activities (accessibility of Antwerp harbour). Other ecosystem services addressed by the SEA study are pollution breakdown and recreation.[11]

The cases presented in this guidelines document are a selective sample of good practice cases. In reality, many aspects of biodiversity will often go unnoticed in SEA as the concept of ecosystem services does not yet receive wide recognition. As stated earlier, many of the ecosystem services are considered to be the responsibility of a sector departments (fisheries, irrigation department, public works department, etc.) that have no obvious linkage with biodiversity issues and usually does not consider it’s activities in an integrated, cross-sectoral manner. This explains that many ecosystem services go unnoticed, thus losing an opportunity to describe the actual values of biodiversity. In summary: ecosystem services are linked and interdependent. SEA focused on biodiversity can help to show these linkages and thus prevent the optimisation of one service causing degradation of another, equally valuable or even more valuable service.

2 Biodiversity trigger 2: The policy, plan or programme produces direct drivers of change

Direct drivers of change are human interventions (activities) leading to biophysical and social changes with known impacts on ecosystems and associated ecosystem services. Two cases illustrate that even without concrete knowledge of where activities or impacts are geographically located, ways exist to describe biodiversity impact in general terms, design mitigation measures, and provide guidance for the further study at lower level of assessment. The first case from the Netherlands illustrates a sectoral policy without predefined locations of interventions but with a clear driver of change, i.e. a change in hydrology of surface waters and underground aquifers.

- The SEA for the Netherlands National Policy on Water Supply focussed on the most important biophysical effect of water extraction, i.e. a change in the hydrology of underground aquifers and surface waters. A major issue at national scale is the desiccation of various types of landscapes, predominantly old land-use types, predominantly being converted wetlands, rich in biodiversity and highly valued for characteristic “Dutch” landscape features. Quantitative information on potential impacts of water extraction was deemed necessary. The national scale of the study forced the study team to focus on simple vegetation indications for hydrological changes. Combination of potential hydrological changes (modelled) with nationally available vegetation data provided a computational model identifying potentially sensitive areas that require special attention. This information served the purpose of national decision making. Further elaboration of the policy into concrete plans and programmes requires further site-specific field observations to quantify potential impacts.[12].

[11] Marc van Dijk (2005). SEA of the Sigma plan for flood safety and ecological restoration of the Scheldt river. Case study compiled for the drafting of CBD guidelines on Biodiversity in SEA. Resource Analysis, Antwerp, Belgium.

[12] Marlies van Schooten (2004). The Netherlands: SEA for the National Policy Plan on Industrial and Drinking Water Supply. Case study compiled for the drafting of CBD guidelines on Biodiversity in SEA. SevS consultants.

The second case from Bolivia illustrates a programme with known area of intervention, but with unknown area of influence. It shows the importance of using SEA in a broad, integrated manner, including social and economic processes as the major driver of change in ecosystem services.

- An SEA for a 600 km road in Bolivia identified social and economic impacts as the main drivers of change associated to the road scheme. Economic development, creation of employment and immigration from the Andean highlands were considered main pressures on ecosystem services as these would lead to increased land conversion, without exactly knowing where these pressures would appear. The extent of potential influence of the road is immense and identification of impacts at each individual ecosystem was impossible. In stead, and inventory of major types of ecosystems in the entire region was made, processes of key importance for the maintenance of these system were identified, and potential impacts induced by road development were identified. A hierarchy was designed, assigning types of ecosystem into categories with differing levels of protection. An extensive monitoring and mitigation programme accompanies the road scheme, including assistance to management of national parks in the region and social support programmes[13].

A case from Sweden takes biophysical changes resulting from urban development (= the driver of change) as the basis for identifying indicators to measure change in biodiversity. The case focuses on biodiversity conservation as important ecosystem service. The case has similarities to the systematic biodiversity planning case from South Africa; non-protected biodiversity is taken into account.

- Urban planning of the area surrounding Stockholm (Sweden) requires strategic decision making on the model of urban expansion in a biodiversity rich environment. A biodiversity analysis at ecosystem level is carried out to support the SEA process. The analysis results in (i) operational targets for biodiversity conservation translating biodiversity policies into concrete objectives for the region, (ii) distinctive indicators for habitat change, (iii) reliable prediction methods, and (iv) sensible scenarios for future urban growth as a base for comparison. The indicators were linked to the major biophysical changes resulting from the driver of change, in case urban development: habitat loss, isolation/fragmentation, and disturbances[14].

Similarly biophysical changes were used as indicators to model the impacts of major interventions in river hydrology (= the driver of change) in the Netherlands. This case further illustrates the concept of ecosystem services and shows that ecosystem level information provides sufficient information for decision making.

- An SEA for a river management project along the river Meuse in the Netherlands had to study potential combinations of seemingly contradictory ecosystem services: flood control, shipping, and nature restoration. Reduction of peak flows in the river for safety was the main objective. The SEA took a historical perspective and portrayed major services of the ecosystems throughout the ages – biodiversity has been managed and exploited to such an extent that the resulting ecosystems depend on human management as a key process to maintain their appreciated features. Based on this information four alternatives were developed. Water depth, flood duration and groundwater level were considered key biophysical changes affecting biodiversity. These were modelled in a computational model and linked to the requirements of different ‘ecotypes’. It provided sufficient information to compare alternatives, although further field observation are required for later detailed intervention planning[15].

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[13] Consorcio Prime Engenharia / Museo Noel Kempff Mercado / Asociación Potlatch (2004) Evaluación ambiental estratégica y revisión / complementación del eeia del corredor de transporte santa cruz – puerto suárez. Resumen ejecutivo.

[14] Balfors, B., Mörtberg, U., Brokking, P. and Gontier, M. (2005). Impacts of Region-Wide Urban Development on Biodiversity in Strategic Environmental Assessment. Journal of Environmental Assessment Policy and Management Special Edition on SEA and Biodiversity.

[15] Marlies van Schooten (2004). The Netherlands: SEA on the routing the River Meuse (Zandmaas / Maasroute) Case study compiled for the drafting of CBD guidelines on Biodiversity in SEA. SevS consultants.

The availability of biodiversity inventory data greatly enhances SEA studies by allowing computational models to link computed biophysical changes to indicator species or ecosystems. Effects of the interventions can be estimated at a level of detail which is sufficient for strategic decision making.

3. Aspects of biodiversity

Impacts on biodiversity can best be described in terms of changes in composition (what is there), or changes in structure (how is it organised in time and space), or changes in key processes (what physical, biological or human processes govern creation and maintenance of ecosystems).

A case from Nepal shows that prior knowledge on how a biophysical change affects a specific aspect of biodiversity provides a means to focus an SEA study. In this case forestry (= driver of change) leads to selective removal of trees (biophysical change), affecting species composition.

- Plan level SEAs were carried out in Nepal to assess the environmental impacts of districts forestry plans. Forestry practices were considered to impact on biodiversity by changing the species composition of forests; this consequently was the focus of the study. The SEA resulted in recommendations on how to include conservation principles in forestry activities[16].

From India two examples were provided where the need for an SEA was triggered by protected species, but where the SEA study focussed on ecosystem and foodweb structure to provide relevant and sufficient information.

- SEA was used in India as a diagnostic tool to assess siting alternatives of a nuclear power facility. The facility was partially projected on one of India's prominent tiger reserves. The facility also affected traditional land use practices. Regulations limited the study area to a 25 km radius. Within this radius protected areas and ecologically sensitive areas were defined. The study focused on contiguity of habitats for endangered species (such as tiger, leopard, Indian wolf and others) and the area needed for predators to have sufficient stock of prey animals. In other words, the study focussed on ecosystem structure: the spatial structure of habitat and food web structure[17].
- An SEA approach was followed in India to review an EIA of a planned dam and irrigation scheme which resulted in deadlock. The deadlock resulted from a lack of attention to wildlife migration routes (including tigers). The SEA aimed at enhancement of conservation planning and mediation to steer environmental decision making. Again vital habitat links (corridors) and foodweb structure were the focus of study. The creation of a new reservoir provided important new habitats; the design of a canal created fragmentation of major habitats. Redesign of a new migration corridor upstream of the canal mitigated this problem, and the SEA resulted in renewed decision making[13].

Changes in key processes as a means to identify impacts on ecosystem services appear in the earlier described cases on flood management in UK and the Netherlands, and in the shell mining case from the Netherlands.

4. Levels of biodiversity.

Three levels are distinguished (genetic, species, ecosystems) but in general, the ecosystem level is the most suitable level to address biodiversity in SEA, as most cases above have shown. Even in cases where the trigger to start an SEA was at species level (protected tigers in India), the studies focussed

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[16] B. Uprety (2005): Integration of Biodiversity Aspects in Strategic Environmental Assessment of Nepal Water Plan and Environmental Impact Assessment of Operational Forest Management Plans in Nepal

[17] Rajvanshi & V. Matur (2004). Integrating Biodiversity into Strategic Environmental Assessment. Case Studies from India. Wildlife Institute of India, Dehradun, India.

on ecosystem structure. Similarly, the Nepal case focuses on species composition only and does not go into further detail of individual species. In other studies individual species only serve the purpose of being an indicator for changes in key ecosystem processes. The large extent of study areas, the limited resources available for SEA, and a lesser level of detail required for strategic decision making explain this focus on more generic biodiversity issues and a 'loss' of focus on species level information.

However, situations exist with a need to address lower levels. A case from U.K. shows that for local level plans it may be needed and possible that the SEA looks at species level information. The limited extent of the study area and the presence of many protected species in non-protected areas required detailed analysis of these species. As in the Swedish case, the study focussed on indicator species for each biophysical change in order to reduce data collection effort.

- In the UK A Local Transport Plan requires an SEA. In an area renown for it's species diversity, the SEA focussed on species and their habitats. Roads are considered to lead to a number biophysical changes: barrier effects (for example cutting of routes to foraging areas of bats), road mortality, emission into air and water, hydrological changes, and fragmentation of habitats. For each effect a 'focal species' was used as an indicator. Many protected species rely on unprotected countryside and species-level attention. Furthermore, the study included alternatives that would minimise impacts on priority habitat as listed in the Biodiversity Action Plan[18].

5. Legal protection - a word of caution.

A case form the Netherlands shows the far-reaching influence of a formal system of protected areas ánd a policy for the enhancement of this system as this may lead to insufficient attention to non-protected biodiversity. It forces spatial planners to take biodiversity into account and it defines the setting for SEA of such plans. Similarly formal policies trigger biodiversity attention within SEA through Biodiversity Action Plans in the UK and in many other countries.

- Analysis of four spatial planning SEAs at national, provincial and municipal level in the Netherlands revealed the overwhelming importance of the National Ecological Network (NEN, predecessor to and part of the European Natura 2000 network of protected areas). The NEN is intended to create a continuous network of protected areas; the area has been formally defined, but in broad terms. All spatial plans coinciding with the NEN have to include nature restoration measures in order to comply with the NEN policy and SEAs strictly assess proposed alternatives on this aspect. The focus consequently is on ecosystems; species level diversity does not play a role as the NEN includes species-related protected areas (EU birds & habitat directives). Further biodiversity attention is focussed on restoration of key hydrological processes in existing protected areas. Since most activities focus on enhancing the quality of existing nature and increasing the surface area of protected area, non-protected biodiversity is lost out of sight[19].

The down-side of the strong Netherlands policy on the National Ecological Network is that non-protected biodiversity and ecosystem services other than maintenance of biodiversity get out of focus in spatial planning, and even in the SEAs of such plans. SEA is supposed to picture the impacts of plans on protected and non-protected biodiversity. The built-in argument is that if biodiversity is not protected it probably is not worth taking into account and it consequently does not appear in the SEA. The UMhlathuze strategic catchment assessment (South Africa) provided very strong arguments that non-protected and non-threatened biodiversity still represents highly valued ecosystem services.

Public participation may be the key to biodiversity-inclusive SEA in cases where this is not triggered by objectives of the study or by formal regulations. In a number of cases public participation lead to a

[18] Larry Burrows (2004). United Kingdom: Integration of Biodiversity Issues into SEA: Somerset Country Council. Case study compiled for the drafting of CBD guidelines on Biodiversity in SEA. Somerset County Council, UK.

[19] Arend Kolhoff & Roel Slootweg (2005). Biodiversity in SEA for spatial plans – experiences from The Netherlands. Journal of Environmental Assessment Policy and Management Special Edition on SEA and Biodiversity.

broader perspective of biodiversity resulting in formulation of different alternatives. The UK flood management case and the Dutch shell mining case both show that public participation resulted in enhanced studies, including a significant contribution to formulation of viable alternatives.

6. Scale issues: extent and grain size.

The required level of detail in a study depends on a variety of factors, such as the spatial and temporal scale of the study, the number of relevant issues to be studied, the severity of decision making implications, available human and financial resources, etc. From a biodiversity perspective two scale aspects are important:

- The **extent** of the study, in terms of size of the area and duration of time under consideration. Physical, biological or social processes work on different scales in time and space. The extent of the study is not necessary limited by the geographical limits or by the time horizon of the policy or plan under assessment. It is important to know the relevant process to be studied and define the extent of the study accordingly.
- The **level of detail**, in ecology often referred to as **grain size**, of the study. An important determinant of the required level of detail is the level of decision making. Looking at the idealised tiered structure of SEA, in general a higher level of decision making, such as policy decisions, require lower level of detail. Descending from policy to programmes and plans the required level of detail increases while in some cases (but definitely not always) the extent of the study area is reduced. The availability of information and financial resources, and the priorities expressed by stakeholders during the scoping process will further define the level of detail at which the study needs to be carried out.

Biodiversity has fine grain and large extent. In studying biodiversity fine grain has to be sacrificed for a large extent, or reciprocally, a requirement for fine-grain information often limits the extent of the study. Some practical examples show how the dilemma of large extent and fain grain of biodiversity can be addressed in different situations. They show that biodiversity aspects composition, structure and key process provide a good means to focus the assessment and to limit data gathering requirements:

- **Limited extent with high level of detail: focus on species composition.** Selective logging by forestry activities primarily affects species composition. SEAs for district forestry plans in Nepal concentrated on the effects of forestry on forest composition and looked at species level information only. The extent of the study was limited, so species level information could be obtained[20].
- **Very large extent and low level of detail: focus on key processes.** Hydrological processes are critical for the maintenance of wetlands. Road construction potentially affects hydrology. An SEA for a 600 km road in Bolivia concentrated on hydrology as a key process (apart from social aspect not elaborated here); because the road crossed wetlands of international importance hydrological changes needed to be avoided or mitigated. Even though the extent of the study area was of such magnitude that further detailed biodiversity analysis was not feasible, the focus on hydrology provided enough relevant information for decision making[21].
- **Medium extent and reduced level of detail: focus on ecosystem structure.** An SEA for the siting of a nuclear power plant in India focussed on the connectivity of tiger habitats. The highly

[20] B. Uprety (2005): Integration of Biodiversity Aspects in Strategic Environmental Assessment of Nepal Water Plan and Environmental Impact Assessment of Operational Forest Management Plans in Nepal.

[21] Consorcio Prime Engenharia / Museo Noel Kempff Mercado / Asociación Potlatch (2004) Evaluación ambiental estratégica y revisión / complementación del eeia del corredor de transporte santa cruz – puerto suárez. Resumen ejecutivo.

endangered and strictly protected tiger triggered the study, but the study focussed on ecosystem structure, thus avoiding unnecessary detailed surveys[22].

- **Large extent, high level of detail: strong focus on key process and indicator species.** An SEA for a National Drinking Water Policy in the Netherlands concentrated on the main biophysical effects of water extraction (hydrological change). The extent of the study was large (the entire nation); defining a limited number of vegetation indicators for impact determination provided the required level of detail for policy decisions. The availability of detailed vegetation inventories facilitated the use of computer technology to highlight areas sensitive to hydrological changes.[23]

[22] A. Rajvanshi & V. Matur (2004). Integrating Biodiversity into Strategic Environmental Assessment. Case Studies from India. Wildlife Institute of India, Dehradun, India.

[23] M.L.F. van Schooten (2004). SEA for the National Policy Plan on Industrial and Drinking Water Supply, the Netherlands. Case study compiled for the drafting of CBD guidelines on Biodiversity in SEA. SevS consultants.