Strategic Environmental Assessment

Edited by Thomas B Fischer and Ainhoa Gonzalez Del Campo

In: Edward Elgar Research Handbooks of Impact Assessment Series

18. Ecosystem services in SEA - an integrating concept in a world of silo's

Summary

The need to take biodiversity better into account in planning and decision-making processes has never been more urgently publicised. Even though the concept of ecosystem services is being promoted for over 15 years as an effective concept to translate biodiversity for planners, environmental assessors, decision-makers and the public at large, there still is relatively little uptake. This chapter addresses ecosystem services in SEA. It describes the present state of affairs, and explains why the integrative concept of ecosystem services has difficulty to find its way into a world divided into silos. Finally, the chapter simplifies matters to such a level that anybody should be able to understand and work with ecosystem services.

Key words: ecosystem services, biodiversity, planning, SEA, valuation, science-policy interphase

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1. Introduction

The amount of initiatives and publications related to biodiversity, ecosystem services and natural capital over the last decade is overwhelming. Ever since the appearance of the Millennium Ecosystem Assessment (MEA, 2003 & 2005) ecosystem services have been promoted as an effective concept to translate biodiversity into understandable language for planners, decision makers and the public at large. By translating biodiversity into terms of products and services for present and future

stakeholders, the multiple linkages between humankind and its environment can be described in understandable language. Ecosystem services provide a seemingly holistic and integrated consideration of the socio-ecological system which moves away from the traditional silo-based approach of the environment (e.g. soil, water, air, flora, fauna) to one that focuses on the interconnectivity of the social-ecological system (Baker et al., 2013; Reyers et al. 2013). In spite of these apparent advantages the concept of ecosystem services has only very slowly been adopted in the practices of planning and SEA for planning.

Yet, the recent report by the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES, 2019) tells us that around 1 million animal and plant species are now threatened with extinction, many within decades, more than ever before in human history. The need to take biodiversity better taken into account in planning and decision-making processes has never been more urgently publicised. In the words of IPBES Chair, Sir Robert Watson: "*The health of ecosystems on which we and all other species depend is deteriorating more rapidly than ever. We are eroding the very foundations of our economies, livelihoods, food security, health and quality of life worldwide*."

This chapter deals with ecosystem services in strategic environmental assessment, with linkages to the world of ESIA for better understanding. It summarises the conceptual framework of the CBD Guidelines and the present state of affairs, gives some possible explanations why the world has such difficulty in dealing with the integrative concept of ecosystem in world divided into silos. Finally the chapter tries to simplify matters to such a level that anybody should be able to understand and work with ecosystem services.

Some history.

Article 14 of the Convention on Biological Diversity (1992) calls for introduction of appropriate procedures requiring environmental impact assessment of proposed projects that are likely to have significant adverse effects on biodiversity, with a view to avoiding or minimizing such effects. In support of the Convention, the Biodiversity Section of the International Association for Impact Assessment (IAIA) launched an action programme in the early zeroes (IAIA, 2001 & 2004) to draft guidelines on the integration of biodiversity in impact assessment. At the eighth meeting of the Conference of the Parties to the Convention in 2006, Parties endorsed Voluntary Guidelines on Biodiversity-Inclusive Impact Assessment (CBD, 2006), supported by a series of preparatory documents (CBD, 2002 & 2003) and followed by an academic textbook with conceptual background and case studies (Slootweg et al., 2009). The guidelines provide guidance on consideration of biodiversity and ecosystem services in both project- and strategic-level environmental assessments. The Guidelines and all related publications are based on an anthropocentric notion of biodiversity, aimed at audiences from industrialised as well as developing countries. The main message is: Biodiversity provides constraints ànd opportunities for human development through ecosystem services. Its conservation is needed to provide the same opportunities for future generations (i.e. intergenerational equity).

In 2017, 10 years after the adoption of the CBD Guidelines , the CBD secretariat requested the author to make an inventory with respect to the global state of their application. The results were discussed at the IAIA 2017 conference in Montreal (Slootweg, 2017). The document served as a prelude to a new decision text of the Convention on mainstreaming of biodiversity in major economic sectors. In November 2018, COP Decision XIV/3 was adopted (CBD, 2018), '*encouraging Parties, and inviting*

other Governments and relevant stakeholders, notably public and private entities engaged in the energy and mining, infrastructure, manufacturing and processing sectors to include approaches to conserve, enhance and sustainably use biodiversity and ecosystem functions and services in upstream decisions on investments in these sectors, through such available tools as strategic environmental assessments and integrated spatial planning, including the evaluation of alternatives to such investments'.

2. Ecosystem services in SEA: conceptual framework

The term biodiversity-inclusive SEA as used by the CBD Guidelines is following the CBD biodiversity definition. It encompasses the three levels of biodiversity as defined by the convention (genetic, species and ecosystem diversity), and addresses the three objectives of the convention, i.e. conservation, sustainable use and equitable sharing of the benefits derived from biodiversity. The Millennium Ecosystem Assessment (2003) provided the conceptual background and the vocabulary to link biodiversity to human stakeholders by means of ecosystem services. Ecosystem services are defined as '*the benefits that people obtain from ecosystems*'.

The MEA recognises 4 groups of ecosystem services: (i) provisioning services providing harvestable products such as food, water, wood, constructions materials, genetic resources, etc.; (ii) regulating services such as water storage and filtration, flood defence and climate regulation, but also processing of waste or disease regulation by biological control mechanisms; (iii) cultural services that people can use for aesthetic (such as attractiveness of landscapes), spiritual (e.g. holy grounds or waters), educational (places of outstanding scientific interest) or recreational purposes (fundamentally important for the world's largest economic sector, tourism). The fourth category of supporting services are internal ecosystem services needed to create the other three categories of services. These include nutrient cycling, soil formation, primary production, evolutionary processes, etc. In impact assessment the first three categories are used to described impacts; the fourth category is not counted to avoid double counting, but may be needed to understand underlying mechanism through which ecosystems are affected.

Recently the term 'natural capital' is gaining ground, especially in the sector of responsible business conduct, probably because the wording has more resonance in a neoliberal capitalist world. The Natural Capital Coalition (www.naturalcapitalcoaltition.org) developed a Natural Capital Protocol (2016) which states that biodiversity is both a part of natural capital and also underpins ecosystem services. Where natural capital represents the stocks of renewable and non-renewable resources (e.g. plants, animals, air, water, soils, minerals), ecosystem services represent the flows of benefits to people. According to the natural capital coalition any part of the natural world that benefits people, or that underpins the provision of benefits to people, is a form of natural capital. Biodiversity is said to be an essential component of natural capital stocks, even though the exact linkages between biodiversity and natural capital remain unexplained.

Ecosystems provide ecosystem services; according to the CBD definition an ecosystem is '*a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit*' (Article 2 of the Convention; underlining by the author). Here the interpretation of natural capital derails from the CBD ecosystem definition and creates unnecessary

confusion. Ecosystems already include the non-living environment. If the protocol would simply state that natural capital is provided by ecosystems, the confusion about the linkage between biodiversity and natural capital would have been avoided. However, natural capital includes non-renewables (such as minerals or fossil groundwater). The question whether these can ever be exploited in a sustainable manner is left open. In the view of many, including myself, responsible exploitation is the attainable maximum. So far for natural capital.

Biodiversity-inclusive impact assessment thus refers to biodiversity *sensu stricto* (the diversity of ecosystems, species and genes), ecosystem services (the benefits obtained from biodiversity) and the beneficiaries of these services (that should benefit from biodiversity in an equitable manner). Ecosystem services thus act as an integrating concept linking the biophysical environment to human well-being. We will see later in this chapter that in impact assessment there is a widening gap between the world of experts in biodiversity *sensu stricto,* usually focussed on nature conservation, and the world of ecosystem services and their beneficiaries, considered by some as being "*something social*" (citing a member of IAIA's biodiversity section).

The conceptual framework behind the CBD guidelines is extensively described by Slootweg et al. (2009, based on Slootweg et al, 2001 2003). A short summary is provided below on the impact assessment framework, in order to understand some basic concepts (see figure 12.1).

Direct drivers of change: The first step in the impact assessment framework is the description of direct drivers of change, i.e. activities and their effects that change ecosystems and services provided by these ecosystems. Activities can be biophysical as well as societal interventions. Biophysical interventions lead to biophysical effects being defined as changes in the characteristics of the recipient media soil, water, air, flora and fauna. Activities may also lead to societal effects being defined as changes in the characteristics of components of society (individuals, families, functional groups or a society as a whole). Societal effects can in turn lead to biophysical effects (creation of job leads to influx of people, in turn leading to increased pressure on land and water resources). Biophysical and societal effects are neutral entities and can be measured or modelled by external experts; they are not determined by human 'values' or 'meaning'. The magnitude of effects and the direction of change are determined by the combined characteristics of the intervention and the recipient involved.

Range of influence: Biophysical effects resulting either directly from biophysical interventions, or indirectly through societal interventions, are pivotal to the impact assessment framework as these are the actual agents of change in ecosystems and in the services provided by these ecosystems. An important characteristic of biophysical effects is their spatial as well as temporal range of influence. Each biophysical effect has a geographical range of influence (areas of influence: where and how far away), and a time range (when and for how long, permanent or temporary). Experts can model biophysical effects or use empirical evidence to predict where and when an effect will be noticeable. Local knowledge and experience can be helpful as well.

Impacts: By knowing the range of influence of each biophysical effect (for example drawn on a map), the affected ecosystems and land-use types can be identified, each providing a unique set of ecosystem services. Depending on the sensitivity of an ecosystem or land-use to a biophysical effect, the provided ecosystem services may change. A change in provided services will lead to a change in their value for human society and consequently has an impact on human well-being, positively or

negatively. Values can be expressed in economic, social or ecological terms, providing valuable information for decision making on proposed (alternative) activities. Different (groups of) stakeholders can value the effects on ecosystem services differently; in other words, impacts are context dependent. An important consequence of this notion of context dependency is that impacts cannot be determined by external experts only; representatives of the local society have to be consulted. The importance of identifying stakeholders when looking for ways to put biodiversity on the agenda in environmental assessment is apparent. More strongly stated, it can be argued that ecosystem services without stakeholders will go unnoticed in environmental assessment, and as a consequence biodiversity will receive less or no attention.

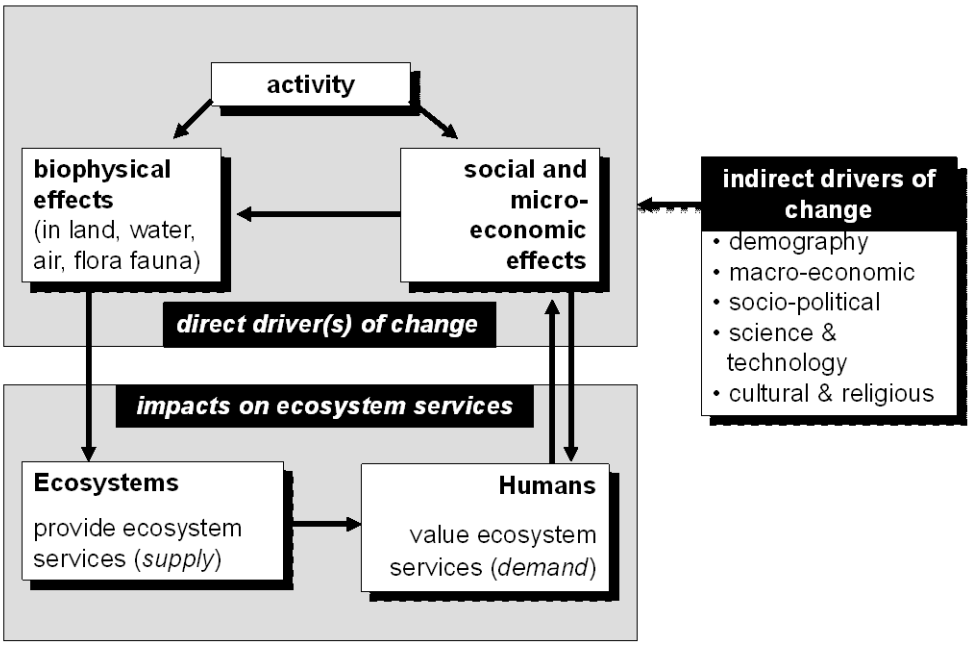

Figure 1: the impact assessment framework (Slootweg et al., 2009)

Direct social impacts: Depending on the characteristics of the existing community, social effects may lead to direct social impacts that may vary between affected groups.

Induced social changes: As human beings or society as a whole are, contrary to the biophysical world, able to respond actively to impacts, the experience of social impacts in some cases leads to induced social effects. For example, a negative impact on living conditions (= ecosystem service) may cause people to move to other areas; a positive impacts may cause people to migrate towards the area. This creates a potential endless loop in the framework; this can be avoided by appropriate scoping.

Indirect drivers of change are societal changes which under certain conditions may influence direct drivers of change. They operate diffusely; their influence is established by understanding their effects on a direct driver of change.

Endogenous and exogenous drivers: endogenous drivers of change are within the influence of a proponent (example: a dam operator can influence river flow and downstream hydrology). Exogenous drivers of change are beyond the influence of a proponent (example: the upstream availability of water may change under the influence of climate change; this cannot be influenced by a dam operator). Depending on the level of planning and decision making, drivers of change may be endogenous or exogenous. For example, changes resulting from climate change may lie beyond the influence of a hydropower dam operator (exogenous) , but they are the subject of global climate negotiations under the Paris agreement. So, whether a driver of change lies within or outside the influence of a plan and its SEA, can be dependent of the decision-making tier.

3. Ecosystem Services in SEA Guidance

The Convention on Biological Diversity.

As explained in the former section the Voluntary Guidelines on Biodiversity in Impact Assessment (CBD, 2006) are fully harmonised with the Millennium Ecosystem Assessment and recognise ecosystem services as the means to translate biodiversity into human values. The guidelines differentiate between four different situations in the way ecosystem services can be addressed in SEA:

1. PPP's for which the sector activities are known; the area of implementation is not (yet) known. In SEA the drivers of change can be identified and described. Ecosystems or types of land-use with valued ecosystem services which are sensitive to these drivers can be identified, allowing to create a sensitivity map. Such approach can be used in pro-active SEA for sector development planning.
2. PPP's for which the area is known, but the type of activities not (yet). Ecosystem services and their stakeholders can be identified, including their present status. For example a map can be created indicating whether ecosystem services are over- or underexploited. This can be translated into a development opportunities and constraints map in pro-active SEA for regional (spatial) development planning, or river basin management planning.
3. PPP's for which both the sector interventions and the intervention area are known. This provides the most advanced level of information: drives of change, area of influence of these drivers, potentially affected ecosystems and ecosystem services, including their stakeholders can all be identified. This usually applies to SEAs for implementation programmes, often in the format of a re-active EIA-like SEA.
4. PPP's only affecting indirect drivers of change. This can apply to, for example, SEAs for economic incentive packages, trade agreements, tax plans. Obviously this is a more complex plan for SEA. It may depend on advanced scenario development or modelling. I would like to argue that Resilience Theory (Slootweg & Jones, 2011; Walker & Salt, 2006) may provide important clues on how to deal with ecosystems and human society (or socio-ecological systems in resilience terminology) in such SEAs, but I will not go into any further detail here[1].

[1] Resilience is a fashion word and with it comes confusion on its meaning. In 2010 the IAIA organised its first workshop on the application of Resilience Theory in impact assessment, Resilience Theory being the most far-

This categorisation was created to show that lack of detailed information on planned activities or planning location, a usual trait of SEA, cannot be an argument to avoid addressing biodiversity issues in SEA. The argument of too little information cannot and should never be used. Reversely, SEA as a tool to assess the consequences of plans at strategic level has always been considered a better tool to address issues at the scale of ecosystems and landscapes in an integrated manner, including its potential to better address cumulative impacts.

The Voluntary Guidelines have directly initiated or influenced the Guidelines on Biodiversity in Impact Assessment of the Ramsar Convention(Ramsar, 2010), the CBD Guidelines on Biodiversity in Impact Assessment in Marine Environment (CBD, 2012), further guidance by OECD-DAC on ecosystem services in SEA (OECD, 2008), and TEEB Guidance for local policy makers (TEEB, 2012). UNEP published a practitioner's guide on the integration of ecosystem services specifically in SEA (Geneletti, 2014). It positions itself as an add-on to existing SEA procedures, focussed on situations where proposed plans either depend on, or impact upon ecosystem services. The UNEP Guide misses out the pro-active use of SEA to identify opportunities and constraints for development based on an ecosystem services assessment in a geographically defined area.

Multilateral Development Banks.

A far reaching effect on impact assessments is created by the binding requirements of the safeguards of multilateral development banks. Among these, the IFC Performance Standards (IFC, 2012) represent the most comprehensive and coherent treatment of biodiversity in a regulatory context. It makes a clear distinction between biodiversity *sensu stricto* (in modified, natural and critical habitats), ecosystem services (and their link to stakeholders) and production of living natural resources (agriculture, animal husbandry, fisheries, forestry). It requires the client to identify the priority ecosystem services impacted by the project and the priority ecosystem services on which the project depends; when affected, communities should participate in the determination of priority ecosystem services. Where the project has direct management control, the mitigation hierarchy has to be applied (avoidance > mitigation > compensation). Where impacts are unavoidable the client is expected to maintain the value and functionality of priority services. The IFC PSs have been the driving force behind the World Resources Institute guidance documents on ecosystem services in impact assessment (Landsberg et al., 2013), the Cross sector Biodiversity Initiative (Ekstrom et al., 2015), and sector specific documents, notably those by IPIECA, the global oil and gas industry association for advancing environmental and social performance IPIECA / IOGP, 2015) and the International Council on Mining and Metals (ICMM, 2006).

In practice, ecosystem services assessments simply were an add on to the existing ESIA structure, not adding much to the available information, and definitely not taking advantage of the integrative character of ecosystem services (Rosa & Sanchez, 2015). As shown above the ecosystem services concept provides a conceptual umbrella that should not become pushed into a separate assessment (Baker et al., 2013). This is exactly what has happened in many ESIAs following the IFC requirement; i.e. ticking the box of things to do without actually understanding the real purpose of it. The

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reaching and innovative way of thinking about complex systems, sustainability and the future. Some steps have been made to integrate this resilience thinking into strategic environmental assessment, but up to this date this largely remains an academic discussion. Other meanings of resilience include ecological (or biophysical) and engineering resilience of ecosystems and the built environment to absorb expected shocks caused by climate change.

challenge of such assessment is to integrate the ecosystem services analysis in such a way that it does not duplicate other analysis (Rosa & Sanchez, 2015). If ecosystem services are used as an integrative approach, from scoping to follow up, it could mean an opportunity to improve the impact assessment process and its outcomes.

Many professionals consider IFC PS6 the best available, doing justice to all the work which has been done over the previous decade on biodiversity and ecosystem services. They well reflect the principles and intentions of the CBD Voluntary Guidelines. Emphasising both potential impacts ánd dependencies on ecosystem services is a major advancement in thinking about the relation between humankind (private businesses in this case) and the biophysical environment. Like the UNEP Guide above, the IFC PS6 and related documents overlook the supply side of the environment in terms of opportunities and constraints for development. When pro-actively planning for new developments such inventory can provide the boundaries within which resources can be sustainably exploited. This omission can of course be explained by the project focussed nature of the standard.

Where IFC PS6 is consistent with the overall objectives of the safeguard policy (in turn consistent with the CBD Voluntary Guidelines), the new World Bank Environmental and Social Standard 6 (World bank, 2016) is not. The overarching Environmental and Social Framework objectives and even the Environmental and Social Standard 1 on impact assessment refer to threats to biodiversity and to ecosystem services. Yet, the requirements of ESS6 on biodiversity refer to '*vulnerable biodiversity or habitats*' and '*the differing values attached to biodiversity and habitats by project affected parties and other interested parties*'. What the word 'values' stand for is unexplained; the same applies to 'other parties'. It does not make clear whether these encompass ecosystem services; only in a footnote it refers to ecosystem services, where it stipulates that requirements related to ES are set out in ESS1. On the other hand, ESS 4 on Community Health and Safety includes a requirement on '*impacts on ecosystem services that may result in adverse health and safety risks to and impact on affected communities*', thus putting ecosystem services in a social perspective. Such social entry point may provide an effective mechanism to deal with ecosystem services

A similar divide between diversity and ecosystem services is created by the Multilateral Financing Institutions Biodiversity Working Group (2015) in its Good practices for Biodiversity Inclusive Impact Assessment and Management Planning. The document contains the logos of all major development banks including World bank, IFC, Inter-American, Asian and African Development Banks, European Investment Bank and European Bank for Reconstruction and Development, and some bilateral donors. Given the wealth of available recent literature, it is an amazingly superficial document not taking into account any of the developments in thinking about biodiversity-inclusive impact assessment over the last decade. It only focusses on species, habitat and ecosystem conservation. There is no mentioning of ecosystem services; instead it refers to biodiversity values without any further definition; linkages to social aspects are completely lacking. There is a total absence of recent literature, IAIA Guidance information, CBD is not even mentioned. Rather contrasting to the Multilateral Financing Institutions document (that contain the logos of ADB and IADB), the Asian Development Bank (2013) and the Inter-American Development Bank (Watkins et al., 2015) consistently refer to biodiversity and ecosystem services in their guidance documents. IADB for example states that a '*consultant should follow international good practice for ecosystem services screening and ecosystem services review such as provided by IFC PS6 or the World Resources Institute*'.

Conclusions.

In its new EES6 the World Bank creates a mist around ecosystem services. From it, the good reader and the willing can make a case for the use of the ecosystem services concept to define values of biodiversity; the unwilling may get around it. A race to the bottom may be expected, with protected biodiversity being the only biodiversity aspect being clearly defined. The Good Practices for Biodiversity Inclusive Impact Assessment document produced by the Multilateral Financing Institution Biodiversity Working Group shows a similar inconsistency and shies even further away from the social side of biodiversity. The retreat from addressing ecosystem services in two recent guidelines by development banks cannot be a coincidence. Although it is a bit bewildering that the individual members of this working group still address ecosystem services in the way IFC does it.

Where the 'green' professionals apparently have difficulty in getting ecosystem services operationalised in the context of impact assessment, the World Bank maintains the concept it ESS 4 on Community Health and Safety. The social professionals can maybe better relate to it, as the concept is directly linked to human well-being. It provides an opportunity to reframe ecosystem services from a social perspective. However, splitting up biodiversity between the social and biological realms is risky since care has to be taken that human exploitation of ecosystem services will remains within limits of (biophysical) sustainability and a functional ecosystem.

The reasons for the 'de-linking' of ecosystem services from biodiversity in ESS 6 and in the MFI document, are unclear (Slootweg, 2017). Interviewees report a lack of clear methodologies to assess ES, a lack of communication, and resulting collaboration, between 'social' and 'green' expert communities, including within the banks, difficulties in aligning the ES assessment with bank procedures. Given the enormous amount of theoretical progress and considerable practical experience on ecosystem services assessment over the last two decades, these reasons sound somewhat puzzling. An attempt to explain why all this material hasn't reached the people having the do the real work follows in the next section.

A last remark on the development banks refers to the use of SEA. Even though reference is made to the need for strategic planning and SEA, the banks show varying effort to actually support countries in applying SEA. The World Bank has applied SEA for some time (SESA in their terminology) but moreover as a due diligence tool for their own procedures and less in support of countries to develop their capacity. On the other hand the Asian Development Bank provided strong support to the Greater Mekong Region in developing their SEA capacity (notably Vietnam). The bank least expected to promote SEA, private investors focussed IFC, has implemented a nationwide SEA for the hydropower sector in Myanmar (IFC, 2018), being a showcase of good practice SEA. IFC is struggling with the rapid and uncontrolled development of individual hydropower projects by private sector actors and is also pushing for more cumulative impact assessments (CIA) of multiple projects in a river basin. The question here whether CIA fits in the SEA family of tools or whether it is a special case of ESIA is subject of a planned publication by NCEA (in prep.)

4. Ecosystem services in practice

Assessment and valuation methods of ecosystem services

The last decade has seen an explosive growth of the number of approaches to assess and value ecosystem services. In this respect it is important not to confuse the generic term *ecosystem services assessment* with SEA. Ecosystem services assessment encompasses all available methodologies to identify, describe, quantify and value ecosystem services. SEA on the other hand, is a process with internationally shared objectives and principles, often procedurally defined and legally binding, by definition linked to decision making. Ecosystem services assessment may thus provide content for an SEA process.

An evaluative study of different approaches to valuation showed there is no one-size-fits-all-approach to ecosystem services assessment. Four key questions need to be answered before being able to define the appropriate method (Berghöfer et al. 2015):

1. Assessment purpose: Assessing ecosystem services can be done for different purposes. They range from raising general awareness to supporting specific planning or decision making.
2. Assessment context: To meaningfully assess ecosystem services it is crucial to understand the context, i.e. the 'supply side' (the ecosystem) and the 'demand side' (the socio-economic, cultural and political system). Understanding this context helps the analyst to ask the right assessment questions; and also the results need to be interpreted in context.
3. Choice of method: Different methods generate different results because they represent different perspectives or focus on different factors. Assessments thus shape values, even if their main aim is to measure them. This means to select an approach (e.g. qualitative, quantitative, or monetary valuation) and to strike a balance between costs, quickness, robustness and detail of findings. More demanding methods do not per se produce more useful results.
4. Connection with policy process: Doing an assessment is unlikely on its own to change policy processes or decisions. Engaging key stakeholders early on and strategically gearing the assessment to political entry points enhances its potential policy impact. Sometimes the (participatory) assessment process itself is just as important for leveraging policy change as the assessment results.

For the SEA community most of the above sounds familiar of course. Slootweg & Beukering (2008) in their overview of ecosystem services valuations with concrete influence on decision making distinguished four distinct levels in methods of ecosystem services assessment:

1. Identification: Recognising ecosystem services raises awareness on issues that had not been thought of before and recognises stakeholders that had been overlooked. Even this most simple ES overview is shown to be of influence on planning an decision making.
2. Quantification: a service can be quantified in its own terms, such as the quantity of renewable water supply, the annual sustainably harvestable amount of fish, timber or fodder from a specific area, amount of carbon stored, number of species occurring in the area, etc. Such quantification allows, for example, for comparison of the impacts of alternatives. Rapid, semi-quantitative proxies are often effectively used. Stakeholders and decision makers can easily relate to such methods.
3. Societal valuation: ecosystem services represent sociocultural, economic and ecological values for society that can be expressed in different terms: examples can be the number of households depending on a service (e.g. in subsistence farming), the number of jobs related to a service (e.g. in fisheries), the number of people protected against forces of nature (e.g. by coastal dunes or

mangroves), the number of red-listed species in an area (red-listed being a societal expression of ecological value), the contribution that an area makes in maintaining other ecosystems (e.g. in the case of migratory fish & birds, or sediment flows in delta's), etc. In practice this appears to be very relevant information for decision makers.

4. Economic quantification of ecosystem services values: the most data intense and complicated valuation methods applying to situations where plans are known in some more detail, often leading to an aggregate total economic value (TEV) of an ecosystem. Contains methods for market based valuation (e.g. net factor income approach), revealed preference methods (e.g. hedonic pricing, avoided damage, travel cost method, etc.), and stated preference methods (e.g. contingent valuation, choice modelling). Outcomes of such approaches are often perceived as coming from a technocratic black box.

The many choices to be made at strategic planning levels imply that quantitative data may not readily be available. In such cases simpler methods have preference over more complicated financial quantification methods. Another observation is that the majority of publications on ecosystem services assessment do not relate to any concrete planning or decision-making situation. Consequently, recommendations from such assessments may not be noticed or used in practice.

Use of ecosystem services in SEA practice

A serious lack of overall evaluations of the effectiveness of SEA in addressing biodiversity hampers a comprehensive analysis (Slootweg, 2017). The little available information points into certain directions. Biodiversity is gradually better taken into account; the quality of impact statements several years after the adoption of the CBD Voluntary Guidelines were found to be better compared to before. Yet, the quality of impact statements shows an enormous variability. SEA seems to live up to its promises by doing a better job at the landscape level (including ecosystem services), providing more room for alternatives, and better taking into account cumulative impacts. However, many bad SEAs do exist. The relatively short track record for SEA does not provide room for comparison over time. Country regulations often have a narrow focus on biodiversity (species and habitat conservation) leading to a neglect of ecosystem services. Additional donor requirements usually lead to better quality impact assessment. Donor and capacity development support contribute to the quality of impact assessment.

Ecosystem services have been promoted as an effective concept to translate biodiversity into understandable language for planners, decision makers and the public at large (CBD, 2006; CBD Secretariat & NCEA, 2006; Partidario & Gomes, 2013; Geneletti, 2013; Baker et al., 2013). There still is a significant gap in the understanding of how ecosystem services exactly relate to ecosystem, species and genetic diversity. Research on biodiversity and ecological function[2] has routinely '*measured functions without extending those to known services'* whereas the ecosystem services field has '*described services without understanding their underlying ecological functions*' (Cardinale et al, 2012, in Brownlie et al, 2013). In practice, however, this doesn't have to hamper effective use of the

[2] Function in ecology usually relates to roles that organisms play in an ecosystem; for example green plants convert sunliht into carbohydrates; soil organisms act as decomposers of organic materials; predators regulate populations of animals, etc. The terminology is confusing as function can be used in different meanings, and may be confused with ecosystem service.

ecosystem services concept. Ecosystem services may be quantified, even when we do not have complete ecological knowledge of all involved species and their roles in the delivery of a service (Slootweg et al., 2010a). The real value of ecosystem services for SEA lies in (IAIA, 2016) (i) the description of the environment in understandable language (i.e., human values); (ii) the recognition of affected groups and whether these are winners or losers of proposed plans, to make impacts on people transparent and facilitate equitable distribution of benefits from development (Mandle & Tallis, 2016); (iii) it provides of a holistic framework to describe linkages between people and their environment beyond silo-and sector based approaches; (iv) it is a means to cross boundaries between sectors and actors (i.e., planners, stakeholders and decision makers); (v) and it is a means to identify relevant geographic scales for negotiating trade-offs, while maintaining the integrity of ecological systems and processes. In spite of these apparent advantages the concept of ecosystem services has only very slowly been adopted in practice (Slootweg & Beukering, 2008; Baker et al, 2013; Geneletti, 2011 & 2013; Laurans et al, 2013). Honrado et a. (2013) consider it "*striking how EIA and SEA miss the opportunity of exploring how ecosystem services can improve local well-being*". So either the concept doesn't work or the efforts to make it work are ineffective.

Why so little uptake of ecosystem services in SEA practice?

In a search for the reasons why the concept of ecosystem services, supported by strong scientific evidence, has so little uptake in the worlds of planning and environmental assessment, Slootweg (2015) distinguished three main reasons (for more detail see also Berghöfer et al, 2016):

Unwillingness. Since SEA has to inform decision makers on plans with significant investments and serious consequences, it is always surrounded by power play. Powerful investors or sector departments want to see their investments or plans realised. In many countries environmental assessment is the only instrument available to force these actors to be transparent on their policies and plans, and to take into account the 'voiceless' in society. This is a main reason why environmental assessment processes are so often flawed by corruption, bad performance, too little too late reports, etc. It is not the quality of the instrument but the powerplay around the instrument aimed at minimising its influence, which causes the trouble. There are many circumstances in which governments and private sector alike explicitly do not want to know all things, or do not want it to be known in the public domain. It is unfair to blame SEA for bad decisions so often made. On the contrary, SEA can be an instrument to recognise the value of ecosystem services for communities and should be supported through the empowerment of civil society organisations (including the press)[3], capacity building exercises, and promotion of the effective use of this universally available tool.

Silo thinking. The world is organised according to sectors, each having its own educational background, its own working environment, its own language and culture, its own silo. Where silo's do not meet, it works well. However in an increasingly crowded and interconnected world it creates problems. Ecosystem services have appeared in thousands of scientific publications and in hundreds of valuation studies (Laurans et al., 2013). These studies are commissioned by, implemented by and aimed at green sector actors and audiences and not at audiences that govern economy and

[3] See for example the GEF Small Grants programme for civil society organisations (https://sgp.undp.org/).

development. To have actual 'real world' impact the concept should be applied in policy and planning processes in other sectors as well and applied to all types of landscapes. The Biodiversity Convention has clearly recognised this issue and has recently adopted Decision XIV/3 on mainstreaming of biodiversity in the energy and mining, infrastructure, manufacturing and processing sectors. If we want to get the biodiversity messages across, we have to leave our green silo and get involved in other sectors, go to their professional associations meetings, learn their language, and understand the opportunities and constrains for mainstreaming from the sector's perspective. The CBD Decision refers to SEA and strategic planning, both from sector and spatial perspective, as important tools for such mainstreaming (CBD 2018, NCEA 2017).

An ineffective science-policy interface. A common trait in many ecosystem services studies is the absence of actual planning and decision-making issues for which these studies have been designed. The assessors think that showing the value of ecosystem services will automatically do the work. However, these assessments have not been designed to answer specific policy, planning or decision-making questions and may go unnoticed or may provide inappropriate information. For example, do we need to know the present level of services delivery, or the potential future delivery, or the past pre-degradation level, or do we need to know the pace of change in service delivery, over time or over space. Last but not least, do we need to know the total economic value of services or do we want to know where services delivery changes and who will be the winners and who the losers. In summary, the what / who / where / when / how questions define the type of information needed. This can hardly be predefined. So, having a solution ready, without having a clear issue or problem seems to miss the point. Much of the TEEB work, the European MAES programme[4], and many academic valuation studies are characterised by this 'solution for an unknown problem' approach. Based on Ruckelshaus et al. (2013) a number underlying of causes may explain this hampered science – policy interface :

It's the process! The process in which biodiversity and ecosystem services information is embedded is at least as important as the scientific tools and outputs (content). To be used in decision making, information has to meet three requirements; it has to be scientifically valid (credible), socially accepted in the sense that it addresses stakeholder concerns in a procedurally fair manner (legitimate), and it has to be relevant for decision makers (salience) in the sense that the right kind of information is presented within the broader policy context, at the right moment in time (Cash et al., 2003 in: Slootweg & Mollinga, 2010). In decision making context '*the recurrently experienced problem is that decision makers are not getting information that they need and scientists are producing information that is not used*'. An interactive science-policy process, meaningfully involving scientists, local experts, stakeholders and decision makers, enhances the credibility, salience and legitimacy of the information (Ruckelshaus et al., 2013).

Keep it simple. Where scientists proposed to start with quantitative Tier 1 models, intending to develop more complex, detailed and data intense Tier 2 and 3 models during the study period, decision makers insisted on developing simpler Tier 0 models, based on semi-quantitative ranking methods. Ranking models allow for an iterative process to rapidly develop and compare alternatives in a transparent manner and allow stakeholders to actively engage in the debate. While in the eyes of the scientists the information may be less than optimal (credibility), the legitimacy and salience of

[4] Mapping and Assessment of Ecosystems and their Services; http://biodiversity.europa.eu/maes

the information is significantly enhanced thus making the obtained information more relevant for decision making.

It's not always about the money. Valuation models that provided estimates of monetary benefits were less important than anticipated (Ruckelshaus et al., 2013). Decision makers often want to understand the consequences of alternative decisions on specific groups of stakeholders. Monetary value information does not provide this information. Moreover, absolute values may not be that relevant, rather it would be more feasible to assess the relative magnitude of changes across different alternatives (Baker et al., 2013).

Involve local experts. In spite of several decades of participatory planning, action research, development cooperation lessons, and endless pleas for involvement of local experts and traditional knowledge, apparently a part of the expert community still ignores these lessons. Christie et al, 2012, report that half of the biodiversity valuation research they reviewed, failed to involve local researchers or policy makers. In everyday practice too many plan and SEA process are carried out from behind desks.

Use knowledge brokers. Reinecke et al. (2013) refer to knowledge brokers that try to bridge the gap between scientists, policy-makers, interest groups, the media and citizens. The incentives for scientists lie in innovation, developing new ideas that can be associated to their names in the scientific literature. Policy makers need more simple and generalised rules of thumb that they can use in complex decision making processes; public praise of the quality of their decision is their incentive. So, the most interesting and thought provoking ideas for a scientist usually are a nightmare for decision makers.

The overall conclusion is similar to the lesson that many environmental assessment practitioners have learned in practice: the simpler - the better, as long as the information is of good quality, relevant to decision makers and reflects the interests of stakeholders. So, maybe forget about computational models and monetary valuation for a while and first start asking local people and local experts and listen well to the language they use.

5. The way forward

Who takes the lead? The discussion on how to deal with the integrative concept of ecosystem services in a world divided into sectors and silos has shown to be a difficult one. Where IFC has accepted to embed this new concept within the organisation and (still) is in support of the concept, other development banks (notably World Bank and the Biodiversity Working Group of the Multilateral Financing Institutions) have decided to maintain a silo based approach to biodiversity. This implies biodiversity to be defined in conservation terms (threatened species, natural and critical habitat, red lists, etc.), the domain of the green silo. Ecosystem services, the concept providing a linkage between the green and the social and economic domains (and thus linkages to the SDGs) runs the risk of being lost. The green connotation and the perception with others that ecosystem services is a thing for the green silo people may refrain others from using it. Yet, the recent Decision by the Biodiversity Convention emphasises that a transition to a more sustainable future has to be made by

those outside the green silo. If the 'green' people don't even maintain the effort to translate biodiversity into ecosystem services for human well-being, who will??

A new concept? Some North-American authorities and development banks (notably Canada and IFC, 2013) have introduced the more neutral concept of valued environmental and social components (VECs). VECs are environmental and social attributes that are considered to be important in assessing risks; they may be physical features, habitats, wildlife populations (e.g., biodiversity),ecosystem services, natural processes (e.g., water and nutrient cycles, microclimate), social conditions (e.g., health, economics), or cultural aspects (e.g., traditional spiritual ceremonies). It more or less lumps all concepts together under one container concept. Of course, when doing an assessment on VECs all applicable safeguards have to be followed and consequently all the other terminology comes back into the picture. One can wonder if putting another word to it can work to convince people to integrate ecosystem services into assessments.

Climate change has entered the debate with full force. The adoption of the Paris agreement has put the debate in higher gear. The impact assessment community is struggling to properly address a series of new issues: adaptation, mitigation, resilience, disaster risk reduction, ecosystem based mitigation and adaptation, adaptive management, etc. Ecosystem services would provide a good conceptual umbrella to accommodate many of these issue within the framework of planning for a sustainable future, or the strategic assessments of such planning. Climate change could act as a concrete driver for application of integrated and pro-active SEAs with an ecosystem services perspective as a conceptual basis.

Sustainable Development Goals. With the adoption of the Sustainable Development Goals the importance of taking ecosystem services into account in SEA becomes more urgent to avoid a disconnect between conservation and development. Biodiversity provides ecosystem services that are directly linked to SDGs covering many different sectors (poverty eradication, food security, a resilient, safe and healthy living environment (including urban), access to water, energy supply, employment, climate regulation and carbon sequestration, etc.). The literature is quite clear on the potential role that ecosystem services assessment can play in SEA (e.g. Geneletti, 2011; Viglizzo et al., 2012; Honrado et al. 2013; Barral & Oscar, 2012). The manner in which the concept can be conveyed to the world of planners is less clear. Of course, in a perfect world planners could adapt the concept and strive for sustainable resource exploitation. Regrettably the world isn't perfect; planning is often guided by economic motives and power play by influential sectors. This is where environmental assessment has to play its legally defined role in making sure that human development doesn't go beyond the boundaries of what an area can sustain, making sure that winners do not take all but also care for the losers, and making sure that potential problems are not exported to other areas and people, or towards the future (Slootweg, 2015).

Pro-active use of SEA. SEA can play different roles. The 'traditional' role of SEA is a re-active one; the planning process is in the lead and the SEA assesses the consequences of the plan (and alternatives if available). SEA can also pro-actively inform a planning process. Rather than assessing the impacts of plans, the rationale for this approach is to use SEA to inform the planning process from the start towards more sustainable solutions (Partidario, 2012). This approach also helps to avoid the perception of environmental assessment being a hindrance to development. By describing a region in terms of ecosystems and their services, a pro-active SEA can picture the supply side for a

development plan. In SEA this supply of goods and services can be assessed against the demand for development, thus providing a good knowledge base to assess whether a region has the potential to facilitate human development ambitions. When used in a pro-active manner, an ecosystem services assessment can thus define options for sustainable development. As Baker et al. (2013) point out, an ecosystem services assessment should form the basic framework for a planning process. In such an approach the strengths of the ecosystem services concept can be used to its full extent.

Simple steps. Slootweg (2015,) provided a simple straightforward series of steps to provide a complete overview of ecosystem services, their stakeholders, their quantitative importance and the development opportunities or constraints they represent. This should be embedded in existing procedural frameworks for SEA. In this manner the application of the ecosystem services concept provides a practical framework for (i) methodological consistency; (ii) to distinguish between expert and stakeholder inputs; (iii) to quantify ecosystem services and identify their beneficiaries; (iv) to quantify the ecological, social and/or economic values of ecosystem services, including the identification of development opportunities and constraints; (v) to identify winners and losers when assessing different development options; and (vi) to develop concrete mitigation or compensation measures for residual negative impacts.

Step	Description
1. Define boundaries of study area	Use conceptual framework to define area under influence of drivers of change, or define by administrative boundaries for spatial plan.
2. Identify and map ecosystems / types of land-use	Describe linkages with neighbouring areas (surface / groundwater flows, wildlife or cattle movements, migration of people. Ecosystems may cross administrative borders !
3. Identify stakeholders of each ecosystem service. (Iterate with 4 and 5)	Stakeholders can be direct users (e.g. farmers, fishermen) or organisation speaking on behalf of users (e.g. user associations), on behalf of wildlife, or having governmental responsibility for a service.
4. Identify and quantify ecosystem services (Iterate with 3 and 5)	Experts and stakeholders commonly agree on a set of ecosystem services, given understandable names. Where possible quantify services in terms of the service itself.
5. Prioritise and value ecosystem services (Iterate with 3 and 4)	Define values in a participatory manner; use local knowledge and expert input. Most important services can be criteria for plan assessment Services can have positive or negative values for different stakeholders and priorities will differ among stakeholders.
6. Present status and trends for ecosystem services.	Condition of ecosystem services (underexploited = opportunity, or overexploited = constraint; any exploitation conflicts?). What are past and expected future trends. At what scale do drivers of change work; at what scale can they be managed (within or outside influence of plan); available management options.
7. Applicable regulatory frameworks for ecosystem services.	Legal or policy frameworks may apply to the use and management of ecosystem services, thus representing boundary conditions for future planning.
8. Gaps in information.	Discuss reliability of information. Apply precautionary approach in case of serious deficiencies.

Table 18.1: steps to use ecosystem services in SEA (adapted from Slootweg 2015).

Ideally an SEA will go through a pro-active and a re-active phase. First by pro-actively informing the planning process on the opportunities and constraints of the area, thus defining the boundaries of sustainability, and provide pertinent input for the development of alternatives (how does the environment influence the plan?). Subsequently, the SEA will assess the consequences of proposed plan measures when these become more clearly defined (how does the plan influence the environment?). Further assessment should include the normal good-practise SEA elements.

Some personal final words. In this chapter I have tried to provide an overview of the existing experiences in applying the ecosystem services concept. It struck me with some surprise that the lessons from literature can be so simply summarised in: listen to people, be careful with 'behind-the-desk' studies using GIS, computational models and complex valuations techniques that people cannot relate to, and look beyond one's silo. Yet, the practise of most present-day ecosystem services assessments and valuations is exactly the opposite. In my own 20 years of experience in planning and assessment of natural resources management plans and projects I have found ecosystem services to be a perfect concept to understand and describe complex situations, and bridge the gaps between sector experts, between experts and stakeholders, and between experts and decision makers. Of course, because of the ecologists/green connotation I often had to adopt different terminology, but keeping the basic concept unharmed. Adapting the language to the audience is a first step to bridge the divide. Stakeholder involvement in this respect is also about finding the right language which resonates with their world and avoids unnecessary semantic discussions or negative perceptions. Having been a scientist for 10 years before becoming a consultant I am convinced the gap between science and political decision making cannot be bridged without the help of intermediaries or intermediary mechanisms. The incentives for scientists lie in innovation; policy makers need simple and generalised rules of thumb that they can use in complex decision making processes; public praise of the quality of their decision is their incentive. The most interesting and thought provoking ideas for a scientist usually are a nightmare for decision makers. Reinecke et al. (2013) therefore refer to knowledge brokers and a hybrid knowledge brokerage domain where interaction between scientists, policy-makers, interest groups, the media and citizens is deliberately sought.

So I end up with a renewed plea to look at biodiversity from an anthropocentric perspective, take conservation, sustainable use and equitable sharing of benefits as three equally important points of departure, and use ecosystem services as an integrating concept in SEA. In the end it is all about the same thing: human survival. We use biodiversity sustainably for our own survival and we conserve it for our future survival, and thus strive for equitable sharing of benefits among and between generations. The concept of ecosystem services is clearly defined, the SEA process instrument is available, scientific and local knowledge usually are sufficient to set criteria for sustainability and to compare plan alternatives, and with the application of a precautionary approach there are no reasons not to make a start with it. SO JUST DO IT.

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