

Support for incorporating ecosystem-services into Strategic Environmental Assessment

Jonathan Baker and Alister Scott (2013)

Purpose of this support document

The purpose of this support document is to provide practitioners, consultees, stakeholders and policy-makers who are assessing, developing or contributing to plans or programmes that require Strategic Environmental Assessment (SEA) and Sustainability Appraisal (SA) support as to how the concept of ecosystem-services may be incorporated into the assessment.¹

The document is structured as below:

- **What is SEA** – introduction to SEA and the questions it seeks to answer
- **Why ecosystem services improves SEA** – rationale for the inclusion of ecosystem services within SEA
- **When to use ecosystem services in SEA** – some indication of when it might be more or less appropriate.
- **How to use ecosystem services within SEA** – an introduction to some possible approach and examples
- **Key lessons and issues to remember** – summary of the barriers and enablers to incorporating ecosystem services into SEA
- **Support** – links to sources of information and support and guidance documents
- **Case studies** – to illustrate the potential

This document is not intended to be guidance on undertaking SEA generally or on how to ensure that your SEA is compliant with the SEA Directive and relevant UK legislation based on your particular context. Rather it is about introducing ecosystem services within SEA and exploring how it might be relevant to your particular SEA and what the benefits of its inclusion may be.

¹ This document seeks to be relevant to SEA and SA but will only refer to SEA to avoid confusion.

What is Strategic Environmental Assessment?

SEA is a tool that allows decision makers to understand the impact of their plan or programme on the environment and how they can avoid nor reduce any negative environmental effects whilst maximising the opportunities presented by the natural environment.

SEA is a legal requirement under European and UK law that requires that certain public plans and programmes that are felt to have potentially significant environmental effects are examined in detail using the SEA process. More information on when SEA is required is available online.

SEA can help you to answer the following policy questions:

- What are the likely and most important environmental effects, good and bad, of my plan or programme?
- What do the public and other stakeholders think of the environmental effects of my plan or programme?
- How can I reduce negative environmental effects?
- How can I make the most of the benefits provided by the natural environment?

It is intended that this support document should be used at the earliest possible stage of the policy decision making process set out on the [NEAT tree](#). It is also designed so that it is relevant across all the stages and iterations:

Ideas ---- Survey ----- Assess ----- Plan ----- Act ----- Evaluate

Why include ecosystem services in SEA?

There are a number of reasons why SEA practitioners, decision makers, consultees and other stakeholders should consider how ecosystem services can contribute to SEA.

Ecosystem services is about the multiple benefits we receive from the environment – including this in SEA is a more accurate and effective way of describing and thinking about the environment.

Ecosystem services is about why the environment, and hence why the SEA matters – too often SEAs are a tick box process. Using ecosystem services in SEA has the potential to explain to decision makers why the environment matters and to demonstrate that SEA can add value to the plan or programme making process. This profile raising potential should result in a more integrated and valuable SEA process and outcome.

Using ecosystem services flips the idea that the environment is a constraint to development and instead recognises it as an asset - using ecosystem services in SEA allows us to consider how the environment supports the delivery of our plan or programme and how the plan or programme can support this.

Ecosystem services is part of the policy landscape – as mentioned much of the UK's natural environment policy, and other areas like spatial planning (including the National Planning Policy Framework) and water, refer to or uses the concept of ecosystem services. Therefore an effective

review of relevant Plans, Policies and Strategies (PPS) at the scoping stage should include policies that are based on ecosystem services.

Ecosystem services is an integrating concept that can support assessment of cumulative effects - the range of ecosystem services are relevant across the different SEA topics. This integrated nature can be used to consider effects across the topics in a way that can support consideration of inter-relationships and cumulative effects. Cumulative effects have in the past been poorly dealt with in SEA and thinking about ecosystem services may help improve this and provide a way of considering cumulative effects more consistently in SEAs

Ecosystem services is about resilience and risk reduction –The implementation of many plans or programmes is reliant upon a functioning natural environment. For example flood risk management plans rely on the storage capacity of green spaces, water slowing functions of wooded areas and the ability of wetlands to reduce the power of surges and waves. Local development plans are reliant on areas of recreation and green spaces that make urban environments more attractive and which improve residents' wellbeing. An effective SEA should understand this relationship and feedback into the plan or programme development process.

Research and practice indicates that ecosystem services in SEA is particularly effective when:

- Describing the environment in a way that is more accurate and effective (scoping and baseline stages of SEA).
- Identifying and evaluating significant effects (assessment and alternatives).
- Considering cumulative effects (assessment and alternatives).
- Engaging and consulting stakeholders and the public (across the whole SEA process but particularly at consultation points (Scoping and Environment Report) and the final reporting).

Despite these positives ecosystem services in SEA is not a panacea, the latter sections provide detail how ecosystem services can be incorporated effectively and how to maximise this positive potential. Using ecosystem services in SEA is not a gold plating addition. SEAs which use ecosystem services can be cost and outcome effective. The process set out here does not necessarily require additional steps or processes and can be easily integrated into existing SEA planning.

How to consider ecosystem services in SEA

There are felt to be ends of a spectrum to incorporating ecosystem services into SEA. This spectrum is based on how much technical information is required as shown in the Figure below.

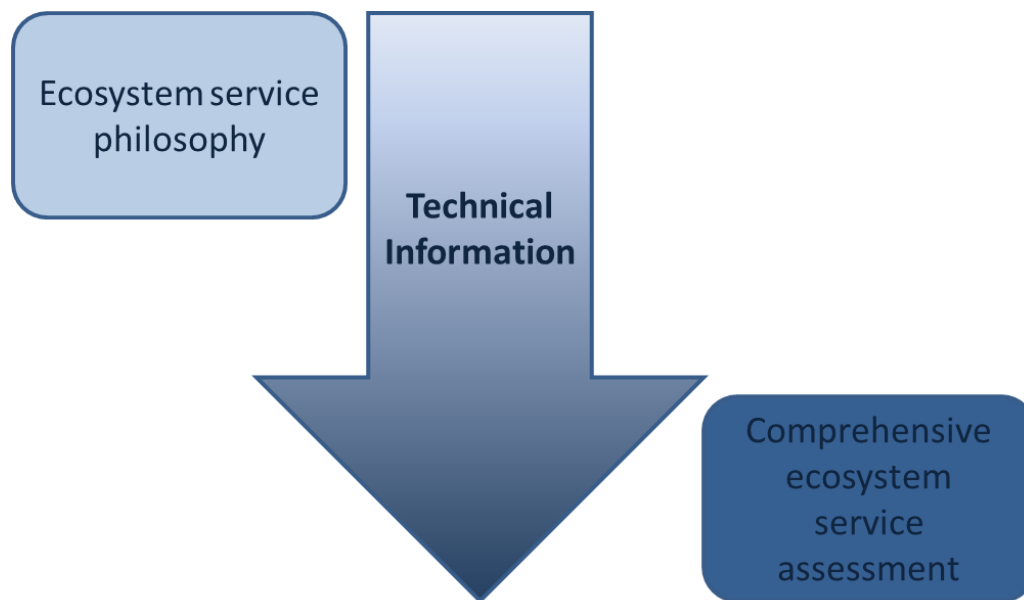


Figure 1: Range of approaches and relationship to technical information

These two broad approaches, the ecosystem services philosophy (adapting current approaches) and comprehensive ecosystem service assessment (a more systematic approach building from first principles) are highly related. In effect the SEA of any plans or programmes that relies or impacts, to a greater or lesser degree, on the natural environment could draw on the ‘ecosystem services philosophy’ approach as an initial starting point. For plans or programmes that are identified via scoping as being very reliant or having a greater impact on the natural environment it may be appropriate to promote the integration of ecosystem services to the point of a comprehensive ecosystem services SEA. The reason being that the scale of reliance or impact is sufficiently large to justify using more technical information to better understand the type and level of ecosystem service provision within your area – these decisions will be made at Scoping stage

Even within comprehensive ecosystem service SEA there is a need to incorporate non ecosystem services aspects as appropriate – for example relating to heritage, deprivation and non-ecosystem services health issues.

A summary of these two approaches is presented below – support on how to use these concepts is set out in the next section.

The ecosystem-service philosophy


The ecosystem services philosophy is more about the use of ecosystem services as framing or description of the environment within your SEA. As such it is a less significant departure from existing practice and relies on changing the language and emphasis of your SEA.

Traditionally SEA focuses on describing the environment as a ‘thing’, something to include as part of the baseline inventory. The ecosystem-service philosophy seeks to develop this description: from things, to benefits / uses. ‘Benefits’ and ‘uses’ avoids the problem of ‘ecosystem services’ and related terminology which is quite technical.

This is shown in the Figure below which demonstrates these three terminologies and their differences. Using this approach provides a framework that shows how and why the environment matters and has a language which complements traditional terminology. The 'benefits' language allows for effective description about the role of the environment in supporting policy when the audience is policy makers. The 'uses' language can be used when talking to members of the public and community and is an effective way to promote knowledge exchange between the SEA process and the public, for instance identifying priority areas or services based on how people are using the environment.

This change in language has the potential to communicate that the environment is an asset, not a constraint to plan or programme that the SEA is assessing. This will support the achievement of good environmental outcomes through the plan or programme supported by the SEA.

More information on how to use this concept is set out in the next section.



| Things | Benefits | Uses |
|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Area of Beech (<i>Fagus sylvatica</i>) dominated wood parkland | Area that provides benefits to society, namely: <ul style="list-style-type: none"> • Food production; • Cultural and spiritual; • Carbon sequestration and storage; • Water and flood regulation; • Soil formation; • Noise reduction; • Ornamental resources; • Biological control; • Pollination. | Area that can be used in a variety of ways, namely: <ul style="list-style-type: none"> • Walk the dog; • Get ivy for Christmas; • Build a jump for bike; • Go for a stroll; • Gets flooded in the winter; • Get some peace and quiet; • Harvest nuts and mushrooms; • To meet as part of a community group. |

Figure 2: Example of using ecosystem service philosophy to described the environment²
Comprehensive Ecosystem Assessment

Comprehensive ecosystem services is marked by the more quantitative approach to ecosystem services – this may include a systematic identification of what ecosystem services are provided within an area; the scale of this provision; issues around supply and demand ; and, may extend to

² Sheate, W.R., Eales, R.P., Daly, E., Baker, J., Murdoch, A., Hill, C., Ojike, U., and Karpouzoglou, T., (in press) Spatial Representation and Specification of Ecosystem Services: a Methodology Using Land Use/Land Cover Data and Stakeholder Engagement. Journal of Environmental Policy Assessment and Management Vol:14, Pages:1-36.

the monetary valuation of ecosystem services (assigning monetary values to the benefits we receive from the environment). Answering these questions is not always easy but methods and tools to support this are improving and becoming more established. Generally this approach builds on the ecosystem services philosophy and involves a much more detailed analysis of the type and nature of ecosystem services being provided within the scope of a plan or programme and assessing their contribution to supporting the plan or programme.

Ecosystem services within the SEA process

The following explores the SEA process and how ecosystem services may be included. It is intended that ecosystem services is integrated into normal SEA practice / processes and that consideration should be given to the following as well as to other guidance and support including the Directive and any relevant UK legislation. The schematic of this process, the key questions to be asked and the support provided in this document are set out in the Figure below.

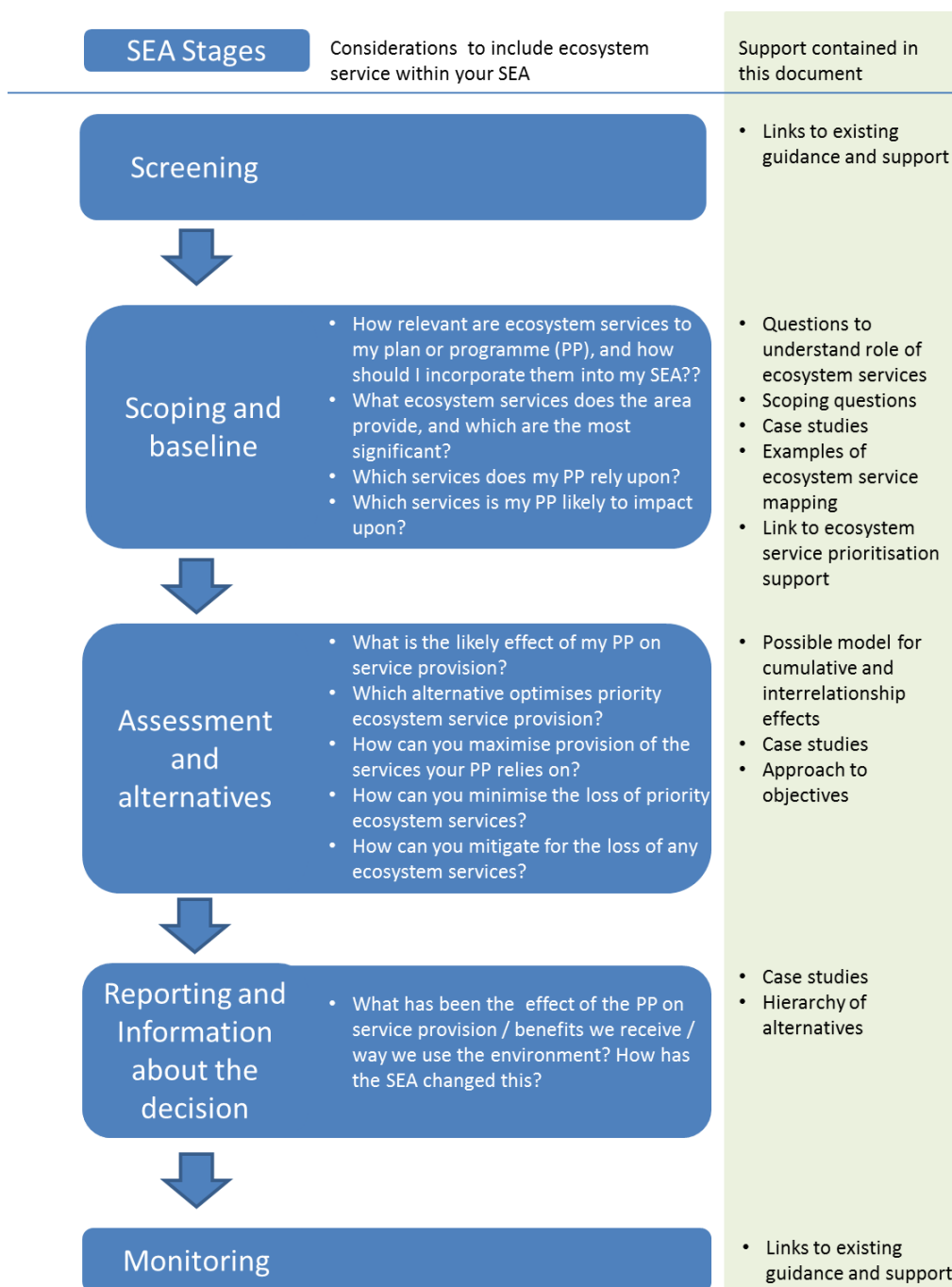


Figure 3: SEA process, ecosystem service considerations and support provided

Scoping and Baseline

How should you consider ecosystem services?

The approach that the SEA will use should be agreed at the beginning of the SEA process by discussions between those who are undertaking the assessment; those who are commissioning it and key stakeholders for the plan or programme. At this initial point you should consider:

How relevant are ecosystem services to my plan or programme, and how should I incorporate them into my SEA?

Ensuring that the approach used in the SEA is consistent with the plan or programme is important as the main determinant of an effective SEA is effective coordination with the plan or programme.

The inclusion of ecosystem services should not be taken for granted as the use of ecosystem services is not necessarily relevant to every SEA and in instances that it is relevant how it is used will vary.

There is a range of approaches (set out above) which may, or may not, be relevant to your SEA. There is therefore a need to consider the following questions when determining what form, if at all, ecosystem services should be considered within your SEA:

- Is it likely that your plan or programme will result in changes to land use / land cover?
- Is your plan or programme highly reliant on the provision of specific ecosystem services?
- Is your plan or programme likely to impact on areas of high ecosystem service provision?
- Is there adequate data about the state of the environment in your area?
- Does your plan or programme operate at a specific scale or area?

If you answered no to all the questions, then it is possible that ecosystem services is not highly relevant to your plan or programme.

If you answered yes to some of the questions you might consider framing your assessment within the ecosystem service philosophy. What this essentially entails is a different way of describing the environment and of considering environmental effects (see the Portuguese case study).

If you answered yes to most of the questions it is possible that in addition to using the ecosystem services philosophy the comprehensive ecosystem assessment is relevant as your plan or programme is likely to result in significant changes to service provision as well as to other environmental effects. There is therefore likely to be some value in understanding the nature of these changes and their impacts (see the MGSDP SEA case study).

Scoping and baseline

The purpose of scoping is to identify the priority environmental issues within the context of your SEA. This is supported by any considerations that should be integrated into your scoping / baseline process to incorporate ecosystem services into your SEA.

What ecosystem services does the area provide, and which are the most significant?

Which services does my plan or programme rely upon?

Which services is my plan or programme likely to impact upon?

The aim of this process is to understand the most important ecosystem services in relation to your plan or programme. Addressing these questions should be incorporated into existing scoping practices; there is no need for additional effort at this stage.

Support about prioritising ecosystem services is available from [Defra](#).

These questions could be addressed via engagement via the Scoping Report – for example, see the [Scoping Report of the Scottish Rural Development Programme](#). The Table below also has example questions. Stakeholders could be asked questions about specific benefits or may be presented with a wide range of uses that are felt to be pertinent and they are asked to prioritise particular services, rather than asking open questions.

Scoping is likely to be more effective if discussions are held with statutory and other stakeholders prior to the publication of the final Scoping Report. One option is to hold a Scoping Meeting at a relatively early stage to introduce the SEA, the assessment framework and to explore the priority environmental issues and benefits. This is an effective time to discuss the potential role of ecosystem services within the assessment.

Table 4: Example questions for scoping in SEA with an ecosystem-service approach

| Different types of example questions |
|---------------------------------------------------------------------------------------------------------------------------------|
| <i>Which benefits provided by the natural environment most support the delivery of [the plan or programme].</i> |
| <i>What are the most important ecosystem services provided in the area? For instance are any irreplaceable within the area?</i> |
| <i>What ecosystem services do you think the [plan or programme] will negatively impact?</i> |
| <i>What ecosystem services do you think the [plan or programme] has the most potential to improve?</i> |
| <i>What are the current deficiencies in ecosystem service provision?</i> |
| <i>What is the most important use of your local environment?</i> |
| <i>Which of these uses of an area do you feel are the most important?</i> |
| <i>How do you use your local environment?</i> |
| <i>Please rank these uses in order of priority.</i> |

The aim of this stage is to identify the priority and irreplaceable (i.e. the most significant) ecosystem-services so that these are accounted for in the rest of the assessment – see Portuguese ICZM Case Study or the Wareham Managed Realignment for examples of this.

At this stage it is likely that environmental designations are likely to be considered. Existing policy, legislation and processes (such as Appropriate Assessment as per Habitat Regulations) will have to be complied with. The main value of ecosystem services with regard to addressing designated sites within SEA is that it presents these areas as environmental **assets** that support the delivery of the plan or programme rather than environmental **constraints** that limit what the decision makers can do.³

This scoping process should be supported by understanding existing ecosystem service provision in your area. There are a number of tools that can be used to support this if necessary – [Natural Asset Check](#), [Ecosystem Assessment](#). At its simplest this process entails understanding which types of land-use / land cover provide which services. This is based on the idea that ecosystem services are provided by specific areas, linking services to habitat types is provided by the [National Ecosystem Assessment \(NEA\)](#) but other land-use / land cover typologies can be created to support this. The basic process required is shown below:

- 1) The first stage is to identify the type of land-use or land type data that is relevant, this may be based on what the most consistent type of data is including the type of land-use that the policy/decision-makers are using and familiar with. This will increase consistency and comparability with the plan.
- 2) The second stage is linking these land-use or types to ecosystem services – i.e. understand which areas provide which services. See for instance Natural England’s work in linking ecosystem services to [Natural Character Areas](#).
- 3) It may be possible to include the relative significance of each of these land-use/types to service provision. Relative significance may be included in data set or it can be determined by investigation, document review or assessing how importance different services are to different stakeholders (via consultation).
- 4) This relationship can then be mapped.

Examples of this process and its use in SEA can be found [here](#) and [here](#). Also see the MGSDP SEA Case Study in the last section. See the [GIS](#) support document for more information on using GIS to map ecosystem services.

SEA requires the consideration of evolutions to the baseline, to do this it might be worth exploring possible [Futures](#) at this stage as well.

Assessment

The assessment stage of the SEA is about understanding the environmental impacts of the plan or programme and determining their significance. The main question you need to consider is:

³ A significant amount of research is exploring the value of designated sites within the framework of ecosystem services. Notable examples include research looking at the Natura2000 networks across the EU (http://ec.europa.eu/environment/nature/natura2000/financing/docs/Economic_Benefits_of_Natura_2000_report.pdf) and on-going research by Defra (<https://www.gov.uk/ecosystems-services>)

What is the likely effect of my plan or programme on service provision?

Assessing impacts and their significance with regard to ecosystem services in SEA is based on changes to land-use / land cover, as set out in the scoping stage above. Therefore this stage of the process looks back at the baseline information and ascertains what impact the plan or programme will have on land-use and how this will alter the provision of ecosystem-services.

This process should be consistent with the rest of the SEA assessment process. One option is to use network analysis to understand how changes in land-use due to your plan or programme may impact on ecosystem service provision. Example of this approach can be found in the Case Study of the Welsh Rural Development Programme SEA and the Scottish Deer Strategy SEA below.

Understanding significance

Questions which might support understanding the significance of any particular changes this include:

Who the ecosystem services that may be affected matter to, and why, and to what spatial scale

Whether there is enough of that particular service - i.e. is flooding an issue, insufficient access to nature, over-heating in summer? These are all indicators that the area is lacking potentially important ecosystem services.

Changes in the provision of ecosystem services can be measured in a wide range of ways and the outputs from these assessments may differ, for instance an assessment might generate changes in terms of monetary figures, visitor numbers, volume of forestry products. When considering the significance of these different outputs it is important to bear in mind that SEA is not worried about the units, but rather worried about the scale of effect and whether this is significant. Therefore there is no need to try and generate single, comparable figures across the ecosystem services topics.

Objectives

The production of objectives is an approach that many SEAs take. The following sets out how ecosystem services may be included here.

Ecosystem services could be integrated via ecosystem service specific objectives (e.g. to increase flood regulation provision from green space / protect and enhance provision of recreation). This might be appropriate where a specific service is felt to be especially important or impacts on it particularly significant. The alternative approach is to add ecosystem service sub-objectives or indicators – this approach is used in the SEA of the Scottish Rural Development Programme.

Ecosystem service inclusive SEA objectives could refer to;

- No net loss of service provision over the whole area;
- Specific focus on ecosystem services in certain areas where they are especially important;
- Aim to increase the most important services;

The framing of these criteria or indicators can be based on consultation and the results of the Scoping Report and the baseline.

It is worth recalling that any biodiversity objectives should mention the role of biodiversity in maintaining the flow of services society receives from the environment. The relationship of ecosystem services and biodiversity is not clear but generally increased biodiversity is felt to support ecosystem service provision.

Cumulative effects

One aspect of SEA practice that is particularly complex is the consideration of the interrelationship of the SEA topics and cumulative effects. Consideration of both these impact types is required by the Directive and Regulations and is noted as a challenge of existing SEA practice.

Ecosystem services is an intrinsically integrated concept – what this means is that it is relevant across the ‘silos’ of SEA topics – see the Figure below which maps the Millennium Ecosystem Assessment’s ecosystem services to the SEA topics.

| Ecosystem Service Categories | | Regulating services | | | | | Supporting services | | | | | Provisioning services | | | | | Cultural services | | | | | | |
|------------------------------|------------------|---------------------|--------------------|------------------------|------------------|--------------|---------------------|---------------------|-----------------|-------------|--------------------|-----------------------|-------------------|-----------------|---------------|-------------------|-------------------|----------------------|-----------------------|------------|-----------------------|------------------------|-----------------------|
| Ecosystem Service | | Gas regulation | Climate regulation | Disturbance regulation | Water regulation | Water supply | Soil formation | Nutrient regulation | Waste treatment | Pollination | Biological control | Habitat provision | Refugium function | Food production | Raw materials | Genetic resources | Medical resources | Ornamental resources | Aesthetic information | Recreation | Cultural and artistic | Spiritual and historic | Science and education |
| SEA Topics | Landscapes | | | | | | | | | | | | | | | | | | | | | | |
| | Materials assets | | | | | | | | | | | | | | | | | | | | | | |
| | Climate factors | | | | | | | | | | | | | | | | | | | | | | |
| | Air | | | | | | | | | | | | | | | | | | | | | | |
| | Water | | | | | | | | | | | | | | | | | | | | | | |
| | Soil | | | | | | | | | | | | | | | | | | | | | | |
| | Flora | | | | | | | | | | | | | | | | | | | | | | |
| | Fauna | | | | | | | | | | | | | | | | | | | | | | |
| | Health | | | | | | | | | | | | | | | | | | | | | | |
| | Population | | | | | | | | | | | | | | | | | | | | | | |
| | Biodiversity | | | | | | | | | | | | | | | | | | | | | | |

Figure 4: Mapping of ecosystem services and SEA topics⁴

⁴ Baker J., Sheate W., Eales R., and Philips P. (2013) Ecosystem services in environmental assessment – help or hindrance? Environmental Impact Assessment Review.

This provides an opportunity to use ecosystem services as a basis upon which interrelationship and cumulative effects are considered. This can be achieved by considering the impact of the plan or programme on the ecosystem services set out above as well as on the individuals SEA topics. The mapping of impacts by ecosystem service will provide a way in which you can step outside the silos of the SEA topics and consider ways in which the impacts of your project interact and how this may determine their significance. The Figure below seeks to support this consideration by providing some instances of how ecosystem services relate to the SEA topics.

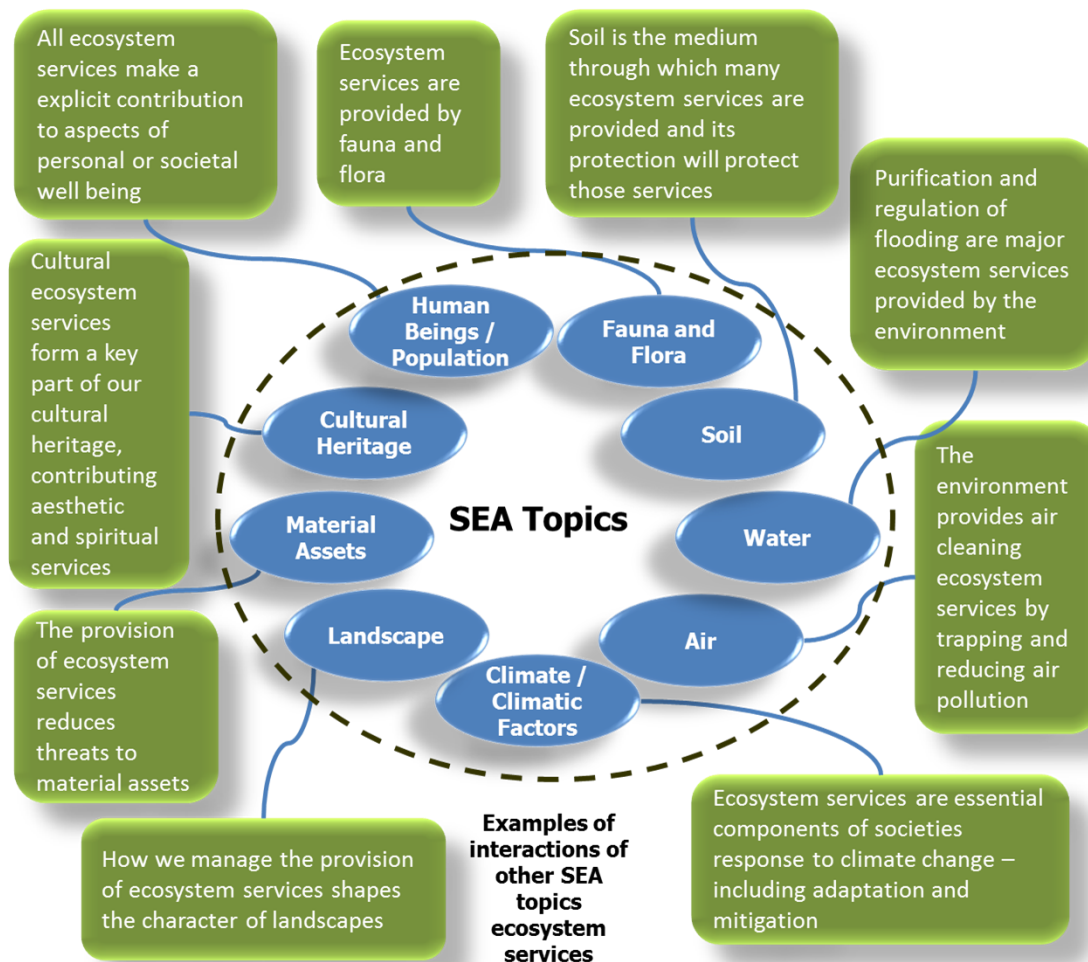


Figure 5: Interactions between ecosystem services and SEA topics

It should be noted an exclusive focus on ecosystem services risks the effective and compliant consideration of aspects such as heritage, air pollution and non-ecosystem service specific topics and issues. These aspects can be integrated into an ecosystem service proofed SEA easily but this needs to be considered to avoid an incomplete understanding of the impacts of the plan or programme.

Alternatives

Incorporating ecosystem services into the assessment of alternatives should consider:

Which alternative optimises priority ecosystem service provision?

How can you maximise provision of the services my plan or programme relies on?

How can you minimise the loss of the priority ecosystem services?

Answering these questions requires referring back to the baseline, Scoping Report and any on-going consultation.

Deciding the location of any plan or programme should be in-line with any priorities determined during the scoping stage. This means that having identified the areas of land-use that are delivering irreplaceable and or priority ecosystem services a range of alternatives should be considered that can optimise these ecosystem-services.

So for example if flood risk mitigation is a priority ecosystem-service the location of the plan or programme should be such that the loss of land-use that is providing flood risk mitigation services is reduced – see the MGSDP SEA and Kijkduin Masterplan Case Studies. If multifunctionality is considered the priority, then loss of land-uses/types that are delivering a wide range of services should be avoided. Any irreplaceable ecosystem-services should be maintained in line with the precautionary principle, which is contained in the recitals of the SEA Directive.

It is possible to provide economic values to this consideration of alternatives – see the Wareham Managed Realignment and the SEA of the Kijkduin Masterplan Case Studies.

Guidance on how to effectively consider alternatives can be found [here](#).

When the preferred alternative has been decided it will be necessary to consider mitigation. With regard to ecosystem services this means asking:

How can you mitigate for the loss of any ecosystem services?

Any mitigation needs to be in-line with the hierarchy of the SEA Directive, *prevent, reduce* and *offset*. If an area of is to be developed this needs to be re-supplied in a way that maintains the multifunctionality of any services lost, so if an area of playing field is lost for example it is not adequate to replace this with a gym as the health services may be replaced but the other services of that area for example heat, water and gas regulation are lost.

It might be the case that mitigation actions are best included in any subsequent [Environmental Impact Assessment](#).

Reporting and information about the decision

The reporting should seek to consider:

What has been the effect of the PP on service provision / benefits we receive / way we use the environment? How has the SEA changed this?

The final Environment Report should present the processes and outcomes of the SEA process. This should include a description of how ecosystem service provision has been affected, positively or negatively, by the plan or programme and how the SEA has affected that. It may be appropriate to present this in terms of 'benefits' or 'uses' for the environment rather than ecosystem services.

Guidance on how to effectively meet the requirements after the decision has been adopted can be found [here](#).

Monitoring

Understand the actual (as opposed to potential) effects of the plan or programme on ecosystem services requires putting in place effective monitoring arrangements. Understanding the changes of ecosystem service provision will likely rely on the same information that informed the assessment. Should certain thresholds be exceeded, for instance coverage of green space, or peat, then corrective actions need to be identified and implemented.

Support and guidance

Support for undertaking SEA

| Document and link | Relevance |
|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Strategic Environmental Assessment good practice guide. (Portuguese Environment Agency, 2007) | <ul style="list-style-type: none"> Portuguese SEA guide which promotes an integrated approach to assessments. |
| Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment | <ul style="list-style-type: none"> The SEA Directive applies to a public plans and programmes. The Directive aims to provide a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation of plans and programmes. |
| Report on the application and effectiveness of the Directive on Strategic Environmental Assessment (COM (2009) 469 final) | <ul style="list-style-type: none"> Report assesses the application and the effectiveness of the SEA Directive and includes proposals for its amendment (in particular the amendment of its scope). |
| A Practical Guide to the Strategic Environment Assessment Directive (ODPM, 2005) | <ul style="list-style-type: none"> Guidance on the implementation of the SEA Directive in the UK |
| Sustainability Appraisal (Planning Advisory Service, 2009) | <ul style="list-style-type: none"> Guidance on the implementation of SA |
| SEA Pathfinder Project: Stage 1 and 2 Combined Summary Report (Scottish Government, 2010) | <ul style="list-style-type: none"> Detailed review of SEA practice in Scotland. |
| Strategic Environmental Assessment Guidance on Air, Soil & Water (SNIFFER, 2009) | <ul style="list-style-type: none"> Online guidance hosted by Scotland & Northern Ireland Forum For Environmental Research (SNIFFER) to support consideration of air, soil and water in SEA. |

Support on ecosystem services in SEA

| Document and link | Relevance |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TEEB for local and regional policy makers. (TEEB, 2010) | <ul style="list-style-type: none"> Report that considers how SEA (and EIA) could seek to include ecosystem services. |
| Biodiversity, Ecology, and Ecosystem Services - Impact Assessment Considerations/Approaches. (International Association of Impact Assessment, 2006) | <ul style="list-style-type: none"> Useful meta-study pulling together work and synthesising. Good range of overarching principles, supported by case studies and possible tools. |
| SEA and Ecosystem Services (OECD, 2010) | <ul style="list-style-type: none"> Advisory note on the inclusion of biodiversity and ecosystem services within SEA. |

| | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Valuation of ecosystem services and Strategic Environmental Assessment: Lessons from influential cases (Netherlands Commission for Environmental Assessment, 2010) | <ul style="list-style-type: none"> • Examples of using economic valuation in SEA |
| Ecosystem Services Review for Impact Assessment (World Resources Institute, 2011) | <ul style="list-style-type: none"> • Provides practical instructions to environmental and social practitioners on how to incorporate ecosystem services throughout environmental and social impact assessment. |
| Biodiversity & Ecosystem Services in Impact Assessment | <ul style="list-style-type: none"> • Special Symposium organized by the IAIA Biodiversity & Ecology Section that considers ecosystem services in impact assessment generally |
| Valuing ecosystem services in the East of England (Sustainability East, 2011) | <ul style="list-style-type: none"> • Report that looks at incorporating ecosystem services into land use planning including SEA. |
| An introductory guide to valuing ecosystem services (Defra,2009) | <ul style="list-style-type: none"> • Defra guide on how to undertake the valuation of ecosystem services including within the context of SEA |
| Using InVEST in Strategic Environmental Assessment (Natural Capital, 2010) | <ul style="list-style-type: none"> • InVEST is a free mapping software tool. This document considering how it might be used within SEA. |

Case Studies

The following case studies have been provided to illustrate specific aspects of the above support.

| Case study | What it demonstrates |
|--------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SEA of the Rural Development Plan for Wales 2007 - 2013 | <ul style="list-style-type: none"> • Early and effective scoping with stakeholders • Use of network (causal chain) analysis |
| SEA of the Strategy for Wild Deer in Scotland | <ul style="list-style-type: none"> • Use of network (causal chain) analysis • Consideration of alternatives • Use of futures thinking and managing uncertainty |
| SEA of the Portuguese Integrated Coastal Zone Management (ICZM) | <ul style="list-style-type: none"> • Ecosystem services • Strategic consideration of biodiversity • Effective integration between SEA and the plan or programme • Policy level SEA |
| SEA of the Kijkduin Masterplan | <ul style="list-style-type: none"> • Consideration of alternatives • Use of green infrastructure / ecosystem services |
| Metropolitan Glasgow Strategic Drainage Partnership (MGSDP) Implementation Plan SEA. | <ul style="list-style-type: none"> • Comprehensive ecosystem assessment • Mapping |
| Wareham managed realignment | <ul style="list-style-type: none"> • Economic valuation of ecosystem services • Alternatives |

Case studies

Case study 1: SEA of the Rural Development Plan for Wales 2007 - 2013

Relevant to:

- Use of network (causal chain) analysis
- Early and effective scoping with stakeholders

Key message:

This case study is an example of early and effective engagement with stakeholders to identify the most important aspects of the environment. This was supported by the use of network analysis although it didn't directly consider ecosystem services.

Elements of good practice / key lessons from the SEA:

The Welsh Assembly Government (WAG) commissioned an SEA to be undertaken alongside their Rural Development Plan (RDP) 2007 – 2013. The SEA is notable for the early and effective engagement with stakeholders during the scoping stage; this led to the consideration of climate change and biodiversity across the SEA. The SEA is also a useful example of the use of network analysis and the consideration of cumulative impacts with regard to biodiversity and climate change.

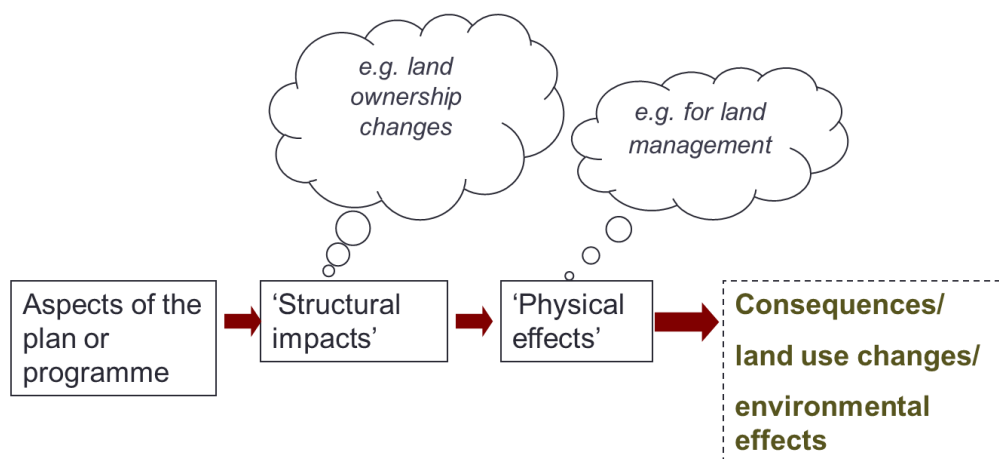


Figure 6: Schematic of causal chain analysis

During the scoping stage the consultants responsible for producing the SEA organised a scoping meeting with WAG officials and representatives from various natural environment and heritage authorities (see Appendix 1 of the Environment Report for list of attendees). These groups worked together to identify SEA objectives and indicators for the assessment process as well as what the 'key issues' were relevant to the plan. These were found to include climate change and biodiversity and their interrelationships. These (and other key issues) were presented within the baseline information and structured to include information as to the 'current situation and trends' and a

description of the main elements to consider. A scoping report was circulated widely to stakeholder groups and consultees, with feedback used to refine the SEA objectives and key issues.

Example SEA objectives for climate change and biodiversity used in this assessment are presented in the table below.

Network analysis as a tool was found to be particularly useful for this SEA, as the RDP refers primarily to funding arrangements, making it difficult to determine precise environmental impacts. The results of this network analysis (see Annex 5 of the Environment Report) were effective for relating funding decisions to broad environmental impacts (the basic process is shown in the figure above). This was undertaken strategically rather than at the level of specific sites, and this process was used to assess various alternatives that were identified through the SEA process. A total of 25 network (causal chain) diagrams were generated to illustrate and compare the likely effects of the different funding schemes.

Source of further information:

- Environment Report of the SEA of the Wales Rural Development Programme 2007-2013: <http://wales.gov.uk/topics/environmentcountryside/farmingandcountryside/ruraldevelopment/?lang=en>
- Scoping report: <http://wales.gov.uk/docs/drah/publications/100610appendix3studyen.pdf>
- Non-Technical Summary and Environment Report (separate) of the Wales Rural Development Programme 2007 – 2013: <http://wales.gov.uk/topics/environmentcountryside/farmingandcountryside/ruraldevelopment/ruraldevelopmentplan4wales2007/?lang=en>

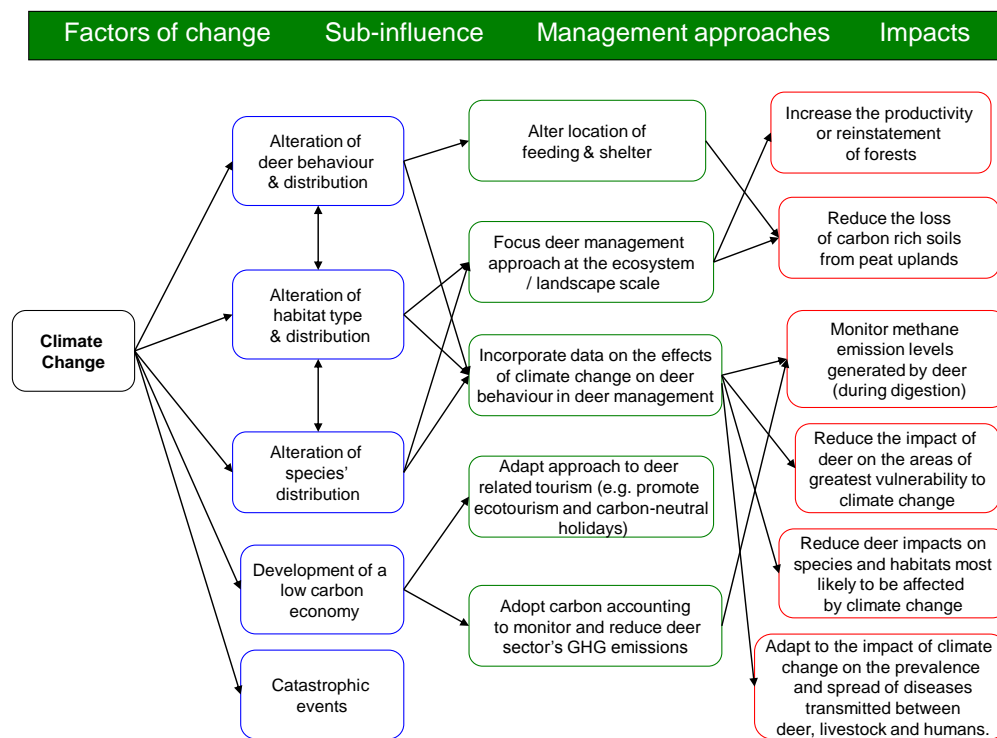
Case study 2: SEA of the Strategy for Wild Deer in Scotland

Relevant to:

- Use of network (causal chain) analysis
- Consideration of alternatives

Key message:

Causal chain analysis is an effective approach for considering complex long term issues (such as climate change and biodiversity). In particular this case study shows that it is useful for bringing together stakeholders and the identification of various alternative management options.



Elements of good practice / key lessons from the SEA:

The strategy sought to provide a long term vision for the effective management of wild deer across Scotland – the SEA process facilitated many elements of this, in particular providing a medium for cross-departmental and agency engagement. The SEA also sought to provide the opportunity to consider pertinent long term drivers and challenges, how these may have been expected to impact on the objectives of the Strategy and how the Strategy could respond.

Section 6 of the SEA report (p 40) explores 'a suite of alternative approaches to managing wild deer, which could enable the Strategy to respond to future changes and unexpected or unforeseen events'. The first stage of this exploration of future scenarios involved bringing together stakeholders involved in delivering the plan from a range of related departments as well as independent experts to consider the relative importance and predictability of various factors of change. This took the form of a brain storming session and led to the population of a diagram of the

main potential long term drivers in terms of those that were most important and certain/uncertain (predictable/unpredictable) (see figure above).

As indicated in the figure the top three drivers (climate change, land use change and public perception change) based on a combination of their importance and predictability were then subject to network (causal chain) analysis. This is an approach that seeks to consider various drivers and identify through qualitative assessment their likely environmental (or other) impacts. Within the SEA this involved bringing together various stakeholders and experts and considering and linking the various elements of the system. The network diagram was based on the relationships between the:

- **Driver:** as identified via brainstorming with stakeholders;
- **Factors of Change:** the possible broader impacts of the driver;
- **Sub-influence:** impacts specific to the strategy (or plan or programme) due to the factors of change (and ultimately the driver);

See the figure above for worked example, all the examples are presented in Appendix 14 of the Environmental Report.

The completed causal chains provide a systematic and transparent means of understanding better how the Strategy might be implemented and also what the likely impact on the ground may be. This process aided the identification and assessment of the potential environmental effects of the strategy as well as identifying various alternative management options whilst retaining its integrity as a strategic plan. It was felt to be a particularly effective tool for the consideration of climate change impacts.

Source of further information:

- Environment Report is available here: <http://www.dcs.gov.uk/information/Section%20Content/wDNa.aspx>
- Appendices are available here: <http://www.dcs.gov.uk/information/Publications/Compiled%20Appendices%20-%20Socio-Economic%20Assessment%20Report.pdf>

Case study 3: SEA of the Portuguese Integrated Coastal Zone Management (ICZM)

Key Message

Ecosystem services can be integrated into SEA without the need for extensive technical exercises. An Ecosystem services approach is also a useful tool to enable the strategic consideration of biodiversity which would otherwise be difficult in very high level plans. The ecosystems concept is a flexible approach that is effective at making clear the strategic value of biodiversity – something that a site specific assessment would not achieve.



Relevant to:

- Ecosystem services
- Effective integration between SEA and the plan or programme
- Policy level SEA

Introduction

Portugal developed a preliminary document proposing the basis for a national Integrated Coastal Zone Management (ICZM) in 2006. The development of this document was managed by the Ministry of Environment, Spatial Planning and Regional Development. In 2007 and 2009 the National Strategy for ICZM was published presenting Portugal's integrated vision for ICZM – the Portuguese Strategy for ICZM (PS-ICZM). The policy included drivers established by the European Marine Strategy Framework and addressed the challenge of ensuring a clear articulation between coastal management, the planning and management of the maritime space and conservation of marine and coastal biodiversity. The policy covers Portugal's entire coastline including the islands.

Good practices to be learnt from this case study

There is no obligation to undertake SEA for the PS-ICZM as it is a policy level document – however the National Water Institute (INAG, the Portuguese authority), mandated by the government to develop the PS-ICZM, understood the merits of SEA for strategic decision-making and decided to use SEA.

The importance of biodiversity to delivering the policy's objectives was recognized; however, considering the strategic nature of the policy the effective consideration of biodiversity was potentially challenging. To address this, an ecosystem approach was included to account for the value and protection of natural and cultural heritage and biodiversity. This helped to identify the importance of different ecosystems that provide distinct services for a variety of stakeholders. It also allowed for the assessment of different management options and strategies.

The SEA proved to be effective in placing ecosystem services on the agenda. It also facilitated the integration of environmental and sustainability issues into the strategy's concept and design. It

enabled consideration of ecosystem services and highlighted risks and opportunities associated with the strategy. In the end, the SEA strongly influenced the PS-ICZM.

The SEA did not conduct a detailed analysis and assessment of existing ecosystems and services in the Portuguese coastal zone. Rather, it identified and compared policy options in terms of their risk or benefit to strategic level ecosystem services that were identified through consultation with key policy stakeholders. This required a consideration of strategic ecosystem services that could be affected by policy choices relevant to the PS-ICZM; for example: the management of natural coastal dynamics, especially in vulnerable zones; the maintenance of the productivity of coastal zones; the maintenance and conservation of the availability of natural and cultural heritage and biodiversity; the sustainable use of resources and the management of coastal risks (for example erosion, coastal stability, sea level rise etc).

PS-ICZM alternatives were assessed in two rounds using the Critical Decision Factors (CDF) approach laid out in [Annex 2](#) of this guidance. This entailed considering three sets of strategic options: thematic, institutional and a model of governance. For each of these sets, three alternative options were assessed.

For example the thematic options are outlined below.

1. 'Naturalization' of the coastal zone: a strategic priority for conservation with the purpose of improving natural dynamic processes and preventing urban sprawl, particularly in vulnerable zones;
2. 'Artificialization' of the coastal zone: a strategic priority for infrastructure, with the purpose of promoting intensive use and productivity of coastal zones and replacing or compensating natural hydrodynamic processes;
3. A socio-ecological option: articulating socio-economic and ecological dynamics in relation to resource-use and the management of risks (using an ecosystem approach).

In the first round of assessment these options were compared in terms of risks and opportunities. The results were used to identify policy priorities and strategic objectives as well as measures and actions to be followed. The strategic objectives of the PS-ICZM were then assessed in a second round that considered the measures and actions necessary to implement the objectives. These results were then used to refine the PS-ICZM. Guidelines for planning, management and monitoring were then proposed by the SEA and adopted by the PS-ICZM.

Integration with decision making

The SEA was heavily integrated into the development of the PS-ICZM, which has itself influenced the Maritime Spatial Plan for Portugal, currently in development. In this plan, maritime and coastal ecosystem services and biodiversity are considered in relation to fisheries, off-shore wind power production, recreation and tourism (seaside tourism, diving, sailing, mass cruises, etc), conservation of biodiversity in marine reserves, transportation and ports, vulnerability and adaptation to climate change, natural coastal dynamics, and various socio-ecological systems (amongst others). In this instance it was felt that the ecosystems approach was helpful in the development of a balanced and coherent policy that met multiple demands for ecosystem services without undermining the sustainability of coastal and maritime and coastal ecosystems and services or biodiversity.

Sources of further information

- Partidário, M. R. (2010) TEEB case: SEA for including ecosystem services in coastal management, Portugal <http://www.eea.europa.eu/atlas/teeb/sea-for-including-ecosystem-services-1>
- INAG (Instituto Nacional da Água) e Quaternaire, 2008, Estratégia Nacional da Gestão Integrada das Zonas Costeiras, INAG, Lisboa <http://engizc.inag.pt/>
- MAOTDR (Ministério do Ambiente, Ordenamento do Território e Desenvolvimento Regional). 2007. Bases para a Estratégia de Gestão Integrada da Zona Costeira Nacional Lisboa.
- Partidário, M.R. (coordenação) 2008. Avaliação Ambiental Estratégica da Estratégia Nacional da Gestão Integrada das Zonas Costeiras, INAG, Lisboa <http://engizc.inag.pt/>
- Partidário M. R., Vicente G, Lobos V. 2009. Strategic Environmental Assessment of the National Strategy for Integrated Coastal Zone Management in Portugal. J Coast Res 2 (56): 1271–5

Case Study 4: SEA of the Kijkduin Masterplan

Relevant to:

- Consideration of climate change mitigation and adaptation within alternatives
- Use of green infrastructure / ecosystem services

Key message:

The consideration of climate change, especially within the assessment of alternatives, offers real potential to reduce climate risks and maximise adaptation opportunities in the plan or programme.

Elements of good practice / key lessons from the SEA:

Introduction

Kijkduin is a coastal resort in the Hague municipality situated on the coast of the North Sea. To the south of the town is the Kijkduin Park and the Natura 2000 sites of Solleveld and Westduinpark. The municipal authorities undertook an SEA to support the development of their Masterplan for a proposed development of 1,000 private homes in the area. The development was also intended to broaden and upgrade the public, commercial and recreational facilities and to strengthen the landscape structure including sea flood defenses. Vulnerability to the impacts of rising sea levels was recognized from the inception of the project, mainly due to consultation with key stakeholders at the scoping stage, meaning that climate change adaptation needs were integrated into the Masterplan at an early stage of its development. Furthermore, the municipality of The Hague is committed to transform Kijkduin borough into a unique coastal resort within the overall objective of achieving CO₂ neutrality by 2050. Therefore a climate mitigation strategy was prepared parallel to the Masterplan, and was able to inform the development of the Masterplan.

Development of alternatives

The SEA developed and assessed three alternatives for the Masterplan.

Alternative A proposed a clear separation between urban areas and green spaces. This meant that new homes and other new functions would be realised on the city side of the so-called green border in the south of the planning area and on the North Sea coast. The consequence was a reduction in the area available for housing development.

Alternative B was characterized by a lower density of buildings. This allowed for the establishment of a 'green' connection with Meer en Bosch Park and the nearby Natura 2000 sites and meant that the new residential housing could be accessed via existing roads. However there was likely to be some fragmentation of green areas in this alternative. Low density building would take place along the existing infrastructure. In general the main area of development would be further away from the existing city.

Alternative C focused on the establishment of an ecological corridor between the dunes and the hinterland and building housing on both sides. The advantage of this alternative was that attractive

and relaxed living environments would be created on either side of a large contiguous park-like area. However the new neighborhood would be somewhat isolated and there were doubts about its economic viability.

Assessment of alternatives

The three alternatives were assessed for a broad range of environmental impacts

The assessment of each alternative for each climate change issue is summarised in the following table:

| Theme | Alternative | | |
|---------------------|-------------|----|----|
| | A | B | C |
| GHG emissions | -- | -- | -- |
| Renewable energy | ++ | + | + |
| Climate change risk | - | 0 | + |

The assessment of each alternative with regard to issue (3), climate change risk exposure, is summarised below.

Alternative A

- The area proposed for development lies in a area potentially susceptible to flooding, so the risk and potential consequences of flooding are therefore to be high for Alternative A. However proposed broadening of the dunes would mean that the rise in sea levels would be less likely to increase in the future. **Alternative A there has a neutral score (0) on flooding.**
- Alternative A is characterized by increased building densities of residential locations. The increase in paved surface is predicted to result in a higher risk of nuisance of excess water logging. On the other hand the sports grounds in Alternative A are located in the lowest part of the plan area, and therefore offer good opportunities for temporary storage of water during extreme rainfall (as they can be flooded with minimal long term negative impacts). Also the planned natural banks have some scope to increase water storage capacity. **Alternative A therefore has a neutral score (0) on water logging.**
- Compact building on (existing) residential locations leads to an increase in the so-called heat islands, moreover because these locations directly connect to the existing urban area. The probability of occurrence of heat stress will increase because of this. **Alternative A has negative score (-) on the criterion of heat resilience.**

Alternative B

- Flood-sensitive functions such as housing and large scale facilities are not planned in the flood prone area. **Alternative B scores neutral (0) on the flooding risk criterion.**
- By filling up a local watercourse the water storage capacity of the planning area decreases. Also new homes are planned in the low-lying part of the development area where the sports fields are located. Therefore the risk of water logging increases. **Thus alternative B receives a negative score (-) for this criterion.**
- Alternative B features a more spread-out development in lower densities. The heat island effect is therefore not significantly increased. The construction of a pedestrian link between the boulevard and new developments and the increasing recreational resort area makes **this alternative score positive on the criterion of heat-resistant design (+).**

Alternative C

- **Alternative C scores neutral (0) on the flooding test and does not affect the probability of flooding.** This is because sensitive functions such as housing and major facilities are not planned in the flood-prone area.
- In alternative C facilities and new housing are constructed in low densities in a park-like setting. This creates opportunities for the delayed water discharge and for the enlargement of the storage capacity and therefore peak rainfall is less likely to result in excess water problems. **Alternative C scored positive (+) on the criterion of water logging.**
- Residing in low densities in a park like setting does not contribute to the heat island effect. The recreational opportunities are increasing and **that is positive for the level of heat resistance of the design.**

Conclusions

In the end, none of the three alternatives was taken on completely. Instead, the SEA picked various aspects of each and proposed a composite alternative which maximized opportunities and reduced risks.

Source of further information:

- de Groot, M. and Nuesink, J. (2011) Climate adaptation and spatial planning: SEA as integration platform IAIA Conference Prague 2011 (available online in due course – check here <http://www.iaia.org/specialmeetings/prague11/>).
- Climate effect atlas – (in Dutch) <http://klimaateffectatlas.wur.nl/bin/cmsclient.html>

Case Study 5: Metropolitan Glasgow Strategic Drainage Partnership (MGSDP) Implementation Plan SEA

Relevant to:

- Consideration of climate change mitigation and adaptation within alternatives
- Use of green infrastructure / ecosystem services

Key message:

Illustrates the value of ecosystem services in delivering the objectives of a plan or programme and how to develop a detailed ecosystem services baseline. As well as the positive reaction to ecosystem services in EA from key regulators and stakeholders.

Introduction

The MGSDP (2011) was established in 2002 in response to an extraordinary rainfall event that brought severe rainwater flooding to parts of Glasgow's east end. The flood event drew attention to the lack of capacity within Glasgow's antiquated underground drainage system which is under considerable pressure. In response, the MGSDP's Development Plan has considered two high level alternatives for addressing the area's strategic drainage needs: 1) a traditional approach of keeping water in underground pipes; and 2) a more novel approach of keeping water on the surface through various SuDS techniques. Following an appraisal of the two alternatives, the MGSDP deemed it appropriate to pursue a combined strategy that takes onboard elements of each alternative.

Elements of good practice / key lessons from the SEA:

A key part of the MGSDP's approach focuses on enhancing the capacity of the region's landscape to retain surface water. Enhancing provision of relevant ecosystem services in this regard, through green infrastructure development, can reduce pressure on the underground drainage network. The MGSDP are currently in the process of developing their Implementation Plan (2011) and, in line with the requirements of the Environmental Assessment (Scotland) Act (2005), are undertaking an SEA to inform plan-development.

The successful delivery of the Implementation Plan is clearly reliant on healthy, functioning ecosystems as well as the direct provision of water management related ecosystem services. Accordingly, it was considered appropriate to develop an ecosystems approach based SEA methodology to ensure that the Implementation Plan's impact across all relevant aspects of ecosystem function can be understood fully. In essence, the SEA approach aims to protect, enhance and rehabilitate key aspects of ecosystem function with a view to sustaining and increasing the supply of scoped-in ecosystem services shown below.

Table 5: Ecosystem processes and ecosystem services

| Ecosystem processes: | Ecosystem services: |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> • Hydrological cycle function (also contributes to <i>flood prevention</i>) • Broadleaved woodland habitat networks • Fen, marsh and swamp habitat networks • Neutral grassland habitat networks | <ul style="list-style-type: none"> • Water and flood regulation (<i>flood mitigation</i>) • Water purification (<i>urban and rural diffuse pollution management</i>) • Outdoor recreation |

The natural environment of the Metropolitan Glasgow area will be supporting these ecosystem processes and providing these ecosystem services though the spatial distribution of these goods and services is likely to be inconsistent across the region. Additionally, there will be locations where there is a shortfall of these services where the MGSDP may be required to provide new or enhanced green infrastructure.

Accordingly, understanding where the natural environment is providing these ecosystem services as well as areas where there might be a shortfall of these services is a key issue for both the SEA and plan-development. As part of the SEA process, a Green Infrastructure Masterplan will be developed for the region using Geographic Information System (GIS) based modelling. In terms of SEA process, the Masterplan forms much of the baseline stage and is relied upon in the later stages of the SEA – for instance it identifies (scopes) key issues and impacts. This is particularly important given the Implementation Plan’s inherent reliance on the effective functioning of the region’s ecosystems. In this regard, the Masterplan will also be used to identify spatially prioritised enhancement opportunities following the outcomes of the environmental assessment.

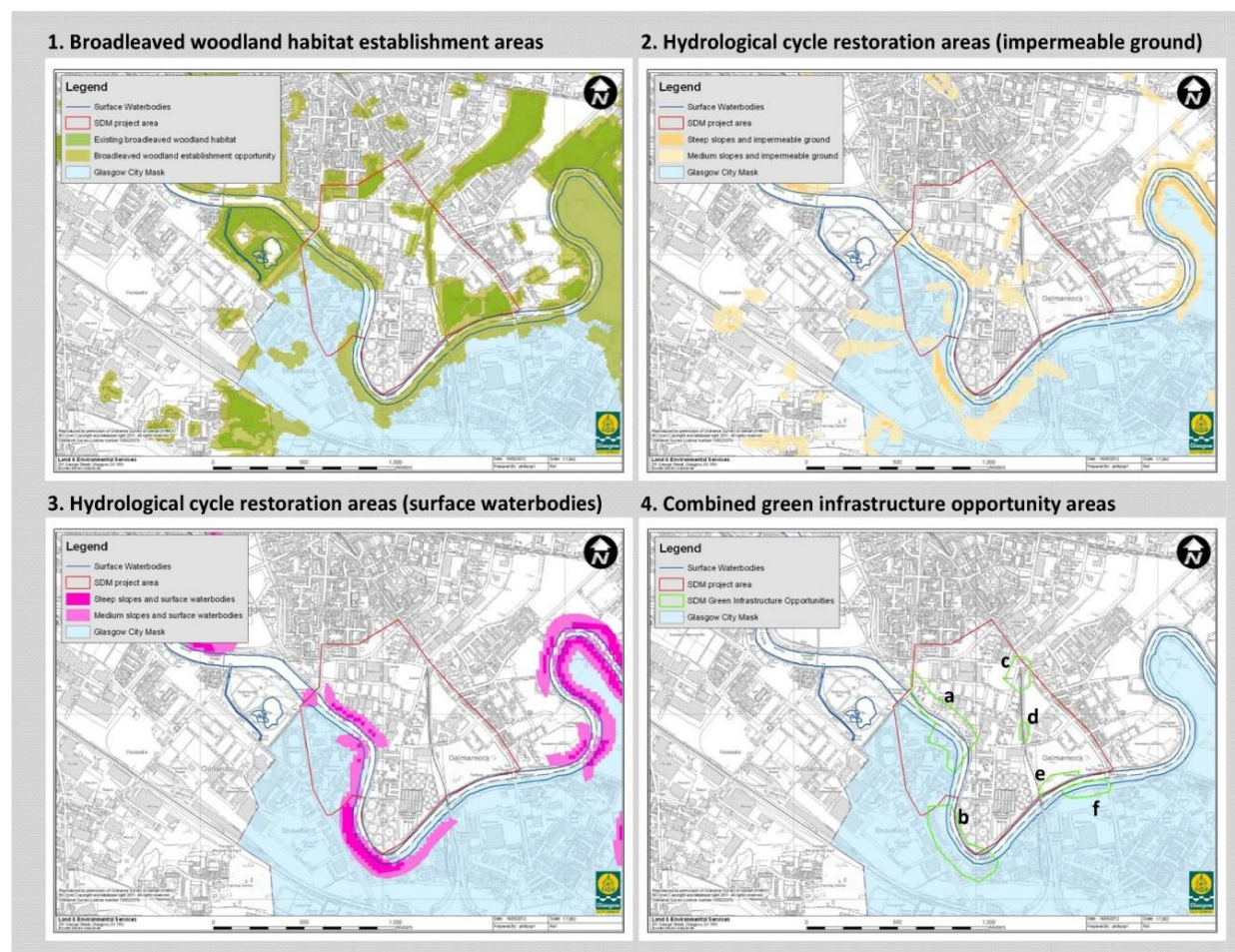


Figure 7: Green Infrastructure Masterplan Development GIS Mapping⁵

The first stage of the assessment uses network analysis to help understand the potential implications of several ‘generic’ Implementation Plan projects. In line with ecosystems approach principles, this method aims to facilitate a much more holistic understanding of potential environmental effects as well as a more comprehensive analysis of key ‘surprise’ type effects such as cumulative, synergistic and secondary effects. Based on an understanding of how an ecosystem’s biophysical structure links to specific ecosystem services, the network analysis model can be used to tease out potential impacts on ecosystem service provision and visa versa. This type of network analysis approach has been trialed in the Thames Gateway.

⁵ Focusing on the South Dalmarnock area of Glasgow’s east end, the figure above shows outputs from several stages of the GIS modelling undertaken to inform the identification of opportunity areas in the MGSDP’s Green Infrastructure Masterplan. Map 1 shows patches of existing broadleaved woodland habitat as well as land with high ecological potential to support the further establishment of this habitat. Maps 2 and 3 show areas of ‘steeply’ sloped and ‘medium’ sloped ground within the immediate catchment of large areas of impermeable ground and surface waterbodies respectively. Precipitation falling at these locations is likely to drain quickly to the nearby area of impermeable ground or surface waterbody contributing to increased pressure on the underground drainage network or increased streamflow respectively. Other aspects of the GIS modelling not shown here include neutral grassland and fen, marsh and swamp habitat establishment opportunities, pluvial flood risk areas, fluvial flood risk areas and combined flood risk areas.

Although broadly supportive, responses to the SEA Scoping Report raised key concerns in relation to the proposed ecosystems approach. As recognized in the Scoping Report itself, Scottish Natural Heritage (SNH) and Historic Scotland highlighted the difficulties in assessing the plan's potential effects on climate change mitigation and historic environment issues within an ecosystems services framework. SNH were also concerned that potential effects on discrete flora and fauna issues may be lost in the analysis. The need for specialist knowledge was also raised. In contrast however, several technical benefits of the proposed approach were discussed and agreed with the Scottish Environment Protection Agency (SEPA) including a more holistic understanding of environmental impact, more effective mitigation and better consultation. SEPA are interested in the MGSDP's approach as a potential template for SEAs of key water management plans for which they are responsible.

In contrast, the proposed approach has a number of key strengths also. Despite expressing some concerns all of the statutory consultees welcomed the innovative approach:

SNH response

"This is an innovative approach but it does seem appropriate to use it in this case given the objectives of the Plan (...) one of the benefits of the SEA is to identify alternative mechanisms to meet the Plan's objectives and it (the ecosystems approach based method) can be used to explore the use of natural systems in this context"

SEPA response:

"We note the innovative approach to the assessment and welcome the proportionate approach to the assessment"

Historic Scotland response:

"The Scoping Report proposes that an ecosystems approach will be applied to the SEA methodology. We welcome the use of integrated methods which aim to bring SEA closer to the plan-making process"

Source of further information:

- MGSDP website - <http://www.mgsdp.org/>

Case study 6: Wareham Managed Re-alignment (UK) - Green infrastructure in environmental assessment (EIA/SEA)

Relevant to:

- Ecosystem services
- Valuation
- Consideration of alternatives

Key message:

It is possible to value ecosystem services but there are potential issues. Also demonstrates how to effectively consider alternatives and integrate this into decision making.

Introduction

Work was undertaken for the UK's Environment Agency to provide an approach for incorporating the economic values of green infrastructure provided ecosystem services related to flood and coastal management into traditional forms of EA (EEA, 2011)

Elements of good practice / key lessons from the SEA:

Guidelines produced for the Environment Agency suggest that, supported by EIA/ SEA, it is possible to provide economic values for the environment that can be incorporated into traditional cost benefit analyses. The guidance suggests an initial investigation of the available economic value data followed, (where appropriate) by value transfer producing quantified economic information. What this study suggests is that EIA/ SEA can be supplemented where appropriate by the economic valuation of green infrastructure.

This was applied to a flood and coastal erosion project, the Wareham Managed Re-alignment. This study demonstrated certain barriers to the use of valuing ecosystem services in assessment. For instance there was found to be significant additional uncertainty surrounding the absolute value of the environment due to the uncertain nature of the physical changes and the socio-economic context that determines the value of these.

This suggested that absolute values may not be that relevant, rather it would be more feasible to assess the relative magnitude of changes across different options to ascertain which delivered the most ecosystem-services. This was done within the project and was considered to provide a useful analysis as to which of the options would have the least impact on the biophysical status of the environment and the related ecosystem services. In addition the case study found that decisions had to be made as to the cost effectiveness and appropriateness of ecosystem service valuation i.e. what level of detail was required and would the results of such valuation be suitably 'robust'.

The project identified some specific policy benefits, for instance the project provided support for the public expenditure of funds on a scheme which without the inclusion of valued ecosystem services may appear to have low cost-benefit ratios, therefore removing funding hurdles for projects related to ecosystem services (Defra, 2009).

Source of further information:

- Eftc (2010) *Economic Evaluation of Environmental Effects* [Online] Available from <http://publications.environment-agency.gov.uk/pdf/GEHO0310BSFH-e-e.pdf>
- Defra (2009) An introductory guide to valuing ecosystem services (case study from page 49) [Online] Available from: <http://www.defra.gov.uk/environment/policy/natural-environ/documents/eco-valuing.pdf>