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Ecosystem services in environmental assessment — Help or hindrance?

J. Baker [a,*], W.R. Sheate [a,b], P. Phillips [c,d], R. Eales [a]

[a] Collingwood Environmental Planning, United Kingdom
[b] Imperial College London (Centre for Environmental Policy), United Kingdom
[c] Glasgow City Council, United Kingdom
[d] Department of Civil and Environmental Engineering, University of Strathclyde, United Kingdom

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ABSTRACT

This paper presents a critical analysis of the potential role of ecosystem services within environmental assessment, including both strategic environmental assessment (SEA) and environmental impact assessment (EIA). It identifies some of the common problems with current environmental assessment practice and then explores whether integrating ecosystem services may be able to help address some of these problems. Case studies are included to illustrate different approaches to using ecosystem services within environmental assessment and to highlight how context (e.g. sector, scale, environmental situation) will influence the most appropriate way of integrating ecosystem services into environmental assessment practice. The analysis also reflects on how ecosystem services' potential role may, or may not, differ from previous integrated approaches to environmental assessment and what lessons can be learnt from their development.

Two main approaches are recognised from the literature and the case studies to integrating ecosystem services within environmental assessment: firstly a comprehensive approach, where the assessment framework is entirely guided by ecosystem services; and secondly a philosophical approach that applies more of a light-touch ecosystems-thinking mind-set, helping to frame the assessment methodology rather than fundamentally defining it. Inevitably, there are variations between these two extremes, and benefits and criticisms of both.

The authors conclude that ecosystem services provides a potentially valuable framing for environmental assessment, but that it requires a pragmatic, context specific consideration of how ecosystem services can be used to help address some of the common problems with current environmental assessment practice. There is also a need to recognise that at times it may just not be appropriate if it does not provide added value.

1. Introduction

The ecosystem service concept has emerged as a major part of how the environment is framed within policy. Ecosystem services are described as the advantages or benefits that we receive from healthy, functioning ecosystems (Haines-Young and Potschin, 2008; Hughes and Brooks, 2009; Scottish Government, 2011; UKNEA, 2011). Ecosystem services are essential for all life on earth, as well as providing a useful indicator of ecosystem health. There are a few examples of seminal work that are driving this area forward (MEA, 2005; TEEB, 2011; UKNEA, 2011) and the incorporation of ecosystem services is notable in international (CBD, 2012a), European (EC, 2012), and National (DEFRA, 2012) environmental policy.

1.1. Ecosystem services and decision making

The Millennium Ecosystem Assessment (MEA) conceptual framework has formed the basis of much of the subsequent development of ecosystem services and decision making. This framework links specific ecosystem services, such as food provision and flood regulation, with 'constituents of well-being' such as health and personal safety. In doing so it highlights the multifunctional and interconnected character of the natural environment and ecosystem services, with a single ecosystem service contributing to a number of the constituents of well-being (DEFRA, 2009; MEA, 2005). This bundled nature is recognised as an intrinsic characteristic and strength of ecosystem services (Chee, 2004; Mander, et al., 2007). It is possible to produce an economic analysis (via monetary valuation) as to the value of some ecosystem services in supporting these constituents of wellbeing; these techniques are numerous and are becoming established though contested (Eftec, 2010). 'Ecosystem services' therefore provides a seemingly holistic concept which moves away from the traditional silo-based approach of discrete areas impacting on environmental

* Corresponding author.
E-mail address: j.baker@cep.co.uk (J. Baker).

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quality, e.g. soil, water, air, to one that focuses on the interconnectivity of the natural environment.

There is significant interest in the potential role of ecosystem services within decision support tools such as environmental assessment — including both strategic environmental assessment (SEA) and environmental impact assessment (EIA).[1] This is perhaps inevitable given the rise of the concept.

Several organisations have produced briefings, guidance or other forms of support in the area of ecosystem services in environmental assessment. Internationally the OECD (2010) and WRI (2011) and others (NER, 2010) have been developing guidance in this area (for EIA or SEA); the European Commission guidance on *Incorporating Biodiversity and Climate Change into the SEA and EIA Procedures* (CEC, in press) suggests ecosystem services is a useful concept for considering issues such as climate change adaptation and resilience within environmental assessment, and in the UK IEMA has produced a briefing on *Considering Ecosystem Services in EIA* (IEMA, 2012). The WRI guidance is in response to new International Finance Corporation (IFC, 2012) performance standards requiring risks and impacts to ecosystem services to be assessed.

From these documents, two key characteristics of ecosystem services can be seen to be driving the inclusion of ecosystem services in environmental assessment:

- Using ecosystem services presents a more complete, holistic and integrated consideration of the socio-ecological system.
- The ecosystem service concept is an effective framing of the environment in terms of communicating with and influencing stakeholders and decision makers.

These characteristics are subject to further analysis through this paper, but there is something of déjà vu about this initial characterisation. Haven't previous approaches been presented with similar promises of delivering more integrated, influential, comprehensive and stakeholder led environmental assessment? Examples of such approaches include land suitability analysis[2] (McHarg, 1969), environmental appraisal (Department of the Environment, 1992), Sustainability Assessment/Appraisal (SA) (e.g. George, 2001; Gibson, 2006), Quality of Life Capital Approach[3] (Therivel, 2009), to name a few. Historically, it is worth remembering that the UK Government sought to encourage local authorities to use an economic valuation approach in developing early SEA for local development plans in their guidance on *'Policy Appraisal and the Environment'* (Department of the Environment, 1992). Local authorities, however, found it inappropriate for their needs and set about the development of their own approach which led to objective-led environmental appraisal (Department of the Environment, 1993) and eventually sustainability appraisal (ODPM, 2005). Valuation, therefore, as an approach to spatial planning and assessment historically has not had a good reception (Sheate, 1994) and so the strong promotion of monetary valuation of ecosystem services as a methodology may not play well in SEA and EIA — this is expanded upon in later sections of the paper.

This paper considers whether ecosystem services bring anything that is different to these approaches which have either become established or faded from sight. For instance, does it offer any added value compared with sustainability assessment or is there anything to learning from the UK's Quality of Life Capital/Assessment which was developed by the Environment Agency and Natural England in the late 1990s/early 2000s, but was "*found* (to have) *not been widely used and that changed circumstances in the planning system meant that it did not warrant further investment*" (Environment Agency, 2008, p. 1). Alternatively, there is a risk that ecosystem services could become a separate assessment process akin to Landscape Character Assessment (Natural England, 2012), or it could be largely omitted from most environmental assessments as too resource intensive, as has tended to be seen with data-hungry Life Cycle Assessment (Sheate, 2009).

2. Structure and approach of the paper

This paper begins with a short overview of some of the common problems with current practice that limit the efficacy of environmental assessment. What is it about environmental assessment that suggests ecosystem services might have something to offer it? The paper then takes an empirical case study approach to explore how ecosystem services have been used in EIA and SEA to date. These case studies are illustrative rather than representative, not least because there are limited examples available of the practical application of ecosystem services in environmental assessment. However, the case studies have been selected to illustrate a range of issues arising from current environmental assessment practice and how an ecosystem service-based approach may or may not help to address those issues. These case studies are then interrogated to identify and explore the main strengths and weaknesses emerging from the practical application of ecosystem services within environmental assessment and what wider lessons can be drawn from this. The paper concludes with an analysis of the relative pros and cons of applying the ecosystem service concept within environmental assessment with reference to broad themes and principles.

3. What are the problems with current environmental assessment practice?

There is nothing intrinsic about the concept of ecosystem services which demands its inclusion in environmental assessment. Rather, to warrant its integration, ecosystem services need to offer something that can improve the environmental assessment process or more importantly the environmental outcomes that it delivers. Before exploring the potential value of integrating ecosystem services into environmental assessment, it is first important to understand the current problems with environmental assessment practice to highlight the problems that ecosystem services may contribute to addressing.

There is a considerable body of literature which identifies problems with environmental assessment practice, many of which have been evident since the introduction of environmental assessment (e.g. CEC, in press; DCLG, 2011). A summary of the key recurring problems within environmental assessment is presented below:

A lack of consistency and quality in screening — Deficiencies with screening include projects, plans or programmes (PPP) being subject to so-called 'salami slicing' where different aspects of a PPP are assessed separately, or not at all, reducing the assessed impact of PPPs. This is particularly a problem at the project level and EIA (IEMA, 2011).

A lack of early and effective scoping — Scoping shapes the rest of the assessment and is an important stage to involve stakeholders (Finnveden, 2003). The main reasons given for ineffective scoping are risk aversion, poor planning of the assessment and 'commercial realities' (European Commission, 2009a,b; IEMA, 2011).

[1] Environmental assessment is used in this paper as a generic term for a procedure that ensures that the environmental implications of decisions are taken into account before the decisions are made. This includes environmental assessment undertaken for individual projects, commonly known as environmental impact assessment (EIA), and for public plans or programmes, commonly known as strategic environmental assessment (SEA).

[2] Land suitability analysis is based on a judgement that some land is suitable for certain uses and clearly unsuitable for other uses: these natural constraints should be respected when developing land.

[3] Quality of Life Capital approach (or Quality of Life assessment) — Asks what matters and why? For example, the value to society of a small woodland on the suburban fringe. Quality of Life Capital approach considers the benefits of the woodland in the form of recreation, wildlife habitat, soil stability, water retention, absorption of carbon dioxide and improving air quality and the provision of economic benefits such as timber or charcoal (Environment Agency, 2008).

Ineffectual collection and use of baseline information within the assessment, in particular relating to the evolution of the baseline — Effective consideration of the baseline is considered to be insufficient (Dalal-Clayton, 2005; DCLG, 2011). Part of this problem stems from a lack of integration between different environmental topics — so called "silo thinking" (Morrison-Saunders and Therivel, 2006). There is also felt to be an insufficient consideration of trends within the baseline with data analysis focussing on "snap shots" which are of limited value (Eales and Sheate, 2011a).

Lack of consideration of, genuine, reasonable alternatives — This has resulted in numerous objections and Judicial Reviews, particularly within SEA (e.g. Seaport,[4] St. Albans and Hertfordshire,[5] and Newmarket cases in the UK[6]). Concerns stem primarily from the narrow scope of the alternatives that proponents and policy makers consider which limits the opportunity for environmental assessment to support the identification of a more environmentally robust preferred alternative. The hierarchy of alternatives as set out in UK SEA guidance appears to be, at best, irregularly applied (DCLG, 2008).

Limited understanding and coverage of cumulative effects and significance of effects — The combination of various methods and attempts to be consistent across all topics means that significance is often communicated and justified poorly. The inherent complexity of the socio-ecological system, inadequate integration across environmental topics and overly restrictive boundary setting contribute to generally poor consideration of cumulative effects (Cooper and Sheate, 2002; Phillips, 2007).

Inadequate compliance with the mitigation hierarchy — The application of the hierarchy of 'prevent, reduce, mitigate and offset' has been noted as a concern with most environmental assessment practice being felt to focus on mitigation rather than actions to prevent impacts (Eales and Sheate, 2011b; European Commission, 2009a,b).

Lack of early and effective consultation and engagement with communities — Inadequate consultation and engagement can result in increased antagonism between proponents and policy makers as well as a missed opportunity to gather information from local stakeholders. (European Commission, 2009a,b; IEMA, 2011). The core reason for this is a lack of recognition as to the value of engagement within environmental assessment and the broader decision making process (IEMA, 2011; Munton, 2003).

Environmental assessment being seen as a hurdle not a useful tool to support the decision making process — This is a more general problem with how environmental assessment is used, with it often evident that environmental assessment processes tend to not be utilised but rather tolerated (Eales and Sheate, 2011b). The problem comes down a failure to recognise or explain the value that environmental assessment can add to the development of the project, plan or programme (IEMA, 2011).

A lack of innovation and an overreliance on guidance — Practitioners have tended to fixate on following guidance as the only way to comply with the legal requirements relating to environmental assessment. There are multiple ways in which one might comply and guidance should be treated as just a starting point to build on rather than something to follow in a prescriptive way (Baker, 2012; Phillips and Sheate, 2010). The majority of these problems are long standing and have a number of complex and interacting drivers. All are essentially problems of implementation. The key question for an ecosystem service approach is therefore whether it can facilitate better implementation of environmental assessment and not simply create additional burdens on practitioners and decision makers, even if it is seen as part of the natural evolution of environmental assessment towards a stronger reflection of sustainability (Sheate, 2012).

4. Examples of the use of ecosystem services within environmental assessment

There are only limited examples of the use of ecosystem services within environmental assessment. However, this section of the paper summarises five EIA and SEA case studies that illustrate a range of approaches to using ecosystem services in environmental assessment.

4.1. Case study 1: SEA of the Portuguese Integrated Coastal Zone Management Plan

4.1.1. An ecosystem service approach to the strategic consideration of biodiversity in delivering a plan's objectives

A preliminary document proposing the basis for a national Integrated Coastal Zone Management (ICZM) was developed in Portugal in 2006 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 (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.

4.1.1.1. Why were ecosystem services considered appropriate?. The importance of biodiversity and ecosystem services to delivering the policy's objectives was recognised at an early stage; however, the strategic nature of the policy meant that the effective consideration of biodiversity was potentially challenging. To address this ecosystem services were included to account for the value of biodiversity. This process helped to identify the importance of different ecosystems that provide distinct services for a variety of stakeholders (such as cultural services for tourists, provisioning services for fisheries). It also allowed for the assessment of alternative management options and strategies (Partidário, 2010).

4.1.1.2. How were ecosystem services incorporated?. 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 (regulating services); the maintenance of coastal zone productivity (provisioning services); the maintenance and conservation of the availability of natural and cultural heritage and biodiversity (cultural services); and the sustainable use of resources and the management of coastal risks (supporting services).

[4] Application by (1) Seaport Investments Limited and (2) Magherafelt District Council, F P McCann (Developments) Limited, Younger Homes Limited, Herron Bros Limited, G Small Contracts and Creagh Concrete Products Limited in Northern Ireland: No. [2007] NIQB 62, 7 September 2007.

[5] St.Albans and Hertfordshire County Council v Secretary of State for Communities and Local Government; 2009 [2009]EWHC 1280, 20 May 2009.

[6] Save Historic Newmarket Ltd. v. Forest Heath District Council [2011] EWHC 606.

4.1.1.3. Analysis of approach. The SEA was closely 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, 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). 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 this example, the ecosystem service approach was considered 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 costal ecosystems and services or biodiversity.

4.2. Case study 2: South Africa eThekwini Municipality SEA methodology development

4.2.1. Using ecosystem services to structure the overall assessment framework

Between 2009 and 2011 DANIDA (Danish International Development Agency) funded project to draw on local and international experience to develop a SEA methodology and framework for spatial development plans (SDPs) in eThekwini Municipality (Durban) in South Africa. This sought to integrate an ecosystem goods and services approach to SEA into the planning process in order to strengthen sustainability considerations.[7]

4.2.1.1. Why were ecosystem services considered appropriate?. eThekwini, on the east coast of South Africa and centred on the city of Durban, is a 'biodiversity hotspot' and has more than 10 years of experience use of ecosystem services as the basis for development and monitoring the DMOSS — Durban Metropolitan Open Space System, through state of the environment reporting and a management support system (eThekwini Municipality, 2011a). It form a basis for meeting the legal requirement (under The Local Government: Municipal Planning and Performance Management Regulations (2001)) that the Spatial Development Framework (SDF) must contain a strategic assessment of the environmental impact of the spatial development framework. The SDF is essentially a map providing a spatial representation of the Integrated Development Plan (IDP). In practical terms (given at the time of the study the eThekwini IDP had been recently approved) the logical place to start in applying SEA was at the SDP level, and to then further build capacity within lower level local area plans prior to applying SEA to the new IDP/SDF in the 2015 review.

4.2.1.2. How were ecosystem services incorporated?. A 'mixed metric' (multi-criteria) approach was recommended for the assessment framework, where 'valuations' could be based on monetary valuations, qualitative valuations of ecosystem services by stakeholders or expert judgement, or quantitative measures of the natural and physical environment through monitoring, thresholds etc. The mixed metrics could be readily normalised through a qualitative scoring scheme using significance criteria — the SEA process would look like many other SEA processes except for the fact that the framework would be based in part on ecosystem services. The SEA process, therefore, would not be replaced with a solely monetary valuation process, but informed by a range of approaches to valuing and measurement of sustainability parameters, including monetary where appropriate. By front loading the SEA process with a focus on ecosystem services it enables ecosystem services to help shape the assessment framework and its application.

4.2.1.3. Analysis of approach. SEA was viewed positively by the eThekwini planners, since they thought it would help them undertake strategic forward planning, rather than being reactive. The methodology developed by the project is awaiting application in eThekwini while the IDP process is being aligned with a Long-term Development Plan (eThekwini Municipality, 2011b) that emerged from a wider visioning process across the municipality (Imagine Durban, 2012). The SEA methodology now exists to be applied to the new IDP/SDP process and its development has already helped to build capacity among the planners for integrating an ecosystem approach as part of a broad sustainability-based SEA.

4.3. Case study 3: Metropolitan Glasgow Strategic Drainage Partnership (MGSDP) Implementation Plan SEA

4.3.1. The value of ecosystem services in delivering the objectives of a plan as well as the positive reaction to ecosystem services in environmental assessment from key regulators and stakeholders

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. In response, the MGSDP's Development Plan has considered two high level alternatives for addressing the region's strategic drainage needs: 1) a traditional approach of conveying water in underground pipes; and 2) a more novel approach of conveying water on the surface through various SuDS — sustainable urban drainage system — techniques. Following an appraisal of the two alternatives, the MGSDP pursued a preferred strategy which combined elements of each alternative.

4.3.1.1. Why were ecosystem services considered appropriate?. A key part of the MGSDP's approach focuses on enhancing the capacity of the region's landscape to retain surface water, because enhancing provision of relevant ecosystem services, 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.

4.3.1.2. How were ecosystem services incorporated?. 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, an ecosystems approach based SEA methodology was developed. The incorporation of ecosystem services focused on their spatial representation and a comprehensive assessment methodology that considered impacts on ecosystem function and secondary impacts on ecosystem service provision. 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 the scoped-in ecosystem services shown in Table 1 below.

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.

[7] The second author of this paper was contracted as the international SEA advisor to the project.

Table 1
MGSDP implementation plan SEA — scoped-in ecosystem services.

Ecosystem processes (supporting services)/intermediate ecosystem services	Final ecosystem services and goods obtained
• Hydrological cycle function (also contributes to *flood control*) • Ecological interactions/broadleaved woodland habitat networks • Ecological interactions/fen, marsh and swamp habitat networks • Ecological interactions/neutral grassland habitat networks	• Hazard regulation (*flood control*) • Detoxification and purification of water (*pollution control and drinking water*) • Environmental settings (*recreation/tourism*)

Note: The approach adopted in the MGSDP's Implementation Plan SEA differentiates between ecosystem processes/intermediate ecosystem services and final ecosystem services and the goods obtained from these, as in the UKNEA (2011). The former underpin production of the latter and are akin to supporting services.

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 the 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 SEA.

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 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 vice-versa. This type of network analysis approach has been trialled in the Thames Gateway (CEP, 2008a).

4.3.1.3. Analysis of approach. Although broadly supportive, responses to the SEA Scoping Report raised key concerns in relation to the proposed ecosystems approach. As recognised 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 respectively 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.

4.4. Case study 4: Wareham Managed Re-alignment (UK) — Green infrastructure in environmental assessment (EIA/SEA)

4.4.1. The use of ecosystem service valuation in environmental assessment

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 environmental assessment (EEA, 2011).

4.4.1.1. Why were ecosystem services considered appropriate?. The role of natural habitats in producing ecosystem services which are relevant to reducing coastal erosion and flood risk is well recognised. The Environment Agency therefore sought to explore the use of natural flood management in managing risk for a flood and coastal erosion project, the Wareham Managed Re-alignment.

4.4.1.2. How were ecosystem services incorporated?. The project used guidelines produced for the Environment Agency (Eftec, 2010) which 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. Based on this process the study determined and integrated the economic value of the natural habitats (via ecosystem services such as flood protection and carbon sequestration) into the decision making process which looked at various options and informed the final decision.

4.4.1.3. Analysis of approach. This study demonstrated certain barriers to the use of valuing ecosystem services in decision making. For instance there was found to be significant additional uncertainty surrounding the absolute value of the environment due to the unpredictable 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 natural flood management projects (DEFRA, 2009).

4.5. Case study 5: The Heysham M6 link road EIA

4.5.1. Using ecosystem services to structure the assessment framework

In 2007, the UK's Department for Environment, Food and Rural Affairs (DEFRA) commissioned an ex-post study on the application of the ecosystem-based approach (EBA) in the EIA of an important infrastructure development project, the Heysham M6 link road in Lancashire, England (DEFRA, 2007a). The planning application upon which the EIA was conducted proposed a trunk road to improve connectivity between the Heysham port, Morecambe and the M6 motorway. This proposed route has in the past been controversial due to environmental concerns and divided public opinion among local communities.

4.5.1.1. Why were ecosystem services considered appropriate?. The EBA was defined as "having a clear strategy for and commitment to the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way". This was felt to be relevant as the area has recognised environmental value (Special Site of Scientific Interest, Special Protection Area, Special Area Conservation and Ramsar sites) and is therefore potentially sensitive to any major infrastructure developments. On the other hand, economic

regeneration in the area was felt to benefit from better connections with Heysham port. The EBA was believed to provide a more robust framework for decisions such as this which require strong integration and assessment of social, economic and environmental issues.

The two main questions that the study sought to answer were:

1. How well does the procedure that has been followed for the proposed Heysham M6 link deliver the EBA?
2. To what extent can the information collected to assess the impact of the Heysham M6 link, together with other information already available, be used to successfully use the EBA?

4.5.1.2. How were ecosystem services incorporated?. The study was retrospective and assessed the EIA against the twelve tasks set out in EBA guidelines published by the CBD (2012b). It found that:

- The application of EBA would have helped to promote a stronger consensus at local level, as well as greater ownership of the adopted decisions. This would have made the process more inclusive and participatory, which would have been beneficial given the recurrent delays and opposition that affected the Heysham M6 link project in the past.
- Adopting the EBA would have warranted a solution that optimises local benefits whilst meeting regional, national and international priorities.
- It would have resulted in a more holistic mitigation strategy focusing on ecosystem functions and limits, thus helping ensure the sustainability of project-related outcomes.
- It would have resulted in a stronger framework for ongoing management and monitoring of the mitigation strategy.

4.5.1.3. Analysis of approach. The overarching conclusion of the study was that the EBA should form the basic framework for the planning process rather than serve as a mere tool or set of techniques. Furthermore, the study concluded that, while many of the tools and methods used in the EIA process were to some extent compatible with the EBA, "*there are significant tensions and incompatibilities that need overcoming in the current planning system, which still remains adversarial in nature*". In other words, the application of the EBA may be limited by the specific planning mechanisms and the culture of the organisation or expert in charge of carrying out the EIA.

5. Strengths and weaknesses of using ecosystem services in environmental assessment

The text below presents a summary of the major strengths and weaknesses of using ecosystem services within environmental assessment, based on the analysis of the case studies and supporting documentation, and the available literature.

5.1. Strengths

5.1.1. Ecosystem services is an integrating concept which instead of dealing with discrete environmental 'topics' considers bundles of services that flow from the environment

These services are relevant across a number of different environmental topics so their consideration leads to an inherently integrated framing of the environment. In traditional environmental assessment the question that the scoping stage asks is: "what are the most significant likely environmental impacts of the plan, programme or project?" As shown with the Portuguese ICZMP SEA an ecosystem service approach would adapt this to ask: "what are the most important ecosystem services being provided in the area?" This is instantly a positive way of framing the situation as the environment is described based on service provision rather than as a backdrop to absorb impacts.

5.1.2. The description of the environment moves from things to benefits

This is potentially a much more effective framing of the environment for communication and influencing decision makers and other stakeholders — a woodland is not just a woodland, but a provider of a wide range of ecosystem services which can be interpreted as benefits or uses of the environment (Sheate et al., 2012).

5.1.3. Stakeholders and the public are well placed to engage with this alternative description

An ecosystem service question could be included in scoping reports subject to consultation with stakeholders and the public — e.g. Clackmannanshire Council have drawn on their Green Map Initiative in a range of SEAs (Clackmannanshire Council, 2008, 2010). Stakeholder consultation around planning decisions in the Thames Gateway region has effectively used this "use" framing of ecosystem services to better understand how local communities use and perceive their local environment (CEP, 2008b). This could feed directly into the scoping stages of environmental assessment. In effect ecosystem services is a potentially useful tool to promote learning exchange between local communities and decision makers.

5.1.4. Ecosystem services may be of particular value where there are clear conflicts between traditional environmental and economic arguments

As shown with the Hersham Road EIA, ecosystem services can make the arguments less binary (environment versus economic development), emphasising wider economic benefits of certain habitats and land cover types, e.g. wetlands.

5.1.5. Incorporating ecosystem services into environmental assessment helps practitioners and decision-makers to reflect on the impact of the environment on their plan, programme or project rather than just vice versa

It is possible to consider how ecosystem service support the objectives of a particular plan, programme or project. This flipping of the normal logic of environmental assessment allows practitioners to frame the assessment in terms of a plan, programme or project's resilience and how protecting or enhancing the environment may contribute to a plan, programme or project (Eales et al., 2011).

5.1.6. The ecosystem service framing makes explicit the value of the environment for decision makers

The shift from things to benefits can better demonstrate why the environment, and hence environmental assessment, matters. As shown with the MGDSP case study this approach can be used to communicate to decision makers the value of funding new or enhanced green infrastructure to increase the value and spatial distribution of key ecosystem services whilst also helping to restore degraded ecosystems.

5.2. Weaknesses

5.2.1. The use of ecosystem service language may not resonate with all stakeholders

Although ecosystem services can be communicated by describing benefits and uses there is still a tendency to use the term ecosystem services which has been found to have very little traction within the public (DEFRA, 2007b).

5.2.2. The complexity of ecosystem services as a concept

The integrated nature of ecosystem services presents an inherent difficulty. This was a stumbling block in the Wareham Managed Realignment case study. In addition, the non-linearity of ecosystem service provision and its relationship with biodiversity and other ecological processes means that practitioners operate within a high degree of uncertainty something that may limit its usefulness within assessment.

5.2.3. The contested nature of ecosystem service valuation may not be robust enough for environmental assessment which operates within a legal framework

It remains to be seen that decisions based on the largely assumption based methodology of ecosystem service valuation and benefits transfer will be robust enough to be a valid tool within environmental assessment which is increasingly subject to legal challenge. To the knowledge of the authors there is no precedent for this, but concerns were flagged during the Wareham Managed Realignment and practitioners have also voiced doubts around the legal weight of any decision based on monetary valuation of ecosystem services (Baker, 2012).

5.2.4. Doing comprehensive ecosystem service assessment is potentially very resource intensive

This is especially true for valuation which requires significant primary research to be undertaken to form an effective baseline. However, even avoiding valuation there is the risk of adding supplementary steps (and resource requirements) into existing environmental assessment — for instance the WRI (2011) scoping tool requires the development of various indices and questionnaires.

5.2.5. Ecosystem services may not be relevant to all plans, programmes or projects or all institutional contexts

Only certain sectors or types of plan, programme or project may be relevant for using ecosystem services. In addition, aspects of the environment that are only partially or indirectly based on ecosystem services may be omitted (unless a very broad definition of ecosystem is taken to include the human built environment) — examples include heritage/historic environment, deprivation and aspects of health.

5.2.6. Mitigation and offsetting are complex; there is also a risk that ecosystem service mitigation may not be compliant for environmental assessments which operate within a legal framework

Ecosystem services can be used in mitigation, but one potential difference may be a reconsideration of what is mitigation, especially with quantification in the assessment. Under traditional environmental assessment, mitigation is reducing or compensating for damage done to an area that is being considered as having its own intrinsic worth. That intrinsic value is why it is important to mitigate and that value is specifically located in that area. Mitigation is therefore an ethical choice, required because of the loss of something with intrinsic value, whereas avoidance is preferable as by definition it avoids any ethical dilemma. This changes when considering ecosystem services, where the amount of service provision is being mitigated. When mitigating ecosystem services it is possible that service provision remains stable or improves; however there are winners and losers as a result of this relocation of ecosystem services. The implication of this is that ecosystem service changes mitigation so that it is now equal to avoidance, as there has been no net loss of ecosystem services. The issues described above could be avoided using non valued ecosystem services. Equally, the importance of supporting services is such that these services are arguably not substitutable or transferable.

6. Discussion

An earlier section highlighted certain current problems with environmental assessment practice. This highlighted the problem areas that using ecosystem services within environmental assessment may be able to contribute to improving environmental assessment process and/or the environmental outcomes that it delivers. Clearly in addition to these, ecosystem services may also offer additional benefits. Drawing on the case studies above and the strengths and weaknesses set out above, Table 2 below presents the potential of ecosystem service-based environmental assessment to deal with these problems, providing an analysis of the net impact of the identified strengths and weaknesses of such an approach.

The analysis above suggests that on balance ecosystem services may bring some benefits to environmental assessment practice, but it is not always clear cut and will be context specific. Potential benefits may include an inherently integrated description of the environment and its likely evolution enabling the consideration and description of cumulative effects to be improved. Ecosystem services may also offer alternative ways to frame the environment to inform plan makers, project proponents and decision makers to be made more aware of the range of benefits and services the environment provides and to help tease out information from stakeholders and communities.

However, a number of the more fundamental challenges with current environmental assessment practice such as poor planning and insufficient evidence and resources being deployed are not likely to be "solved" by the inclusion of ecosystem services and, indeed, could even be exacerbated.

One such challenge highlighted by the direct experience of the authors as practitioners, and from the literature (e.g. Baker, 2012; Campbell and Sheate, 2012; Eales and Sheate, 2011a,b; Phillips and Sheate, 2010; Scottish Government, 2010), is that practitioners and decision makers appear reluctant to diverge from the well-established approaches to environmental assessment based on a legitimate but excessive aversion to potential legal challenge. In addition to this inertia, there are concerns relating to the compliance with legal requirements for SEA and EIA of an ecosystem service approach. A simple cross-referencing of, for example, the environmental topics included in the EU SEA Directive (OJ, 1985, 2001) against key ecosystem services illustrates the point that an ecosystem service framework for assessment can be readily compliant in terms of the topics required to be covered by the legislation providing a broad interpretation of ecosystem services is taken (see Fig. 1). This also reaffirms the concept's relevance to cumulative effects as it identifies interactions between the environmental topic areas.

Two broad approaches to incorporating ecosystem services in environmental assessment can be characterised from the literature and case studies:

- Comprehensive ecosystem services environmental assessment; and,
- Ecosystem service philosophy.

The former is marked by the more quantitative approach to ecosystem services — this may include a systematic identification of ecosystem service supply and demand across an area and may extend to the valuation of ecosystem services as shown in the Wareham Managed Re-alignment and the MGSDP examples described above.

The ecosystem service philosophy is more about the use of ecosystem services as a heuristic or as a framing for the environment — see for instance the eThekwini Municipality and Portuguese ICZM SEA approaches. As such it is a less significant departure from existing practice and relies on a changing of language and elements of the approach. The relative merits of these approaches are not currently clear as there are limited applied examples — however the work emerging from the case studies suggests that the ecosystem service philosophy framework is applicable to a wider range of sectors and assessment contexts.

In effect, environmental assessment of all plans, programmes and projects that rely, to a greater or lesser degree, on a high quality natural environment could draw on the 'ecosystem service philosophy' approach as an initial starting point. For plans, programmes or projects that are identified via scoping as being more reliant or having a greater impact on the natural environment it may be appropriate to increase the integration of ecosystem services to the point of a comprehensive ecosystem service environmental assessment. This can be seen with the MGDSP where scoping led to the realisation that ecosystem services and ecosystem health more widely has a large role to play in delivering the objectives of the plan. However, even within comprehensive ecosystem service environmental assessment there is a need to incorporate explicitly non-ecosystem service

Table 2
Potential contribution of an ecosystem services-based approach to resolving problems in environmental assessment practice.

Problems in environmental assessment practice	Potential contribution of ecosystem services
A lack of consistency and quality in screening.	Limited, as ecosystem services are unlikely to be part of the initial consideration of environmental impacts.
A lack of early and effective scoping.	Using ecosystem services as a framing for consultation could be an effective way to build interest and the identification of priority services via scoping could be a useful way of shaping the assessment.
Ineffectual collection and use of baseline information within the assessment, in particular relating to the evolution of the baseline.	Notwithstanding the potentially higher resource requirement, the use of ecosystem services has the potential to facilitate a more integrated approach to the collection of baseline information. In addition, wider sources of information are more relevant for example community knowledge.
Lack of consideration of genuine, reasonable alternatives.	Ecosystem services can be used as part of the framework to assess alternatives, but its inclusion alone does not necessarily lead to better consideration of alternatives. The existing barriers largely remain.
Limited understanding and coverage of cumulative effects and significance of effects.	The integrated, bundled nature of ecosystem services is very relevant to cumulative effects as its ability to cross topic areas presents an opportunity for a more holistic framing of effects. Describing the environment in terms of benefits or uses could be an effective way to form an assessment of significance, if this was based on effective stakeholder engagement and a broad definition of ecosystem is taken to include the built environment, for example.
Inadequate compliance with the mitigation hierarchy.	A focus on ecosystem services has the potential to both support and undermine the mitigation hierarchy as it is currently applied. The potentially transferable nature of ecosystem services means there is a risk that local communities will lose vital services if these are mitigated for in other areas. It is not clear how existing mechanisms will address this concern.
Lack of early and effective consultation and engagement with communities.	Ecosystem services offer a new way to engage with communities — recognising communities as crucial holders of information. The framing of the environment in terms of "use" and "benefits" presents new opportunities for engagement; however the extant concerns relating to practitioners' ability to recognise the benefits of engagement, due to resource and other constraints, remain.
Environmental assessment being seen as a hurdle not a useful tool to support the decision making process.	The framing of the environment, using ecosystem services, as something that can support the aims and objectives of a plan, programme or project rather than simply as a backdrop for impacts presents an opportunity to promote environmental assessment as a process that can add value to and support the decision making process. On the other hand, it may be seen as yet another added requirement and a greater burden. How it is presented and applied remains essential to determining this.
A lack of innovation and an overreliance on guidance.	Integrating ecosystem services within environmental assessment represents a relatively new and an innovative approach and there are currently limited examples of good practice to draw on. However, one of the constraints to incorporating ecosystem services into environmental assessment remains the reluctance of many practitioners to use it without official support, as there is a fear of being accused of "gold plating" environmental assessment — i.e. going above and beyond what is required or necessary.

aspects as appropriate — for example relating to the historic environment, deprivation and non-ecosystem service health issues.

7. Conclusions

A cynical view might be that the effort to incorporate ecosystem services into environmental assessment reflects a methodology looking for a purpose. In other words, it is possible that ecosystem services may need environmental assessment more than environmental assessment needs ecosystem services. SEA and EIA for example are a suitable platform for ecosystem services as previously noted — *"SEA provides a platform to put valuation results in a societal context"* (NER, 2010, page 8). It will therefore be interesting to observe how ecosystem services become more integrated into environmental assessment and decision making over time — i.e. will developments in environmental assessment practice (such as various guidance documents) drive this or will plans, programmes and projects react to other drivers — such as funding and policy developments — and start to use ecosystem services and require environmental assessment to follow suit. Based on the review of potential case studies there appears to be more examples of ecosystem services in environmental assessment at the strategic (SEA) level — time will tell if this observation is significant.

From the analysis of the case studies and literature it is apparent that ecosystem services could potentially be beneficial (Geneletti, 2011; Slootweg et al., 2010). However, the extent to which it is able to improve environmental assessment practice depends on how it is used and in what circumstances. Different environmental assessment contexts — such as sectors, scale, underlying critical factors and environmental characteristics, available resources and available information — are likely to drive the applicability and form of ecosystem services' inclusion. However, it is such an inherently flexible concept that practitioners are likely to be able to adapt it as appropriate, if they have sufficient freedom to do so.

In the contexts where it is useful, practitioners need to be thinking about in what form the approach could be utilised. In some instances it may be necessary to use comprehensive ecosystem service environmental assessment including the valuation of services, but in most instances this is not likely to be feasible due to the significant related resource requirements and the concerns over the potential lack of robustness and objectivity of some valuation techniques — these concerns may be why previous attempts to make explicit the value of the environment did not succeed (Department of the Environment, 1992).

Looking to past experience it is important that ecosystem services do not become pushed into a separate assessment along the lines of what happened in the UK to Quality of Life Capital. This was a very similar approach, but was never mainstreamed and was seen as superfluous, insufficiently rigorous and even too simplistic. This must be avoided as the value of ecosystem services would appear to be via its integration into standard environmental assessment practice. So how to achieve this? Practitioners are currently highly reliant on guidance — it appears that some guidance documents such as those

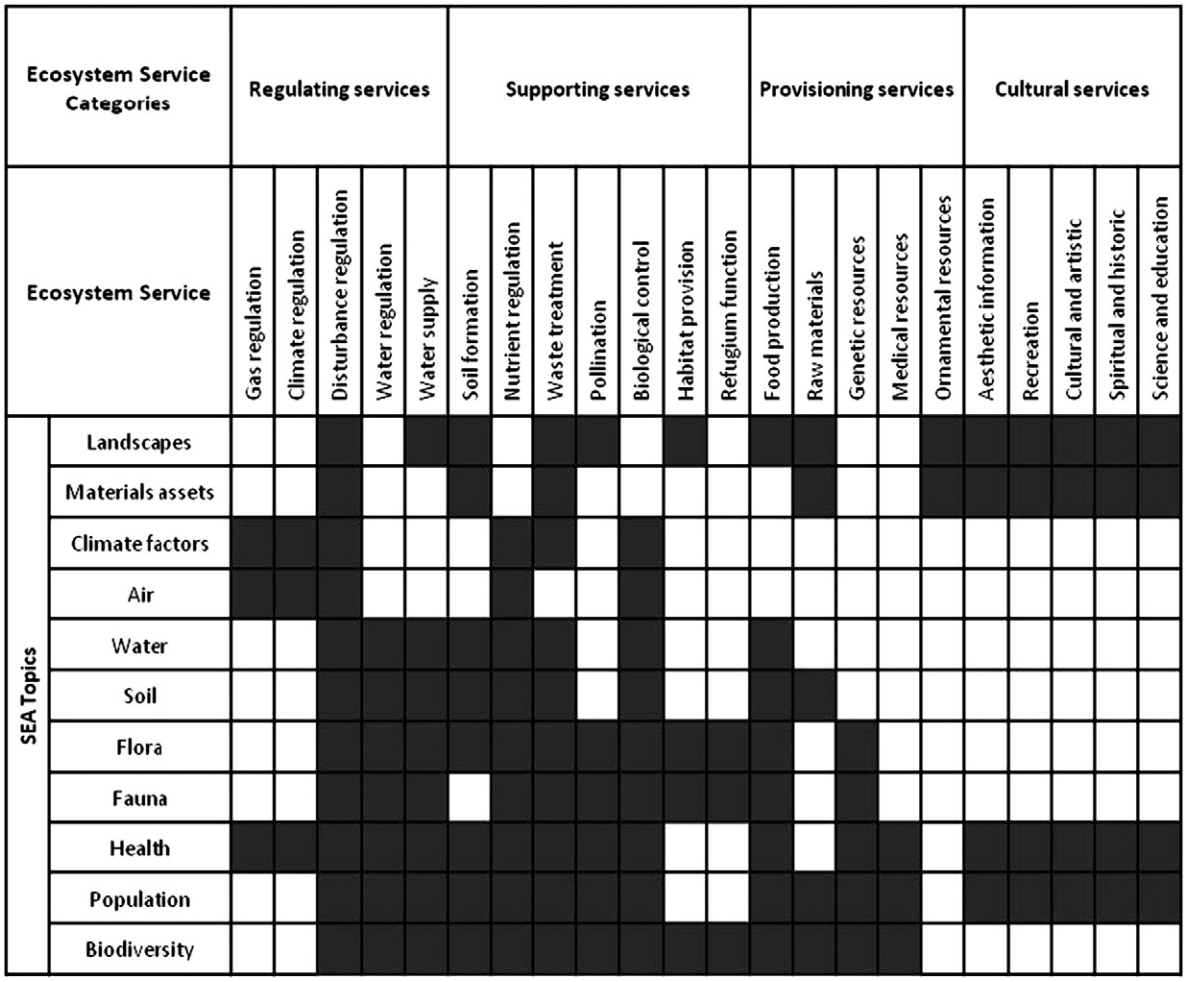

Fig. 1. Compatibility matrix of SEA Directive environmental topics and example ecosystem services. (Note that this figure illustrates those services that are most directly relevant.)

developed by the WRI and OECD are supporting a more comprehensive ecosystem service approach to assessment. This may help its integration, but only if decision makers demand it (as is the case of the IFC) and only if it is seen to make a difference without additional burden. The European Commission's guidance[8] on integrating biodiversity and climate change into EIA and SEA takes a lighter ecosystems-thinking approach to encourage practitioners to think about ecosystem services early on, but not in a prescriptive way.

Prescribing a methodology can work for guidance or standards based approaches, such as for IFC, but is not generally suitable for legally mandated processes such as EIA and SEA, where the objectives of the legislation are prescribed, but the means of achieving those is left more open. While ecosystem services could be integrated relatively simply into the objectives of, for example, an amended SEA or EIA Directive, it is not desirable to prescribe the assessment method itself, not least because it would be too restrictive and pay no attention to context, and amendment of legislation is far from quick or easy.

Further practical examples of the use of ecosystem services in environmental assessment are likely to emerge and this will usefully allow the literature to explore the relevance and value of ecosystem services in environmental assessment in more detail across a range of situations. This is particularly salient within the EU where there are calls to incorporate ecosystem services into any changes to the EIA Directive; such a decision must be based on examples of practice rather than just wishful thinking that ecosystem services is a panacea — it is not. On balance, ecosystem services is likely to make a positive contribution to environmental assessment practice, but it will remain reliant on how practitioners, plan makers and project proponents tackle the intransigent challenges of undertaking environmental assessment with limited resources and time.

So to answer the original question posed by this paper, ecosystem services in environmental assessment is probably more of a help than a hindrance and may help address some current problems with environmental assessment practice. But it needs to be context specific — including in some situations taking a more integrated approach and in others taking a lighter touch — and it will not be appropriate in all cases.

Having demonstrated that integrating ecosystem services within environmental assessment has potential value, the challenge is to learn from the success and failures of past approaches and to ensure that the potential of ecosystem services is realised in practice. Those responsible for plans, programmes and projects, therefore, need to have the courage to allow practitioners to use and develop it — where appropriate. Statutory environmental authorities and consultees need to engage with proponents and practitioners in a robust debate over the practical application of an ecosystems approach on a case by case basis, ensuring that the scoping stage is used effectively to reach agreement on the adopted methodology, recognising both the benefits and limitations.

[8] Collingwood Environmental Planning Ltd. was a co-author of a study with Milieu Ltd. and Integra Consulting Services Ltd. to draft guidance for the European Commission on the integration of biodiversity and climate change into EIA and SEA practice. The resulting guidance documents are expected to be published by the European Commission in 2012.

References

Baker J. Incorporating ecosystem services into SEA: how and why. Unpublished MSc Thesis, Imperial College London Centre for Environmental Policy, 2012.

Campbell G, Sheate W. Embedding an ecosystems approach? Town Country Plann 2012;81(3):139–44.

CBD. Nagoya principle. [Online] Available from:http://www.cbd.int/development/meetings/egmbped/nagoya-declaration-en.pdf2012.

CBD. The ecosystems approach advanced user guide. [Online] Available from:http://www.cbd.int/ecosystem/sourcebook/advanced-guide/2012.

Chee YE. An ecological perspective on the valuation of ecosystem services. Biol Conserv 2004;120(4):549.

Clackmannanshire Council. Environmental report to the Clackmannanshire environment & sustainability framework. [Online] Available from:http://www.scotland.gov.uk/Topics/Environment/environmental-assessment/sea/SEAG2008.

Clackmannanshire Council. Environmental report to the Clackmannanshire local development plan 2010. [Online] Available from:http://www.scotland.gov.uk/Topics/Environment/environmental-assessment/sea/SEAG2010.

Collingwood Environmental Planning. Case study to develop tools and methodologies to deliver an ecosystem based approach — Thames Gateway Green Grids — NR0109. Final Report to DEFRA — available atwww.cep.co.uk/Thesaurus.htm2008.

Collingwood Environmental Planning. Ebbsfleet local study report (DEFRA case study NR0109). available atwww.cep.co.uk/Thesaurus.htm2008.

Cooper LM, Sheate WR. Cumulative effects assessment: a review of UK environmental impact assessments. Environ Impact Assess Rev 2002;22(4):415.

Dalal-Clayton B. Strategic environmental assessment: a sourcebook and reference guide to international experience. Earthscan Publications; 2005.

DCLG. Final report: spatial plans in practice — supporting the reform of local planning. London: Communities and Local Government Publications; 2008.

DCLG. Towards a more efficient and effective use of Strategic Environmental Assessment and Sustainability Appraisal in spatial planning; 2011.

DEFRA. Case study to develop tools and methodologies to deliver an ecosystems approach — Heysham to M6 link DEFRA research project nr0110. [Online] Available from:http://randd.defra.gov.uk/Document.aspx?Document=NR0110_7329_FRA.pdf2007.

DEFRA. Public understanding of the concepts and language around ecosystem services and the natural environment (DEFRA Project code: NR0115). [Online] Available from:http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=15310#RelatedDocuments2007.

DEFRA. An introductory guide to valuing ecosystem services. [Online] Available from: http://www.defra.gov.uk/environment/policy/natural-environ/documents/eco-valuing.pdf2009.

DEFRA. Natural Environment White Paper. [Online] Available from:http://www.defra.gov.uk/environment/natural/whitepaper/2012.

Department of the Environment. Policy appraisal and the environment. London: HMSO; 1992.

Department of the Environment. Guide to environmental appraisal of development plans: a good practice guide. London: HMSO; 1993.

Eales R, Sheate W. Opportunities missed and challenges to come? Town Country Plann 2011a;79(3):134–9.

Eales RP, Sheate WR. Effectiveness of policy level environmental and sustainability assessment: challenges and lessons from recent practice. J Environ Assess Policy 2011b;12(1):39–65.

Eales R, Baker J, Sheate W. Integrating a resilience approach into strategic environmental assessment. International Association for Impact Assessment, Prague Conference, 2011; 2011.

Eftec. Economic evaluation of environmental effects. [Online] Available fromhttp://publications.environment-agency.gov.uk/pdf/GEHO0310BSFH-e-e.pdf2010.

Environment Agency for England and Wales. Joint statement by Natural England, Environment Agency and English Heritage on Quality of Life Assessment. [Online] Available from:http://www.environment-agency.gov.uk/static/documents/Research/statement_on_qola_1979914.pdf2008.

eThekwini Municipality. Headline indicators report 2007/8. Available from:http://www.durban.gov.za/City_Services/development_planning_management/environmental_planning_climate_protection/Publications/Documents/SOE%20Headline%20indicators%20report%202007%202008.pdf2011.

eThekwini Municipality. Integrated development plan (IDP) 2011/12. Available from:http://www.durban.gov.za/City_Government/City_Vision/IDP/Documents/201112.pdf2011.

European Commission. Conclusion from conference for the 25th anniversary of the EIA Directive: successes — failures — perspectives. [Online] Available from:http://ec.europa.eu/environment/eia/conference.htm2009.

European Commission. Report from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee on the Regions. Brussels: European Commission; 2009b. [Report Number: 469].

European Commission. Our life insurance, our natural capital: an EU biodiversity strategy to 2020. [Online] Available from:http://ec.europa.eu/environment/nature/biodiversity/comm2006/pdf/2020/1_EN_ACT_part1_v7%5B1%5D.pdf2012.

European Commission. Practical guidance and recommendations for integrating climate change and biodiversity into Environmental Impact Assessment / Strategic Environmental Assessment procedures (in press).

European Environment Agency (EEA). Territorial cohesion and green infrastructure. [Online] Available from:http://bookshop.europa.eu/en/green-infrastructure-and-territorial-cohesion-pbTHAK11018/;pgid=y8dIS7GUWMdSR0EAlMEUUsWb0000Sj2u0HbW;sid=oO2-CneFtwW-BTg3mHUgrRWgAi7CWjrmvp8=2011.

G.Finnveden G. Strategic environmental assessment methodologies — applications within the energy sector. Environ Assess Rev 2003;23(1):91.

Geneletti D. Reasons and options for integrating ecosystem services in strategic environmental assessment of spatial planning. Int J Biodivers Sci Ecosyst Serv Manage 2011;7(3):143–9.

George C. Sustainability appraisal for sustainable development: integrating everything from jobs to climate change. Impact Assess Proj Apprais 2001;19(2):95.

Gibson RB. Beyond the pillars: sustainability assessment as a framework for effective integration of economic and ecological consideration in significant decision making. Environ Assess Policy Manage 2006;8(3):259–80.

Haines-Young R, Potschin M. England's terrestrial ecosystems and the rationale for an ecosystems approach. Overview Report; 2008 [30 pp. (DEFRA Project Code NR0107)].

Hughes J, Brooks S. Living landscapes: towards ecosystem-based conservation in Scotland. Edinburgh: Scottish Wildlife Trust; 2009.

IEMA. The state of EIA practice in the UK. [Online] available from:http://www.iema.net/eiareport2011.

IEMA. Considering ecosystem services in EIA [Online] Available from:; 2012.

Imagine Durban. Long term plan. available athttp://www.imaginedurban.org/Pages/Longtermplan.aspx2012.

International Finance Corporation. International Finance Corporation. [Online] Available from:http://www1.ifc.org/wps/wcm/connect/corp_ext_content/ifc_external_corporate_site/home2012.

U.Mander U, K.Helming K, H.Wiggering H. Multifunctional land use: meeting future demand for goods and services. Earth and environmental sciences. London: Springer; 2007.

McHarg IL. Design with nature. New York: Wiley; 1969.

MEA. Millennium ecosystem assessment: summary of findings. [Online] Available from:http://www.maweb.org/en/index.aspx2005.

MGSDP. The Metropolitan Glasgow Strategic Drainage Partnership. [Online]http://www.mgsdp.org/2011.

A.Morrison-Saunders A, R.Therivel R. Sustainability integration and assessment. J Environ Assess Policy Manage 2006;8(3):281–98.

Munton R. Deliberative democracy and environmental assessment. In: Berfhout F, Leach M, Scoones I, editors. Negotiating environmental change new perspectives from social science; 2003. p. 109.

Natural England. Landscape character assessment. [Online] Available from:http://www.naturalengland.org.uk/ourwork/landscape/englands/character/assessment/default.aspx2012.

NER. Valuation of ecosystem services and strategic environmental assessment: lessons from influential cases. [Online] Available from:http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0CDEQFjAB&url=http%3A%2F%2Fcontent.undp.org%2Fgo%2Fcms-service%2Fdownload%2Fpublication%2F%3Fversion%3Dlive%26id%3D2078079&ei=8PyHT-TfCuiG0AXX5qnhCQ&usg=AFQjCNEOVxepE2vsY7ZRN8nTZwllXE0vVQ2010.

OECD. Strategic environmental in assessment ecosystem services. [Online] available fromhttp://www.oecd.org/dataoecd/24/54/41882953.pdf2010.

Office of the Deputy Prime Minster (ODPM). Sustainability appraisal of regional spatial strategies and local development documents. Wetherby: ODPM Publications; 2005.

Official Journal (OJ) of the European Commission. Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment 85/337/EEC; 1985.

Official Journal (OJ) of the European Commission. Council Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment; 2001.

Partidário MR. TEEB case: SEA for including ecosystem services in coastal management, Portugal. [Online] Available from:http://www.eea.europa.eu/atlas/teeb/sea-for-including-ecosystem-services-12010.

Phillips P. Has cumulative effects assessment (CEA) been undertaken adequately as a statutory component of strategic environmental assessment (SEA) in Scotland? Unpublished MSc Thesis, University of Strathclyde Department of Civil Engineering, 2007.

P.Phillips P, W.R.Sheate WR. A new SEA pathway: reflecting on strategic environmental assessment in Scotland. Environmentalist 2010;104:19–22. [20 September 2010, available at www.iema.net].

Scottish Government. SEA Pathfinder Project: stage 1 and 2 combined summary report. November 2010, available athttp://www.scotland.gov.uk/Resource/Doc/921/0107233.pdf2010.

Scottish Government. Applying an ecosystems approach to land use: information note. Available athttp://www.scotland.gov.uk/Resource/Doc/345453/0114927.pdf2011.

Sheate WR. Making an impact: a guide to EIA law and policy. London: Cameron May Ltd.; 1994.

Sheate WR. The evolving nature of environmental assessment and management: linking tools to help deliver sustainability. Chapter 1In: W.R.Sheate WR, editor. Tools, techniques and approaches for sustainabilityCollected writings in environmental assessment policy and management2009Singapore: World Scientific; 2009.

Sheate WR. Purposes, paradigms and pressure groups: accountability and sustainability in EU environmental assessment, 1985–2010. Environ Impact Assess Rev 2012;33:91-102.

Sheate WR, Eales RP, Daly E, Baker J, Murdoch A, Hill C, et al. Spatial representation and specification of ecosystem services: a methodology using land use/land cover data and stakeholder engagement. J Environ Policy Assess Manage 2012;14:1-36.

Slootweg R, Rajvanshi A, Mathur VB, Kolhoff A. Biodiversity in environmental assessment: enhancing ecosystem services for human well-being. Ecology, biodiversity and conservation series. Cambridge, UK: Cambridge University Press; 2010.

TEEB. Summary for policy makers. [Online] Available from:http://www.maweb.org/en/index.aspx2011.
R.Therivel R. Quality of life capital. In: Morris P, Therivel R, editors. Methods of environmental impact assessment. 3rd edition. London: Routeldege; 2009. p. 460–6.
UKNEA. UK NEA synthesis of findings. [Online] Available from:http://uknea.unep-wcmc.org/2011.
WRI. Ecosystem services review for impact assessment. [Online] Available from:http://www.wri.org/publication/ecosystem-services-review-for-impact-assessment2011.