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Landscapes, sustainability and the place-based analysis of ecosystem services

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Abstract There is currently, widespread interest in the assessment of ecosystem services, and the new insights that the concept provides in understanding the ecology of landscapes and the science of sustainability. Three major assessment frameworks can be identified in the contemporary literature, namely one based on habitats, one based on the identification of the system elements that delivers the service, and one based on the understanding of places. Although all are useful for supporting decision making in relation to sustainable development, different situations require different perspectives, and so it is important to understand their advantages and drawbacks. Moreover, it is important to determine how they relate to other approaches used, for example, in landscape planning, so that the contribution that ecosystem assessments can make to sustainability debates can be better understood. The aim of this paper is to describe the strengths of the place-based approach because it is more easily overlooked as an assessment option. In particular we will argue that a place-based approach can help us better understand issues of multi-functionality, the valuation of natural capital and the role of landscape in framing debates about ecosystem services and sustainability. An appreciation of these issues will enable researchers interested in landscape to key questions and priorities in relation to questions of sustainability. Although it is useful to consider different assessment perspectives separately, we conclude that in practice, the habitat and systems approaches can form part of a place-based assessment, just as a better understanding of place can enrich assessments that spring from these more natural science approaches. Nevertheless, in designing analytical strategies to take the ecosystem approach forward, we suggest that it is vital to consider these different perspectives in order to build assessments that are relevant, legitimate and credible, and which can effectively address the problems of sustainability that emerge at the landscape scale.

Keywords Ecosystem assessments · Ecosystem approach · Ecosystem services · Place-based approaches · Sustainability science · Cultural landscapes

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Introduction

Ecosystem assessments are a systematic process that aims to provide support for decision making relating to questions of ecosystem services and sustainable development. According to a recently published manual based on the lessons of the Millennium Ecosystem Assessment, they provide "the connection between environmental issues and people" (Ash et al. 2010).

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Yet what kinds of support is it that they offer? How do they connect environment and people? In this paper we examine these questions thought the lens of 'place'; place, we argue is a major way in which these connections can be established. Our motivation for exploring these issues stems from the repeated claims that 'place-based' perspectives represent an important and novel aspect of contemporary assessment approaches—and the realisation that methodologically progress has been limited. The difficulties seem to arise in relation to the way social context is handled by natural scientists and the problems they face in dealing with multiple values at the landscape scale.

We begin by considering the emergence of place-based discourses in environmental management and then look at how they have been played out in landscape ecology and the growing inter-disciplinary nexus that is forming around the concept of ecosystem services. We propose that a focus on 'place' can help clarify important issues, and in particular operationalising the ecosystem service concept in terms of the contributions that ecosystems make to human well-being; the synergies with contemporary ideas about the nature of spatial planning at the landscape scale are noted. In the central part of this piece we consider the place-based approach from a methodological viewpoint, and compare it to other assessment frameworks that are now commonly used. From this analysis we identify key issues and priorities in relation to questions of sustainability that emerge through a consideration of place. We conclude by looking at the practical issues that surround the idea of place-based assessments and reflect on some strategies for overcoming them, and how insights from all three perspectives can best be combined. As a result we will be better able to undertake assessments that are relevant, legitimate and credible, and to communicate results effectively.

Place-based discourses and sustainability science

Much of the current debate around the importance of place can be traced to the emergence of 'sustainability science' over the last decade, and earlier calls for more 'civic' or 'citizen' orientated science that preceded it (O'Riordan 1999; Potschin and Haines-Young 2006). The thrust of these arguments was that traditional practices of science needed to be transformed to address the needs of sustainable development. The transition was seen as involving a move away from 'reductionism' to 'integration' and 'synthesis', with a focus on the "interactions between nature and society" (Kates et al. 2001, p. 641) and an understanding of "ecological and social characteristics of *particular places* and sectors" (our italics). While integration and synthesis of knowledge between disciplines is a prerequisite, the integration of science and society more generally is seen as a fundamental part of the new science, which has to be socially sensitive. As a "social movement", sustainable development has been seen as requiring involvement of stakeholders "with the ideal of reconciling different and sometimes opposing values and goals toward a new synthesis and subsequent coordination of mutual action to achieve multiple values…" (Kates et al. 2005, p 20). The importance of *place* is that it provides the context in which the problems can be recognised and articulated, and within which different values can be understood, conflicts resolved and choices made. It can be seen as the basis of any attempt to apply the ecosystem approach and to apply the notion of a cultural landscape.

The ideas that have coalesced around the notion of a socially sensitive sustainability science also echo shifting views about approaches to environmental management and spatial planning that have emerged in the latter part of the twentieth century. Namely, the recognition of the short-comings of expert driven approaches that seek to impose control over the environmental systems. There is now a widespread acknowledgement of the advantages of more adaptive, *socially grounded* forms of ecosystem management and planning (see for example Wilson and Bryant 1997; Bryant and Wilson 1998; Lackey 1998; Stringer et al. 2006; Reed 2008). In such work, an analysis and understanding of location or place, has been acknowledged as one way in which this social grounding can be achieved and the connections between people and the environment understood. Albrechts (2006a, b, 2010), for example, has argued that strategic spatial planning is fundamentally a "sociospatial" process, that must be both "transformative" and "integrative", and which by involving people is able to "shape and frame what a place *is* and what it might *become*" (Albrechts 2006a, b, p 1152, our italics). Berkes (2004) also notes the shift in thinking that has occurred in relation to community-based conservation; contemporary approaches, he suggests, are characterised by the prevalence of

systems thinking, recognition that people must be included in ecosystems, and acceptance of the need to move towards participatory forms of environmental management.

The development of socially grounded, place-based thinking, is also evident in landscape ecology, where Wu (2006, p. 2), for example, has observed that "the dominant research mode is gradually shifting from plot-based and question-driven studies to place-based and solution-driven investigations…". Increasingly, he suggests, findings can only be understood in the environmental, economic, and socio-cultural settings of a specific landscape or region. However, as Musacchio (2009) notes, place-based problems are inherently complex, and we need to find new ways of approaching issues if we are to tackle the challenges of sustainable development. To address the challenges of understanding and designing sustainable landscapes, we need to persue "translational landscape research and practice", that build on more traditional inter- and trans-disciplinary research and practice (Musacchio 2009). The resolution of these wicked place-based problems, she concludes, is best accomplished at regional or landscape scales, because it is here where we can better see how the global is linked to the local.

The question, it seems, is not *whether* a place-based perspective is needed for understanding the connections between people and the environment, but *how* it can be done. For landscape ecology, Wu (2006, p 2) suggests, it is not likely to be easy, but we must find ways of retaining an ecological focus while at the same time integrate it with the "social and economic fabrics of landscape". The aim of 'translational landscape research and practice', Musacchio (2009) claims, should be to enhance human health and security, ecosystem services, and resource management, by paying attention to six different dimensions of sustainability at the landscape scale, namely those concerning environment, economic, equity, aesthetics, experience, and ethics. To take such debates forward, we will focus specifically on the theme of ecosystem services, and ask whether current approaches used for assessing them are able to provide insights across the range of factors that need to be considered in relation to sustainability and cultural landscapes.

The concept of ecosystem services has usefully rekindled discussions about the critical natural capital and sustainable development, and reawakened interest in ideas about thresholds and uncertainties in coupled social-ecological systems (Potschin and Haines-Young 2011). The ecosystem service concept also illuminates what is implied by the idea of a 'sustainable landscape'. It is, we suggest, not so much defined in terms of particular structures or patterns, but by the way it functions, and whether that functionality is sufficient to maintain, the output of services that people need or value (Haines-Young 2000). Ecosystem Assessments can clearly help establish the connections between people and the environment, by looking at the balance between the supply and demand for ecosystem services. However, understanding the way the characteristics of different localities or places affect the judgements we make about that balance are presently under-developed.

Progress with place-based approaches in the ecosystem service literature is, we suggest, patchy. It is interesting to note, for example, that while Carpenter et al. (2009) suggest that following the MA, place-based, comparative, long-term research has emerged as a key component of the science of managing ecosystems services, methodologies for undertaking such assessments are often lacking. In the *Manual for Assessment Practitioners* (Ash et al. 2010), for example, the term 'place-based' is used only once, as part of the definition of local knowledge. Although the *Manual* acknowledges that assessments and ecosystem services are 'place and time specific' (p. 125) and that the best way to test the validity of assessment is "in the *place* where [it] is conducted" (p. 110), guidance on what a 'place-based assessment' might look like is limited.

A potentially more helpful framework for assessment is provided by Cowling et al. (2008) who make the distinction between biophysical, social and valuation assessments. They note that while interest in ecosystem service assessments has increased, most has focussed on biophysical and valuation assessments, and few are truly "embedded in social processes" (p 9483). They regard social assessments as fundamental and argue that they should precede the others, because they help to elucidate the values and understandings of the people and organisations that can influence future change. Although they make a strong case for understanding local contexts, however, their description of this assessment framework does not fully describe how this can be accomplished. A stronger focus on the concept of place, we suggest, may allow further progress to be achieved. We therefore propose

below, an alternative typology for assessment approaches that more clearly highlights the integrating role that place-based thinking can play in taking the agenda of sustainability science forward.

Our motivation for proposing a typology that describes more clearly what a place-based assessment might involve, also addresses the point made by Norton and Noonan (2007), in their examination of the development of the 'inter-disciplinary partnership' between ecology and economics. They note the lack of progress amongst ecological economists in developing an appropriate framework for evaluating the impact of ecological and economic change triggered by people. Current shortcomings, they suggest, lie not so much with conventional approaches but with but rather "with inaction in developing compelling alternative" (Norton and Noonan 2007, p 664). The new typology, we suggest begins to describe what such alternatives might involve by making more explicit reference to the notions of 'place'.

Assessment approaches

Although distinction made by Cowling et al. (2008) between biophysical, social and valuation assessments is helpful, it by no means covers the range of approaches that can be identified in the literature. Although we agree that the social component might ground the others, the separation of valuation seems to suggest that consideration of these issues can be delayed. Experience suggests, for example, that in practice valuation goals probably also frame much of the assessment strategy whether they are considered explicitly at the outset or not. By way of extending the discussion of assessment approaches, therefore, we identify from our experience three other perspectives that might be used to help practitioners to plan their work. For convenience we will label them the 'habitat', 'system' and 'place-based' perspectives.

The habitats perspective on ecosystem assessments

The habitat-perspective on ecosystem assessment is one of the more common analytical strategies found in the literature. It is, for example the basis of the Millennium Ecosystem Assessment (MA 2005), where the underlying assumption is that at some scale, putative habitats units form the basis of the ecosystems for which the status and trends of the various services are reported. For the MA the habitat units were global biomes. For sub-global assessments that follow in the style of the MA, the frameworks are often some combination of appropriate biotope or habitat units that break down these broader scale entities into more regionally or nationally meaningful units.

The features of the habitats approach can be illustrated by the outcomes of a pilot study that looked at the prospect of making an assessment of the status and trends of England's terrestrial ecosystem services (Haines-Young and Potschin 2008). It was undertaken before the UK National Ecosystem Assessment (UK NEA 2011) was commissioned, and sought to review how data then available might be used to make an assessment. Figure 1 illustrates how the different components of the assessment were put together. While the major conclusions about status and trends have been superseded, the framework remains helpful in reviewing the strengths and weaknesses of the general approach. In the matrix shown in Fig. 1, the columns are the Broad Habitats defined under the UK Biodiversity Action Plan. In the upper part of the Table, the rows are the ecosystem services in the MA. The pilot study sought to identify any published evidence linking the services to the Broad Habitats, and supplemented this with judgements from a range of habitat experts from a range of national conservation organisations. They were asked to identify the services they felt were the most significant for each habitat. In Fig. 1 the information on trends was taken from Countryside Survey 2000 (Haines-Young et al. 2000), which was the most recent nationally available information on changes in stock and condition of each Broad Habitat that were available at the time of the pilot study. Stock was measured in terms of area, while condition was determined using an indicator of the capacity of each habitat to generate ecosystem services. The assessment of the pressure on each type of habitat was made mainly using the national condition monitoring of designated areas of each habitat published by Natural England plus expert judgement.

Although more sophisticated than earlier England pilot study, the UK National Ecosystem Assessment (UK NEA 2011) demonstrates that a habitats perspective is still widely used; this study used groups of the same Broad Habitats as the assessment framework, and looked at how the status of a refined set of services

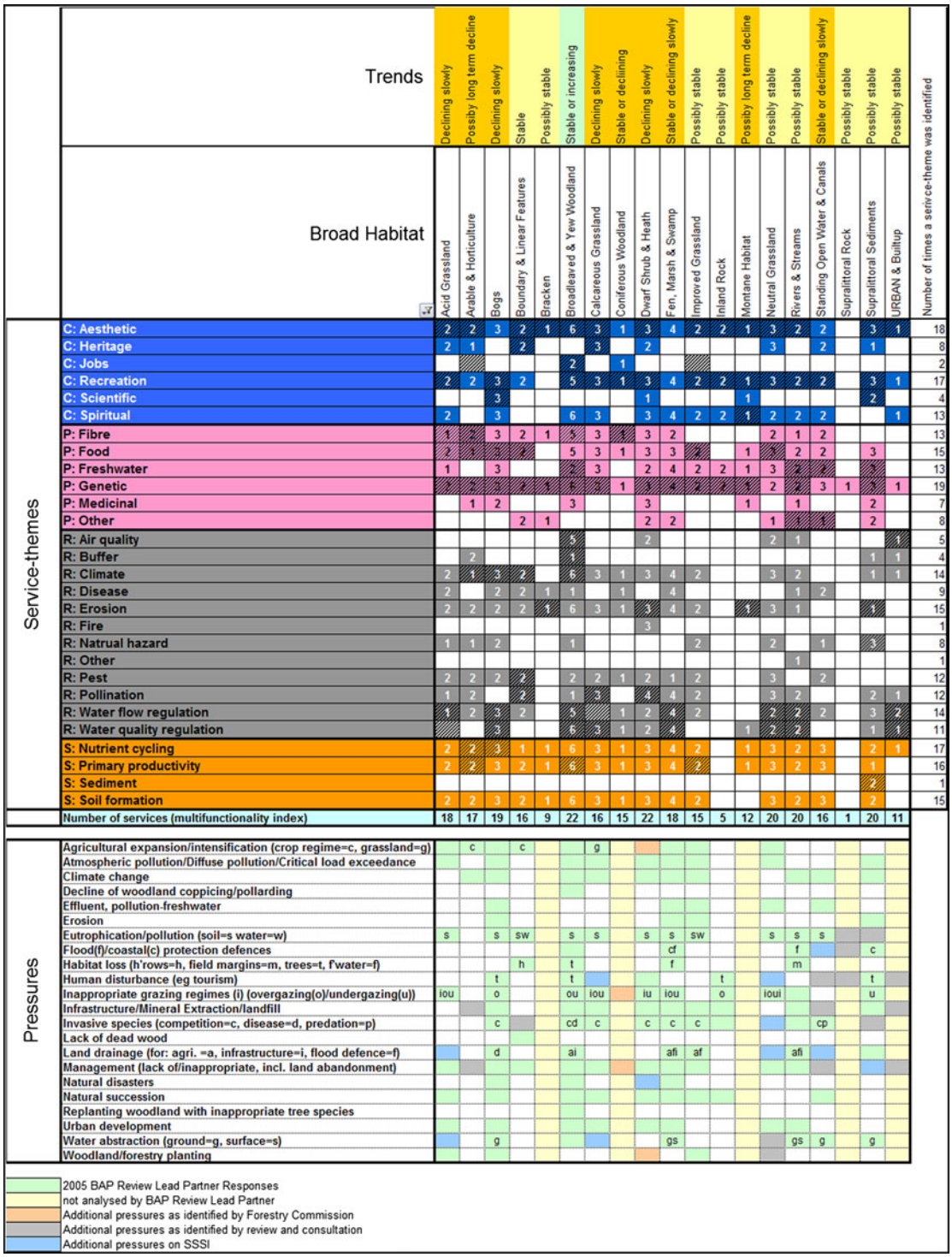

Fig. 1 Summary of pilot study to assess status and trends of ecosystem services associated with England's major terrestrial habitats (after Haines-Young and Potschin 2008). *Notes* Columns are groups of Broad Habitats that link to UK Biodiversity Action Plan. Rows of matrix are list of final services defined y the MA; importances and trends assessment based on expert judgement and available published data. *Issues* how can overall status of the service to be assessed (i.e., how could we 'sum' across the rows of the matrix)? How can the overall contribution of a habitat be assessed (i.e., what metrics allow the columns to be compared?)

was changing across them (UK NEA 2011). It drew heavily on the empirical results of Countryside Survey 2007 (Carey et al. 2008) but the assessments of service trends was essentially based on expert judgement and the results synthesised using habitat units in the same manner as the pilot study.

The strengths and weaknesses of the habitats approach are summarised in Table 1. Experience gained from UK NEA suggests that this approach is one that tends to emphasise the biophysical components that underlie ecosystem services and as such focuses more on the capacity of ecosystems to supply a service than issues surrounding societal demand. As a number of commentators have argued, only if a beneficiary can be identified can something be regarded as a service (Boyd and Banzhaf 2007; Fisher et al. 2008). Given that such relationships may vary spatially and over time, and that different groups of

Table 1 Characteristics, strengths and weaknesses of contrasting assessment approaches

Approach	Characteristic	Advantages	Disadvantages
Habitat based	Assessment of services made on the basis of stock and condition of components of biodiversity, usually habitat, ecotopes or biomes etc., and potentially their change over time	Clear links with exiting conservation frameworks and approaches	Unclear how different habitats should be weighted to make some overall assessment of services
		Multi-functional character of 'ecosystems' evident	Unclear how habitat combinations influence overall service output across landscape or land cover mosaics
		Can often make use of existing biodiversity or habitat monitoring data	By focussing on supply side issues, may be difficult to look at societal demand for the service
		Focuses more on potential (capacity) of ecosystem units to supply a service	Communication of key messages to publics may be difficult
Systems or process-based	Assessment of services is based on structural and functional relationships that determine service output, usually for some defined dynamic process-response unit (e.g., catchment, aquifer etc. or some defined 'service providing unit' that captures key elements of social-ecological system)	Allows overall assessment of service state and trend to be made	Unclear how issues of multi-functionality can be addressed
		Impacts of alternative assumptions explored easily allowing tests of sensitivity to assumptions and potentially scenario modelling	Systems modelling is complex and present understandings may be limited—especially in the context of predicting spatial pattern
		Generalisation easier, assumptions simpler to test	May be difficult to calibrate and test models at local scales due to lack of data
		Depending on how process-response unit is defined, may be possible to look at demand and supply balances	Not quick… Not cheap…Often assumptions not transparent
Place-based	Services assessed as a bundle across units that have strong social relevance or resonance	Allows better understanding of local contexts, and therefore priorities and values	Difficult to generalise results because of the uniqueness of place
	Deliberative and temporally sensitive by giving attention to past change and future visions	Can be used to look at patterns of use and demand as well as adequacy of supply of service	Difficult to measure or model services at local scales because of uncertainties and lack of base-line data
		Allows issues of trade-offs and any associated conflicts to be identified and potentially resolved, and local scenarios to be examined as part of developing management visions	Needs many different kinds of skills and competences to be combined to accomplish the inter- and transdisiplinary challenges required by the analysis of place
		Allows implications of alternative management of policy options to be tested easily through participatory methods; can support adaptive management approaches	Time consuming
			Expensive
		Local buy-in	

people may have different uses or needs for ecosystem system outputs, the identification of a consistent set of 'final services' may be difficult using the habitats approach. In the UK NEA these beneficiaries were largely assumed. Nevertheless, by looking at habitat units as a whole their multi-functional character is evident. Also, depending on the habitat units selected, there is often an easy read-across to conservation policy, although communication with the wider public may be more difficult if they do not think in terms of habitats.

Perhaps the most serious shortcoming of the habitats approach is that it is difficult to gain a picture of each service as a whole, since the contributions that each habitat make to overall output is unclear or can only be assumed; this was certainly the case in the UK NEA. The contribution that each habitat makes is not simply a function of its area, but an understanding of how habitat condition (or ecological status) affects the capacity to generate that service is largely unknown. Moreover, the effect of variations in spatial pattern within the habitat or land cover mosaic also tends to be overlooked. Thus, while many studies have used area-based stock estimates of each habitat to weight the contribution they make to the supply of a service, the synergies between different habitat combinations and the impacts of changes in habitat condition on service output are often difficult to factor into the assessment. Although the habitats approach to assessment seems to make ecological sense, as a comprehensive assessment framework it can be limited.

The systems or process-based perspective on ecosystem assessments

The treatment of ecosystem services as a set of functional relationships is commensurate with the very idea of an eco*system.* Thus a number of studies have sought to model the structure and dynamics of the social-ecological systems that deliver particular benefits to people. It is likely that these approaches will play an increasingly important role in future assessments as a wider range of analytical 'tool boxes' become available (e.g., InVest[1] and ARIES[2]). Fundamentally the approach involves constructing some kind of 'ecological production function' that expresses the way service outputs vary with changes in the various direct and indirect drivers of change for a given spatial unit (Haines-Young 2011; Tallis and Polasky 2011). Such functional relationships are particularly helpful in understanding the changes in marginal value that might result from modifications to the different factors that influence service output. The related concepts of Service Providing Units (SPU, Luck et al. 2003, 2009) and Ecosystem Service Providers (Kremen 2005) illustrate the key characteristics of this type of model-based approach.

The system or process-based approach is more obviously grounded in theory than the habitats framework, although this is not to say that the latter is purely speculative or subjective. On the contrary even if the habitat approach is mainly based on expert judgement, it generally embodies a good deal of informal conceptual knowledge and empirical insights. Nevertheless, an advantage of the process or systems perspective is that it puts theory into the foreground. An example that illustrates the approach is provided by Kremen et al. (2007), who have proposed a 'mobile-agent-based ecosystem service' model (MABES) as the basis for analysing the pollination service and the way land use change can impact upon it. The model sets out the relationships and feedbacks between the ecology of the organisms involved in the services, and the characteristics of the markets and policies that affect land use and hence the dynamics of the system that supply the service. These workers go on to suggest that the model can be generalised to other types of ecosystem service generated by mobile organisms, such as pest and disease control. Subsequent work has shown how it and be used to make quantitative estimates of both the supply and value components of the pollination service in California (Lonsdorf et al. 2011).

Table 1 summarises the strengths and drawbacks of the system or process-based approach to assessment. On the positive side the quantitative, dynamic character of the underlying model generally enables trends to be examined more easily, the impacts of alternative assumptions to be explored, and the sensitivity of the systems to different inputs to better understood. The approach is potentially more credible in scientific terms because the outputs are more easily tested. As illustrated by exchanges surrounding the question of

[1] http://www.naturalcapitalproject.org/InVEST.html.

[2] http://www.ariesonline.org/.

whether crop production is limited by pollinators (the 'pollination paradox'; see Ghazoul 2007, 2008; Klein et al. 2008) alternative views are possible and opposing models of the world can be debated. On the down-side, systems or process-based approaches are often complex, time-consuming and expensive to develop, and their service-specific nature means that the issue of multi-functionality is more difficult to address. As Tallis and Polasky (2011) note, production function approaches have mainly been applied at more local scales, and a major future challenge is to enable them to make integrated assessments across multiple services (see also Raudsepp-Hearne et al. 2010). While generalisation using models is feasible, lack of data at local scales may, however, mean that the application of these models in particular circumstances is frustrated. Finally, while their explicit theoretical structure means that their assumptions can be debated scientifically, in terms of communication with non-expert audiences, lack of transparency may be a problem with model-based approaches, although this issue may, however, be overcome by using participatory techniques. Prell et al. (2007), for example, have shown how knowledge an be captured from a range of stakeholder groups using conceptual and formal model building techniques in support of upland water catchment management in the UK.

The place-based perspective on ecosystem assessments

A place-based assessment is, we advocate, one which looks at bundles of services across units that have a strong social relevance or resonance. As suggested in our introduction, the emergence of a focus on place has been an important feature of sustainability science and more 'solution-orientated' approaches to landscape ecology, but their successful execution is by no means straightforward. The key assumption of place-based thinking is that *context matters*. The place-based approach provides an understanding of context through a deliberative process, designed to reveal how different people or groups see a place, and what visions and values they bring to assessing the significance of past and future change.

An illustration of how an understanding of context matters, is provided by the *Countryside Quality Counts* Project (Haines-Young et al. 2008) which resulted in two assessments of the impact of countryside change in England on, what now could be described as a cultural service, 'landscape character'. The assessment sought to answer two fundamental questions namely: '*where has change occurred?*' and '*did that change matter?*'. The 'places' used in the study were the set of 159 national, landscape character areas, described first in the 1990s, which were designed to capture the range of cultural landscapes that are found across England. The study used existing data to identify how the various elements that defined their character were changing; these elements included agricultural and woodland land cover, type and condition of boundary features, and patterns of settlement, semi-natural habitats and historic features. A judgement about the significance of any changes in these features could, however, only be made in relation to the specific contexts of each landscape. These contexts were provided by the set of character areas descriptions, generated by local, consultative processes. They explained in qualitative terms what made each landscape locally distinctive, and what features helped defined its 'sense of place'. Thus the assessment was based on judgements about whether observed changes were sustaining or enhancing the particular character of each landscape area, or whether they were tending to erode or transform it. The approach used was therefore fundamentally place-based. So, for example, woodland expansion was not universally regarded as a benefit in terms of landscape character, except in those contexts (places) where it served to strengthen or maintain it.

A place-based focus is also evidence in much marine work, where the idea of ecosystem-based management is frequently represented as focusing on specific areas and ecosystems and the activities that affect them (see for example: Gilliland and Laffoley 2008; Suárez de Vivero et al. 2009). As Douvere (2008, p. 764) has emphasised, in the marine environment the focus on the management of places is one of the key features of ecosystem-based frameworks and represents "a marked departure from existing approaches that usually focus on a single species, sector, activity or concern". Turner et al. (2007) make a similar point about place-based outcomes in relation to the more general discussion of the development of land use change science and sustainability. Such work emphasises that a place-based perspective is relevant to the assessment of all the main categories of ecosystem services.

Alongside the other perspectives, Table 1 also summarises the strengths and weaknesses of the place-based framework. We suggest that the facility for thinking 'cross-sectorally' is one of its key advantages. Not only can it potentially look at patterns of use amongst the various stakeholders, but also the adequacy of supply of benefits and the different priorities and values of the different interest groups in different places. The case study described by Ruiz-Frau et al. (2011) on mapping stakeholder values in the coastal waters of Wales illustrates how a focus on place can be effective in identifying the multiple benefits that these ecosystems provide and the locations that are important in generating them; similar activity mapping has been done to support the deliberative processes of agreeing candidate sites for marine protected areas off the coast of in SW England in the *Finding Sanctuary* Project.[3] Fagerholm and Käyhkö (2009) provide a further example, for the terrestrial situation; this study used participatory GIS mapping techniques to capture the spatial differentiation of social landscape values at local community level to support sustainable landscape management on Zanzibar island, Tanzania. These types of insight can be used to look critically at questions of trade-offs between different services and the options for resolving the conflicts that may arise in relation to them. Achieving local 'buy-in' is therefore an important potential benefit from applying the approach. In relation to the difficulties associated with the place-based perspective issues include the problems of generalising results to other contexts, and how exactly to model or measure service supply and demand in different situations, especially where local, base-line data may be lacking. Moreover, the trans-disciplinary character of the place-based approach generally means that many different skills and competences need to be brought together and so, as Cowling et al. (2008, p. 9484) note in relation to social assessments in general, they "take time and can be costly".

Issues of relevance, legitimacy and credibility

Whatever perspective on ecosystem assessments that one takes, as Ash et al. (2010) have pointed out, the most important goals to achieve are relevance, legitimacy and credibility. Assessments must be designed for specific purposes, and since situations involving multiple interests are complex it is perhaps too simplistic to suggest that distinct methods like the habitat, systems and place-based perspectives can be identified. It is certainly not our intention to argue that they are mutually exclusive methodologies. In practice, each of these elements needs to be combined if effective outcomes are to be achieved; we suggest that a review of the issues identified in Table 1 can be an aid in any planning or scoping exercise leading up to an ecosystem assessment. Thus one purpose of this paper is to encourage those concerned with undertaking ecosystem assessments to consider these different dimensions and ensure that the resulting analytical strategy negotiates their strengths and weaknesses. A second purpose is to stress that due consideration needs to be given to place-based thinking because this is the component that some commentators often feel is the most complex and difficult (e.g., Cowling et al. 2008); if we are to meet the challenge of Norton and Noonan (2007) of developing a compelling alternative to the traditional types of valuation, then it is precisely here where progress can be made.

Many of the core concerns of the place-based perspective can be examined by posing the questions suggested in Table 2. In putting these forward we draw heavily upon and adapt the overlooked *Quality of Life Capital* approach,[4] developed a decade or so ago in the context of sustainability appraisal (see Potschin and Haines-Young 2003). The questions range from considering what services are relevant in a particular area through to an exploration of the way a place is linked to other places. The questions also seek to bring out how services are to be valued and what management or policy actions are appropriate in the particular contexts of the place; they can help us unpack what a cultural landscape means. We stress, however, that the questions are not a simple sequence but should be examined iteratively as part of a deliberative process directed towards understanding the nature of a place. Not all interests groups will answer them in the same way, and an examination of the differences and how they can be bridged is part of the understanding the contexts in which the assessment is set.

[3] http://www.finding-sanctuary.org/.

[4] See for example, http://www.environment-agency.gov.uk/static/documents/Research/statement_on_qola_1979914.pdf.

Although the questions will need to be rephrased to take account of different languages and concepts that are familiar to different interest groups, we suggest they capture in a succinct way many of the challenges that the design of assessments that connect to environment and people; these links are also highlighted in Table 2. The 'boundary' and 'scale' problems are ones that are common to all ecosystem assessments and are some of the most difficult to resolve. The analysis of 'place', however, can potentially bring a richer insight into both. As Paasi (2002) has argued traditional views that a region or a place is a simple, contiguous 'bounded space' have been challenged by the new regional geographies that have emerged in the last two decades. Not only may different interest groups see the boundaries of that space differently (see for example Fish et al. 2003), and have different strengths of attachment to them, but also as Paasi (2002) argues, boundaries may not only occur simply at the 'edges' of regions. Rather, he suggests, they can occur everywhere defined by the different practices and narratives that often define the collective identity of a place. A place is, we propose, as much defined by a common or overlapping set of problems (that is as a 'place of concern', cf. Lackey 1998), as much by any physical limits or landscapes although these can often be used as a proxy. Recent progress in value mapping is illustrated by the work of (Brown 2006; Brown and Raymond 2007; Raymond et al. 2009). Thus the first three questions suggested in Table 2 help scope the assessment by defining the issues to be considered and promote an understanding of the place as a multi-scalar entity, in terms of the way it is connected to other places.

The remaining 'place-based questions' proposed in Table 2 mainly concern issues of value or the way the different groups assign importance to the different service outputs and the way the balance of outputs has and might shift. The design of these questions is intended to deal with the fact that while economic criteria may be important, they may not be the only one to be considered in the assessment. Thus issues of risk may arise in relation to ecosystem thresholds or limits, collective rather than individual values related to the non-use aspects of the place may be significant, and questions of equity and social justice may also shape decisions. However, as Clement and Cheng (2011) have shown in the context of forest planning,

Table 2 Framework for developing a place-based assessment of ecosystem services

	Question	Rationale
1	What are the ecosystem services associated with this place that matter to peoples' well-being?	Helps in setting the conceptual and spatial boundaries to the assessment; defines the place of concern
2	How are these services generated? Do they arise locally or are they generated outside the place or area being considered?	Identification of dependencies and cross-scale issues in relation to the supply of services; helps explore the links between the place of interest and other places
3	How important is each of these services, to which individuals or groups, and for what reasons? Do people outside the area also depend on these services?	Helps to identify who has a stake in the deliberations about the place and their needs, and develops understanding of the spatial relationships between one place and other places
4	How can the importance of these services be prioritised or valued?	Opens up discussions about how values should be assessed and compared (e.g., using individual vs community values; monetary vs non-monetary)
5	Do we expect to have enough of each of these services either here or elsewhere in the future?	Highlight the issues surrounding the notion of living with environmental limits and questions about sustainability of natural capital
6	What, if anything, could replace or substitute for each of the benefits obtained from these services, either here or elsewhere?	Links to question 4, and further explores the nature of criticality, compensation and substitutability of benefits; provides a riches insight into the relationships between different places
7	What kinds of management or policy actions are needed to protect or enhance these services and in particular how might actions directed towards one service impact or enhance another?	Helps in understanding the acceptability of management or policy interventions to different stakeholder groups and the identification of potential trade-offs and conflicts and how they might be resolved

Adapted from quality of life capital approach (see text)

the links people have to different places and the values they attach to them are 'complex and multi-layered', involving sometimes conflicting utilitarian and intellectual dimensions. Elsewhere Brown et al. (2002) have detected 'spatial discounting', with stakeholders valuing near places that provide a benefit more highly than distant ones; such findings suggest that values mapping can therefore be a complex spatial problem as well as a challenging social and ethical one.

Although the questions we propose as way of opening up a place-based assessment are helpful, we certainly would not claim that they cover the only things that need to be considered. One of the most difficult issues to address in the place-based context is that of generalisation, because we are often explicitly dealing with unique situations in particular areas. Such issues are particular sensitive for geographers, because the lack of scientific credibility was one of the factors that Schaefer (1953) and others argued undermined the regional paradigm in the mid twentieth century (see also Livingstone 1992). Lane and McDonald (2005) make a similar point about the problem for community based planning when parochial concerns dominate at the local scale. A short coming of the questions we have proposed in Table 2 is that none of them explicitly deal with the nature of the evidence to be used in the assessment, the difficulty being that the problem of the relevance, legitimacy and credibility of evidence permeates all of them. A key proposition of those who advocate sustainability science is that we should be open to different kinds of knowledges, and not allow expert knowledge to pre-empt or over-rule local knowledge. While such pluralism is to be welcomed, it does not follow that the rational sifting and testing of evidence should be abandoned. The core idea of sustainability science and place-based approaches in that *rational* science is embedded in a social context and *not* displaced by social discourse. Thus in dealing with place as a 'multi-scalar entity' we are forced to look at different kinds of evidence, ranging from the general to the particular. The purpose of place-based assessments is to understand how the local is nested into the global; a key element of 'complexity thinking' is that we should simultaneously analyse systems different scales (Berkes 2006). Thus we should not only be concerned with whether the results of the place-based analysis are consistent with local understandings, but also with understandings and experiences from elsewhere. While much uncertainty may surround the evidence from all these sources the search for consistency and the most scientifically and socially robust knowledge must guide the assessment process if the goals of relevance, legitimacy and credibility are to be achieved.

Conclusion

All assessment situations are different, and so one cannot be prescriptive about the types of assessment approach that should be used. Thus our intention here has been to flag up three distinct types of assessment methods that are currently used. We have considered the habitat, systems and place-based perspective and shown how they might contribute to an understanding of the way people and environment are connected through the notion of ecosystem services and the way values change with context, that is from one place to another. In practice, it is clear that the habitat and systems approaches can form part of a place-based assessment, just as a better understanding of place can enrich assessments that spring from these more natural science perspectives. However, if we accept that ecosystem assessments are systematic *and rational* processes designed to support for decision making through an ecosystem approach, then we need to be clearer about how a *critical* sustainability science can operate at the interface of people and their environment. Any "compelling alternative" to traditional assessment methods based on 'habitats' or 'systems' thinking must have 'place' at its core.

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