Prioritisation of Ecosystem Services for Ecosystem Accounting

Paper prepared for discussion at the expert meeting on ecosystem accounting organised by the UNSD, the EEA and the World Bank, hosted by Defra and ONS, London, December 2011

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Summary

This paper reflects on issues affecting the way we might prioritise ecosystem services for inclusion in ecosystem accounting. It draws on the recent experience of the UK National Ecosystem Assessment (UK NEA) and recent discussions in England around the idea of a 'natural asset check'; the aim is to draw some lessons that might assist environmental accountants to identify priorities within their own countries.

It is argued that, from the UK perspective, if an accounts-based approach to undertaking a natural asset check is adopted, then criteria for the selection of ecosystem services to be included in the analysis are:

- the need to identify and report on the changes in the underpinning 'supporting' or 'intermediate services', because these more fully capture the integrity of ecosystems and are often the target of policy or management interventions;
- the identification of those final ecosystem services which are essential, or make the greatest contribution to social and economic well-being;
- the identification of where the greatest risks to the output of final ecosystem services are, given the possibility of large and irreversible [non-marginal] impacts; and,
- the identification of where loss of ecosystem integrity would impose significant restoration costs on future generations.

Although the availability of information is a major practical constraint, it is argued that selection of services for any experimental accounting framework should be 'needs-' and 'risk-based' rather than data driven. For the final services included in such work, accounts must document the demand for ecosystem services as well as the capacity of ecosystems to supply them. A primary function of such exploratory exercises would be to highlight current information gaps and strategies for overcoming them.

Prioritisation of Ecosystem Services for Ecosystem Accounting

Background

1. This paper reflects on issues affecting the way we might prioritise ecosystem services for inclusion in ecosystem accounting. It draws on the recent experience of the UK National Ecosystem Assessment (UK NEA) and recent discussions in England around the idea of a 'natural asset check'. The aim of this paper is to explore the role accounting approaches might play in future work, and in particular, where the focus of effort might be placed to ensure its usefulness. Such experience may help discussions in the wider international community in terms of their efforts to provide guidance on constructing 'meaningful' national level physical and monetary accounts.

2. In the recently published Environment White Paper for England (EWPE)[1], the importance of sustaining natural capital was noted: 'like any financial asset, it needs to be properly defined, managed and protected in order to continue to provide benefits' (Para 3.31). To accomplish this goal a number of measures are considered, including establishing independent *Natural Capital Committee* that will provide advice on:

   - When, where and how natural assets are being used unsustainably;
   - Where action to protect and improve natural capital should be focussed for greatest impact on well-being; and,
   - Research priorities.

   As a first step is a scoping study for a 'natural capital asset check' is proposed.

3. Interest in such a 'natural asset check' comes from a number of sources. These include, most directly, the recommendations of the Government Economic Service Review on the economics of sustainable development (Price et al., 2010), which suggested that such a check would be helpful in monitoring the impact of Government policies on specific environmental assets. More generally, interest has been stimulated by the completion of the UK National Ecosystem Assessment (UK NEA, 2011), which found that in the UK roughly 30% of the services generated eight broad aquatic and terrestrial habitat types are declining, while many others were found to be in a reduced or degraded state. If, according to the Environment White Paper, we 'as a generation are to leave the natural environment of England in a better state than it inherited' (EWPE, Summary para. 2) then on-going monitoring of the state of our natural capital is needed. Availability of the UK NEA prompts the question of whether such assessments constitute the kind of asset check that is required to achieve such a goal and, therefore, what role (if any) ecosystem accounting might play in helping decision making related to sustainability.

4. It is not appropriate here to discuss the relative merits of ecosystem assessments and ecosystem accounting as alternative or complementary frameworks. Instead, this paper starts from the position that ecosystem accounting is fundamental to undertaking the kind of natural asset check being considered by the UK (for further discussion of this issue see Howard et al., 2011). The paper explores more specifically how we might prioritise the kinds of service that are included in the accounts to ensure its maximum utility to decision makers. These issues are

[1] http://www.defra.gov.uk/environment/natural/whitepaper/

especially important to consider when looking at experimental accounts as part of a 'proof of concept' exercise.

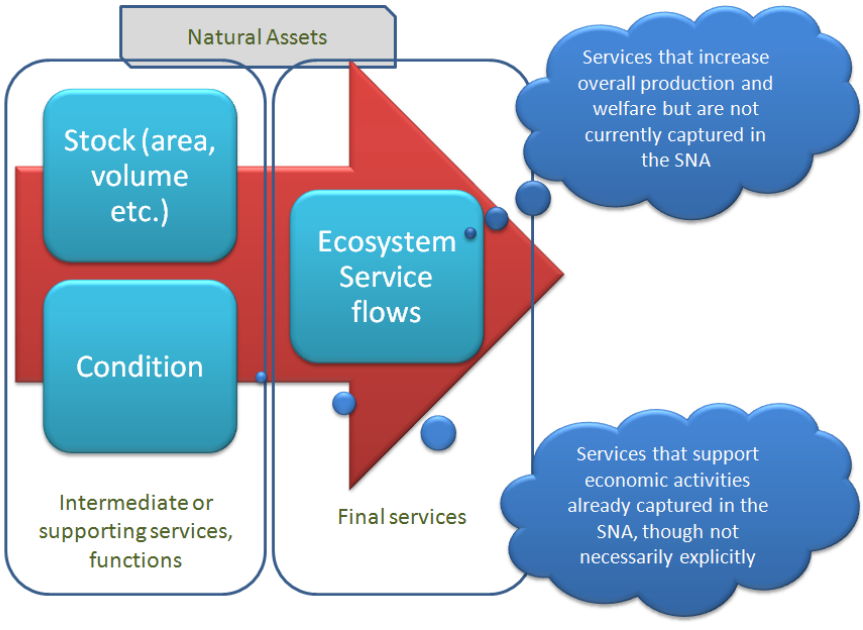
5. **It is argued that the prioritisation of ecosystem services in national accounting exercises should be based on understandings of needs, risk and restoration costs, rather than data availability alone.** In the UK, the NEA has given us some insight into the importance of different ecosystem services. The proposals for the natural asset check implies that we should focus on where the natural capital base is most vulnerable, in terms of potentially irreversible change. It is suggested that to build accounts that are useful for making an audit of our natural capital, then a broader definition of risk is probably required, but that initiatives such as the UK NEA can assist in identifying where the focus of any accounting exercise might lie.

Defining natural capital for accounting purposes

6. Although ecosystem accounts have a pragmatic purpose, in that they are essentially decision support tools, their structure must reflect our understanding of how ecosystems work. Despite the differences in the way ecosystem services have been defined, there is broad agreement in the research literature that fundamentally two 'tiers' have to be considered (Figure 1). First, the 'final ecosystem services' are the basis of the goods and benefits that are valued by people. Second, the ecological structures and functions that underpin the 'final' ecosystem outputs; these are sometimes referred to as 'supporting' or 'intermediate' services (Potschin and Haines-Young, 2011). Both constitute what is generally taken to be 'natural capital'. Both also correspond to the notion of an 'asset', that is something that can produce value.

7. If the 'two-tier' model of ecosystems services is accepted, then it follows that for the integrity of the natural asset base to be represented or 'checked' using accounts, then both aspects of ecosystems have to be included. CICES (Haines-Young and Potschin, 2010 & 2011) deals only with the set of final services, since the focus here is on: (a) understanding the contributions that these services make to human well-being; and (b) avoiding the problem of 'double counting' that

Figure 1: The structure of ecosystem accounts that might support a 'natural asset check' and integrated economic and environmental accounting approaches.

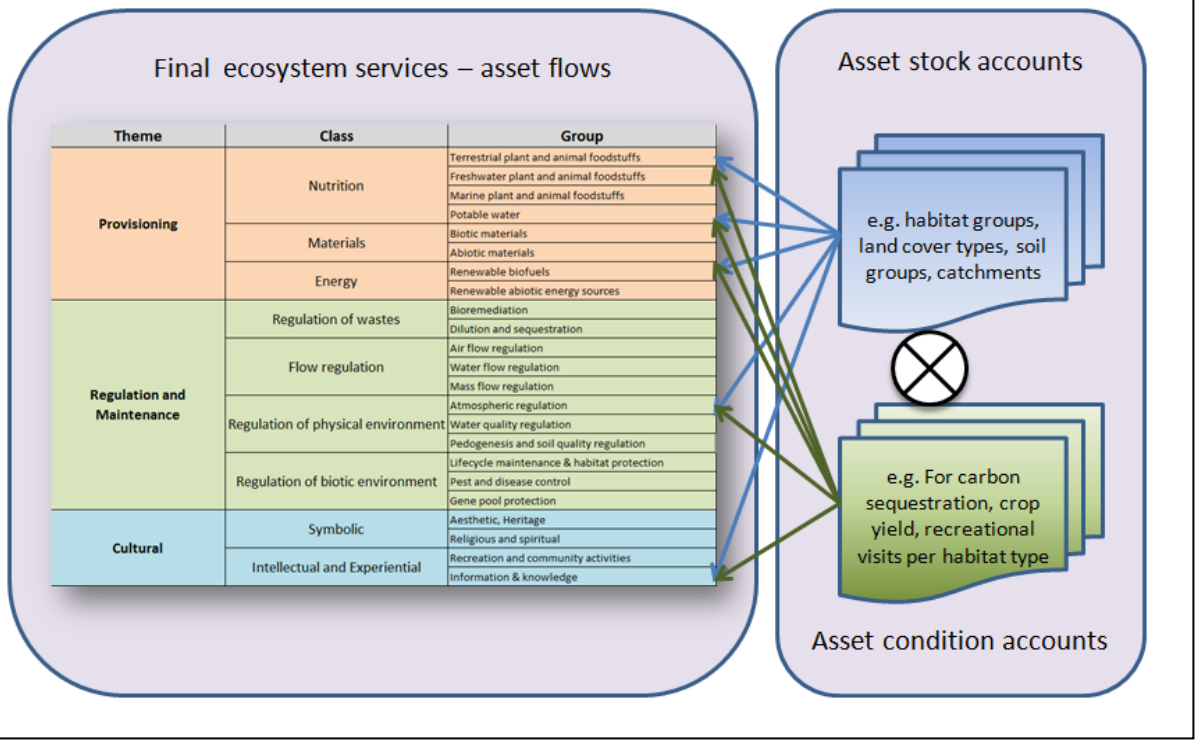


would arise if the underpinning structures and functions that may support several final services are valued separately. Thus while CICES can help us to identify services that are not currently captured in the System of National Accounts (SNA), as well as the services that support those already included, it does not fully define the types of accounts that are needed to characterise natural capital and to undertake a natural asset check.

8. The problem of extending CICES to supporting services was explored in the discussion that led up to the initial draft proposal, and it was decided to exclude them from the classification. **However, this does not mean that they should be overlooked**. In the wider context of accounts, some of the complexities in handling the underpinning structures and processes can be addressed by viewing the final services as functions underlying natural capital assets, characterised in terms of their stocks and condition or quality. *Condition* (or *quality*) refers to the capability of each unit of stock to generate a unit of service. It is suggested that these stock and condition accounts are used to represent the 'supporting' or 'intermediate' elements shown in Figure 1. An understanding of **both** elements is required because changes in the output of a final service can be due to changes either in the extent of an ecosystem or its condition.

9. For example, a full ecosystem account for the service 'carbon sequestration' would require documentation of the changes in area of the different ecosystem units (usually habitats and/or soil types) in the region of interest, together with tables describing the current capacity of these different units to take up or loose carbon per unit of stock. These same ecosystem units may be involved in the generation of other services, such as surface water runoff, the output of which would in turn be captured in an additional sets of condition accounts. The general structure of the 'multi-functional' ecosystem accounts would therefore be something like that shown in Figure 2.

Figure 2: Relationship between final ecosystem services and the assessment of asst stocks and conditions



10. The rationale for prioritising the inclusion of accounts for the underlying ecological structures and processes in any set of ecosystem accounts is three-fold:

    a. The accounts for the underlying structures provide a way of analysing the relationships between the different service outputs and hence the potential trade-offs and synergies that need to be taken note of in any policy decision.

    b. The accounts for the underlying structures and processes can identify the points at which management interventions occur (e.g. by increasing the stock of a habitat or its condition), and hence enable the impacts of policy to be accessed using environmental accounts.

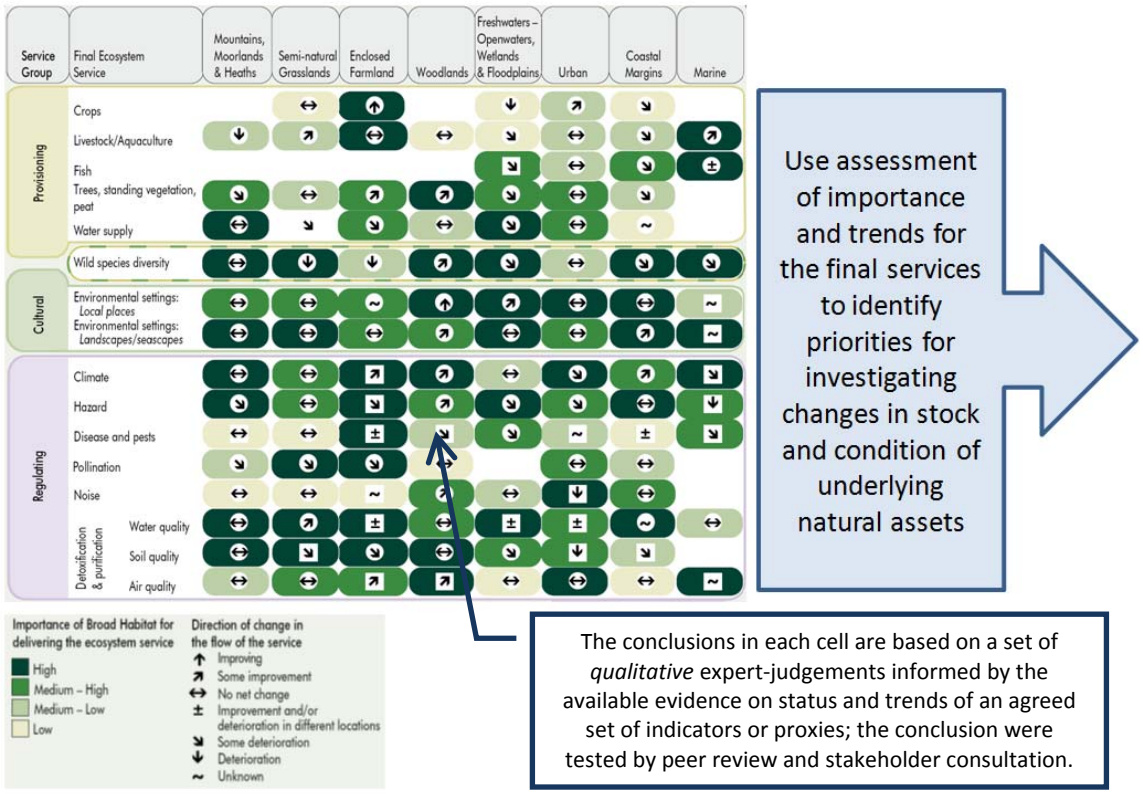
    c. The accounts for the underlying structures and processes also help identify those services that support economic activity but which are not captured in the SNA in a more explicit way (cf. Figure 1).

11. Clearly the suggestion that the development of experimental ecosystem service accounts should include both final and intermediate services adds complexity to the task. There is also the potential problem that by having to take note of particular ecological structures and processes that give rise to the final services, standardised accounting approaches are more difficult to design. However, as Figure 2 suggests, if something like CICES is used as the analytical framework, comparison can be made at that level so that common understandings are possible in terms of final services. The role of the accounts of underlying structures and processes is to capture the particular conditions or circumstances that give rise to the final services that are of interest in different countries or regions.

12. In the wider discussions of supporting or intermediate services, board scale processes such as 'nutrient cycling', 'soil formation' and 'primary production' are often identified as the types of component that needs to be considered. Recognition of the fundamental role that biodiversity plays in service output is also often stressed in such discussions. The problem of dealing with these underpinning ecosystem functions and processes, and biodiversity, in any accounting system is finding ways of connecting them to the final services that are of more interest to decision makers. The approach suggested in Figure 2 provides a pragmatic way forward. **If the definition of the ecosystem units and the condition measures associated with them are framed with reference to these underpinning structures and functions, or biodiversity characteristics, then the integrity of these supporting or intermediate services can be captured into the accounts.**

13. For example, in relation to carbon sequestration, if the stock and condition classes used to estimate uptake or loss of carbon are defined in relation to the conservation status of the different habitats, then changes in this final service can be related to changes in the underlying biodiversity characteristics of the ecosystem units. Similarly, for services based on the harvest of biomass in some form, differences in primary or secondary productivity could be used to characterise the stock and condition classes of the different ecosystem units that underpin these types of output. When looked at in this way, the land cover or habitats tables shown in Figure 2 are thus not simply used to disaggregate the accounts, but to capture the status of the underpinning elements of natural capital so that a comprehensive account of ecosystem services to be drawn up.

Figure 3: Use of the conclusions from the UK NEA as a guide to the construction of ecosystem accounts to support a natural asset check (after UK NEA, 2011).



14. Thus if a target set of final services are agreed as the basis for developing the experimental framework for ecosystem accounts, it is suggested that priority should be given to exploring how ecosystem units of different kinds can be defined to characterise variation in the underlying natural asset stocks and their condition. Using this approach ecosystem structures and processes that only *indirectly* generate economic or social benefits can be more fully represented in accounting frameworks.

Defining priorities for an asset check based on ecosystem accounts

15. In the UK the NEA could clearly serve as a guide to which ecosystem services might be included in a set of experimental accounts. The experience suggests that in other countries, where such a formal assessment is not available, a more focused but rapid process of consultation and stakeholder engagement might be useful to help prioritise user needs. An exercise on the scale of the UK NEA is probably not required. **The scoping phase could be largely qualitative, designed to identify the services in which potential users are interested, and the types of application that the accounts need support.** To illustrate how such a scoping exercise might proceed, the UK experience is worth considering further.

16. As noted in the introduction, this paper was prompted by discussions in the UK about the need to undertake a natural asset check that would build on the results of the UK NEA. The Government Economic Service Review (Price et al., 2010: p45), which first recommended such an asset check, suggested that it should focus on assessing the effect of policy on natural assets that are ***essential*** to social and economic activity. For them, the key question is whether national policies or projects might be degrading ***critical*** assets, and in particular whether there was a

danger of 'large and irreversible [non-marginal] impacts'. In the context of our 'UK case study', the Government Economic Service Review is clearly useful because it helps define user needs, and in particular what assessment and accounting exercises would need achieve to be effective in supporting decisions.

17. The UK NEA examined the changing capacity of a broad set of ecosystem types to deliver an agreed set of final ecosystem services (Figure 3). On the basis of the findings of the UK NEA the priority services that might form part of any asset check appear to be as follows (CICES equivalents in parentheses):
    - **Provisioning:** Fish (Commercial fisheries); and, water supply (Water abstraction);
    - **Cultural:** Environmental settings (Symbolic; and, Intellectual and Experiential); and,
    - **Regulating and maintenance:** Hazard (Air, water and mass flow regulation); disease and pests (pest and disease control); pollination (pollination); noise (no CICES equivalent); water quality (water quality regulation); and, soil quality (pedogenesis and soil quality regulation).
18. Although the results of the UK NEA are therefore helpful by itself it clearly does not constitute a national asset check. On the one hand, it mainly focussed on final service output rather than the integrity of the processes that underpinned them. As argued above, it is essential to capture these underpinning structures and services in any set of accounts that represent natural capital as an asset. On the other, it mainly focussed on the capacity of ecosystems to ***supply*** these final services rather than the adequacy of output in relation to societal ***demand***. Both aspects would be more adequately treated by the development of natural asset accounts, and the availability of the Government Economic Service Review on the economics of sustainable development can help us identify more precisely what we need to know about these 'priority' services.
19. Price et al. (2010) suggest that a natural asset check should primarily be concerned with 'large, irreversible impacts on assets that are essential to social and economic activity' [p9]. While the *ex ante* identification of thresholds and potentially irreversible change are not easy (see POST, 2011), some ***progress*** might be made by using the qualitative results of the UK NEA shown in Figure 3. The assessment results can be used to select those services that have been judged as most important. These can then be investigated in more detail to identify any criticalities existing in terms of the underlying supporting services, and how they might be assessed given current data resources. In other words, the prioritisation of services is mainly based on risk and an understanding of needs.
20. The extent to which a natural asset check, and the ecosystem accounts that support it, should ***only*** focus on the potential for large and potentially irreversible change is, however, open to debate. Thresholds are inherently difficult to identify given the current state of knowledge, and so a more precautionary approach might be advisable. This could allow users to explore notions of criticality in terms of limits of acceptable change. Natural asset accounts could be helpful in this context, because they would help us consider the synergies and conflicts between service outputs as a result of changes in underlying ecological structures and functions (e.g. habitat units and biodiversity characteristics or conservation status).
21. If experimental accounts are developed as part of a natural asset check in the UK, we suggest that it would be advisable to examine with potential users whether framing risk narrowly in terms of the danger of irreversible change is either helpful or indeed possible. The implication of

including the analysis of reversible and irreversible in the natural asset check would, however, clearly mean that the scope of the accounting exercise would be broader. As a constraint it is suggested therefore, that the analysis might focus on those reversible and irreversible changes where there is a risk of imposing significant *restoration costs* on future generations.

Conclusions

22. If 'meaningful' national level physical and monetary accounts are to be constructed, then amongst other uses they must be able to support exercises such as a natural asset check. Indeed it is perhaps essential that the opportunity is taken to use accounts for such purposes, to demonstrate better how accounts differ from more general ecosystem assessments. More fundamentally, such exercises help us better understand how integrated economic and environmental accounting would address the needs of decision makers. Although the availability of information is always a key, practical constraint, it is argued that the criteria for selecting services in any experimental accounting framework should primarily be 'needs-' and 'risk-based' rather than data driven. A primary function of such exploratory exercises must be to highlight current information gaps and strategies for overcoming them. The recent experience in the UK illustrates some of the issues that might need to be considered in the design of future work.

Acknowledgements

This paper has drawn on a 'think piece' prepared by Howard et al. (2011), on the approaches to undertaking a UK natural asset check presented to Defra in May 2011, and the several discussions that have followed it. The helpful comments of Rocky Harris at Defra on an earlier draft of this text is also gratefully acknowledged. The views presented here, however, are solely those of the author.

References

Haines-Young, R. and Potschin, M. (2010) Proposal for a Common International Classification of Ecosystem Goods and Services (CICES) for Integrated Environmental and Economic Accounting. Report to the EEA. http://unstats.un.org/unsd/envaccounting/ceea/meetings/UNCEEA-5-7-Bk1.pdf

Haines-Young, R. and Potschin, M. (2011) Common International Classification of Ecosystem Services (CICES): 2011 Update. Paper prepared for discussion at the expert meeting on ecosystem accounts organised by the UNSD, the EEA and the World Bank, London, December 2011. http://unstats.un.org/unsd/envaccounting/seeaLES/egm/Issue8a.pdf

Howard, B.M., Hails, R.S., Watt, A., Potschin, M. and Haines-Young, R. (2011) Considerations in environmental science and management for the design of natural asset checks in public policy appraisal. Paper presented at a workshop hosted by Defra, 11th May 2011.

POST (2011) Living with Environmental Limits. Report 370, January 2011. Parliamentary Office of Science and Technology, London. 159p. http://www.parliament.uk/documents/post/postpn_370-environmental-limits.pdf

Potschin, M. and Haines-Young, R. (2011) Ecosystem services: Exploring a geographical perspective. *Progress in Physical Geography,* 35(5) 575-594.

Price, R., Durham, C. and Chan, J.Y. (2010) Government Economic Service Review of the Economics of Sustainable Development. Findings. Defra, London. 62p. http://archive.defra.gov.uk/evidence/economics/susdev/documents/esd-review-report.pdf

UK National Ecosystem Assessment (2011) The UK National Ecosystem Assessment: Technical Report. UNEP-WCMC, Cambridge. http://uknea.unep-wcmc.org/Resources/tabid/82/Default.aspx