Natural Capital Accounting

Roy Haines-Young

(University of Nottingham, UK)

Introduction and 'State-of-the-art'

The need for Natural Capital Accounting has been widely emphasised internationally. For example, the 2012 Rio+20 conference restated its call for progress that had been first made two decades earlier as part of Agenda 21. However, despite the advances made since 1992, through the UN SEEA work on integrated environmental and economic accounting, discussions arising from initiatives such as TEEB and WAVES, the Convention on Biological Diversity and the EU Strategic Plan for Biodiversity 2011-2020, show that much more needs to be done. Given the urgent need to providing decision makers with better and more timely information, the international community is at a critical stage in relation to the development of accounting systems, because there is a danger that investments in data processing and collection will be made on an *ad hoc* basis, rather than in the integrated and systematic way embodied in the notion of 'accounts'.

Although perspectives vary according to the requirements of these different communities, **natural capital accounting is broadly understood to be the systematic organisation of information about the stocks of ecosystem assets, and flows of goods and benefits that arise from them.** In creating such accounts the ambition is to organise information so that it can be used to better understand how these assets, and the flows associated with them, are changing in physical terms, and in terms of the values they represent for society. While many commentators have stressed the need to focus on monetary values, and ultimately to link assessments of natural capital accounts to more conventional economic ones, it is also clear that accounts expressed in terms of biophysical measurements can go a long way to fulfilling policy and management needs (EEA, 2006). Thus to take work in this complex area forward, many see that the first step towards operationalization must be to develop sets of 'satellite accounts' for natural capital that can be used alongside more conventional economic accounting methods by decision makers.

Recent reviews of current approaches to natural capital accounting include those of Edens and Hein (2013), who focus especially on the issues arising from the goal of integrating ecosystem services and ecosystem capital in national accounts, and van Dijk et al. (2014), who look at accounting methods at national scales in the context a broader perspective on the information needs of decision makers. The second of these reviews is especially valuable in highlighting the dangers of more ad hoc approaches to data collection and reporting. Lack of standardisation and long-term perspectives can, they argue lead to increased costs in terms of data sharing and coordination, and over-reliance on particular data sources that are simply easy to acquire, even though they may not be entirely fit for purpose. These commentators very much see accounting systems as bridging the gap between an underlying and comprehensive data infrastructure and the higher level indicators and metrics that decision makes use for their everyday work and as a way of communicating with their publics (Figure 1). In designing such accounts the task is to find ways of aggregating data in efficiently, without loss of information, and the presentation of them in ways that have meaning for manages and decision makers working at different levels of generality.

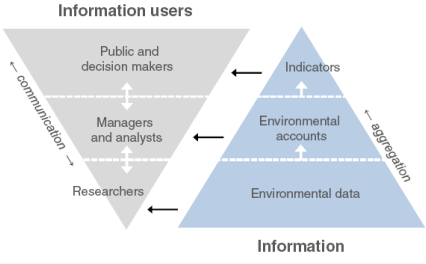

Figure 1: The role of natural capital or environmental accounts (after van Dijk et al., 2014)

The vision of accounts as forming one layer in an information pyramid is especially important in the context of the work being undertaken here, because it implies that there is a need to go beyond a technical understanding of what accounts are, and how to construct them, to an analysis how this information is actually used. An understanding of different 'application contexts' is we suggest, especially important. While the recent Report of the *MAES Pilot Study on Natural Capital Accounting* (Gocheva and Petersen, 2014) found that technical limitations associated with data availability were a barrier to progress, a lack of demand for such information from policy makers is also a limitation.

Some understandings of these different application contexts are provided by the MAES Report. While the initiative was specifically designed to support work in relation to the implementation of the EU 2020 Biodiversity Strategy, the Report notes the wider policy relevance of natural capital accounts to the concerns around the EU Water Framework and Floods Directives, and EU Cohesion Policy. These clearly represent important opportunities where exemplar applications could be developed in the medium term. Experience at the European Scale, through projects such as OpenNESS suggests that the range of policy applications could be extended by considering policy challenges related, for example, to competitiveness and regulatory frameworks. Both these areas have been identified as key in understanding how ecosystem service and natural capital concepts can be operationalised, and sit alongside more traditional concerns relating to biodiversity, sustainable resource use and environmental restoration. As a result there is a pressing need to create a common methodological platform and approach that would, on the one hand, allow customised and targeted applications to be developed, and on the other, encourage effective cross-sectoral analyses to be made, so that the goal of more ecosystem orientated decision making can be achieved.

As van Dijk et al. (2014) emphasise, there are now a number of new opportunities to improve environmental information; although they were more directly concerned with the situation in Australia, their perspective is relevant elsewhere. The TEEB follow-up study for Europe also emphasises the choices that confront us. On the technical front, van Dijk et al. (2014) suggest these opportunities include the design of enhanced monitoring networks, increased standardisation and data management, and new environmental modelling platforms. In relating to the development of enhanced applications, van Dijk et al. (2014) suggest there are opportunities involving developing commitments to share environmental data between institutions and different societal sectors, encouraging the growth of community-based environmental monitoring; and, the increasing use of environmental and sustainability indicators. The development of the user-base is, in fact, the main focus of the findings of the TEEB follow-up study, which suggests the next steps are to work with end users to clarify purposes and priorities, information needs and preferred valuation approaches.

To some extent these opportunities and choices are already partly shaped in Europe by the on-going work on natural capital accounting through the MAES initiative and work within the EEA. The EEA, for example, are actively developing a set of so-called 'simplified ecosystem capital accounts' at the European level, in support of the first application of SEEA experimental ecosystem accounts. These accounts are based on available data, and consist of accounts for individual ecosystem components, including land, carbon, water, soil and nutrients, forest and biodiversity. A key challenge for the future will be to determine their spatial and thematic consistency and acceptability to decision makers across Member States; this will involve investigating how these simplified accounts link with initiatives covering similar topics at other scales, or other thematic sectors relevant to our understanding of the state of natural capital more generally. The review of national applications provided by the MAES Pilot Study on Natural Capital Accounting provides a number of starting points for this analysis that can also usefully inform the work of OpenNESS.

A reading of recent development in the field suggests that while there is an understanding of accounting approaches, a number of conceptual issues will need to be addressed in the future if these methods are to be used operationally. As Schröter et al. (2014, 2012) point out, for example, we need to structure accounts to represent both the ability of ecosystems to supply services and the societal demand for them, that is to distinguish 'capacity' from 'flow'. This is especially complex when beneficiaries are located at some distance from where an ecosystem service is generated. An understanding the balance the supply of ecosystem services and their supply is critical in achieving sustainable forms of development (EEA, 2006). To make progress, Schröter et al. (2014) point out that we need to ensure compatible between indicators for capacity and flow.

The analysis of the supply and demand for ecosystem services, and hence the representation of natural capital stocks and the benefit flows that arise from them, hinges critically on the spatial integration of different sources of data. Progress has already been made within Europe, through the development of the EEA's 1km x 1km accounting grid. Future technical challenges arise in relation to better understanding if and how this spatial framework can be used to build other spatial units for modelling stocks and flows, and for identifying the characteristics of beneficiary populations, and their actual or desired access to ecosystem services. Given that it is unlikely that these factors operate at any single scale, the ability to use the accounting grid approach for 'multi-scale' assessments and analyses will be an essential issue on the development of any future accounting guidelines. VanDijk et al. (2014) has also emphasised the need to achieved better model integration, if accounting methods are to be further developed. Building on their review, we might also consider whether the availability of new data sources is adequately represented in the types of accounting grid currently being considered, and whether this remains an appropriate basis for efficient data integration.

Although basic information of thematic sectors such as land or carbon or water are important in some policy context, our reading of the literature suggests that increasingly the need to understand the synergies and trade-offs between ecosystem services will become an increasingly important focus. Rarely are policy are management or policy decisions made about single environmental components; more usually we need to understand the implications of interventions for bundles of services and who are the potential winners and losers in societal terms. With the development of CICES (Haines-Young and Potschin, 2011) we have a framework for representing final ecosystem services at different thematic scales, and hence we can represent their trajectories in a consistent way. Given the concerns in the current literature, it is clear that any future work would need to show how to map these services onto different beneficiary groups and represent the importance that are attached to them in consistent and comparable ways. To take this forward future work would need to link to the contribution recently made by the US EPA through their FEGS framework (Landers & Nahlik, 2012), and examine its applicability in Europe. A further task must also be to review approaches to mapping trade-offs and synergies in bundles of ES that are currently being examined the parallel work of the MAES mapping pilots (MAES, 2013).

The *MAES Pilot Study on Natural Capital Accounting* concludes that the integration of the monetary aspects of natural capital in accounting remains as a significant challenge and that further national experimentation is crucial. In the context of the EEA simplified accounts as currently proposed, for example, it is envisaged that assessment will be based on understanding the biophysical changes described by the accounts, and especially the consumption of natural capital and the implications for its reinstatement (Weber, 2011). The general applicability of this kind of approach in different application contexts must be an important focus of future work. Studies such as the UK National Ecosystem Assessment (UKNEA) have shown (e.g. Bateman et al. 2013) that an understanding of the implications of different socio-ecological trajectories can usefully be achieved by looking at a range of ecosystem services and considering both market and

non-market economic values in a spatial context. As the *TEEB follow-up for Europe* has observed, however, there is probably no single way forward; this conclusion is further emphasised by the work of Edens and Hein (2012). Thus an important component of future work must be to explore how this diversity of approach can be accommodated and used to widen the uptake of accounting methods by decision makers.

Significance for OpenNESS and specific Work Packages:

Natural capital accounting is a decision support tool, which aims to describe the state and trends in natural capital stocks and ecosystem service flows, primarily to determine whether ecosystems or other natural resources are being used or managed sustainably; the basis that accounts provide for the development of indicators is an important area to explore. A review of the current approaches and applications is part of WP3, and although the potential to apply the methods is limited given the scope of the OpenNESS work programme, where possible accounting methods will be used to inform the discussion with case studies in WP5, especially when linked to the hybrid valuation methods being explored in WP4.

Problems/Issues

A key issue for the development of environmental accounting systems is the availability of data and the maintenance of those data over time so that change between accounting periods can be assessed. The construction of physical, rather than monetary accounts are usually considered the entry point for this kind of work, although the monetization of accounts is may be necessary in some applications where the economic impact of environmental change is required. A further issue to be explored is how to use environmental accounts to calculate 'ecological debt' and the level of reinvestment in natural capital required for its restoration. Such estimates can be used to inform judgements in relation to question s about liabilities following damage to natural assets, or whether natural capital is being managed or used sustainably.

Relationship to the 'Four Challenges' being addressed by OpenNESS

Human well-being: Natural capital accounts can be used to determine the balance between the demand and supply of ecosystem services and hence the extent to which needs in relation to human well-being are met.	**Sustainable Ecosystem Management:** Natural capital accounts would be essential in determining whether natural capital stocks and associated ecosystem flows were being managed sustainably, and whether the levels of reinvestment in natural capita were sufficient to compensate for degradation.
Governance: Natural capital accounts are an important governance tool insofar as they can inform decision makers about the state of natural capital, the consequences of change over time, and the effectiveness of policy interventions.	**Competiveness:** Spatially disaggregated natural capital accounts would be essential for the analysis of the comparative advantage or disadvantage of areas in respect to their natural assets and the flows of ecosystem services, and tracking the contribution that ecosystems make to regional economies.

Recommendations:

- That the OpenNESS conceptual framework should be consistent with that used to frame international natural accounting methods and standards.
- That mapping methods used in OpenNESS should, where possible, be used to develop spatially explicit physical natural capital accounts.

- That the exploration of hybrid valuation approaches undertaken in OpenNESS should consider how they can be applied in the context of natural capital accounting.
- That the experience in the OpenNESS case studies be used to explore the role that natural capital accounting can have at different spatial and temporal scales.

Definitions:

Natural capital accounts: a way of organising information about natural resources so that the state and trends in natural assets can be documented and assessed in a systematic way by decision makers.

Natural assets: see natural capital

Natural capital: the elements of nature that directly or indirectly produce value for people, including ecosystems, species, freshwater, land, minerals, air and oceans, as well as natural processes and functions. The term can be used synonymously with natural asset. Note ecosystem capital and ecosystem assets are sometimes used to refer to the living parts of nature that produce benefits for people.

Key Papers

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