Putting biodiversity into the national accounts: Creating a new paradigm for economic decisions

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Abstract Economics has long taken precedence over the environment in both governmental and business decision making, with the System of National Accounts and the indicator GDP coming to represent much that is *wrong* with the current environmental conditions. Increasing recognition of the environmental damage human activity causes and that human well-being depends on biodiversity and ecosystems means that new systems to measure and sustainably manage the world are needed. Integrating the environment into national accounts has been suggested as a way to improve information but so far impact on decision making is limited. This outlook needs to change. Using examples from Australia and Botswana, we show how integrating information on biodiversity, resource use and the economy via accounting can help create a new decision-making paradigm and enable a new policy framing with spending on biodiversity conservation and sustainability seen as an investment, not a cost.

Keywords Biodiversity conservation · Ecosystem services · Environmental accounting · Natural capital accounting · System of Environmental-Economic Accounting

INTRODUCTION

The importance of the environment to economic prosperity was recognized at the United Nations' Rio Earth Summit in 1992 (UN 1992) and was reinforced by the adoption of the Sustainable Development Goals (SDGs) in 2015 (UN 2015). Unfortunately, these policies have not stopped environmental degradation. With human use of the environment reaching dangerous levels (Rockström et al.

2009), better ways need to be found to achieve environmental, economic and social objectives.

This requires a paradigm shift in the way humanity measures, values and makes decisions about the environment. There are signs this is happening via a combination of better accounting for the environment and recognition by government and business that accounting can be used at all stages of the policy cycle (Bass et al. 2017). The paradigm shift must involve seeing the economy and the environment as integrated systems. This perspective allows a single policy framing to be applied to both economic and environmental matters, one which allows a more complete assessment of tradeoffs between alternative economic-environmental use combinations (Fig. 1).

For economic policy, the standard framing involves the assessment of future benefits obtained from investments now—understanding the different returns to investment choices. In essence, decisions and choices are made by comparing the values of current and future benefits to the capacity of the underpinning assets to supply those benefits to different beneficiaries. Seeing decisions as investment choices is second nature for economists, financiers and accountants, but is largely missing from policies on the environment where the validity of outcomes, such as conservation or sustainability, is taken as given. Framing conservation and sustainability as investment choices would represent a significant and fundamental change in approach.

Such a framing also allows recognition of the importance of ecosystem services which make explicit the dependencies of human economic activity, and human well-being more broadly, on ecosystems and biodiversity and the wide variety of priced and unpriced services they provide (e.g. Boyd and Banzhoff 2007; Milner-Gulland et al. 2014). These services include biomass for food and

Fig. 1 Integrated accounting allowing assessments of tradeoffs within and between different parts of environmental and economic systems and how different investment choices will affect the future, thus enabling a paradigm shift in governmental and business decision making

energy, water, air filtration, pollination, climate regulation and recreational opportunities. To date, while the concept of ecosystem services is in line with an integrated system view, it has not yet gained sufficient traction in policy circles at the national level. However, the importance of ecosystem services and integrating them into economic decisions has been reviewed and acknowledged at other levels (e.g. Bateman et al. 2010).

THE ROLE OF ACCOUNTING IN THE PARADIGM SHIFT

To embed an investment-based approach to environmental management, comprehensive and integrated information is essential. In a narrow, economics-only, world view, the core information set is reflected in accounts. Standard economic and financial accounts encompass information on returns (incomes, expenditure, profit and loss) and underlying assets (manufactured and financial). These are presented at a national level in the System of National Accounts (European Commission et al. 2009), which is the source of the indicator GDP (gross domestic product). These accounts and indicators assist management and planning: for example, savings can be made in good years, increasing the size of the balance sheet, which can then be drawn upon in bad years. Investment in assets is a positive, recognizing that expenditure now will result in benefits later. In contrast, the national information systems supporting environmental policy have been largely ad hoc,

commonly reliant on academic research institutions, rarely underpinned by long-term monitoring, and with policy agencies poorly equipped to use the information.

The notion that extending traditional national accounting to cover the environment can improve decision making has been proposed for more than 40 years (e.g. Nordhaus and Tobin 1972). What has changed recently is that the concepts have been officially codified. Since 2012, the System of Environmental-Economic Accounting (SEEA) (United Nations et al. 2014a) has provided international statistical standards for governments, while from 2016, the Natural Capital Protocol (NCP) (Natural Capital Coalition 2016) has provided an approach for business. These platforms for institutionalizing the use of environmental information in economic and environmental decision making are available now. However, the use of extended accounting for decision making remains limited and accounting has struggled to make the transition from theory to practice and make real impact on government or business strategic planning or management processes (Vardon et al. 2016). In addition, ecosystem accounting, while of tremendous interest and potentially very useful, is still in an experimental phase (United Nations et al. 2014b). Below we use biodiversity accounting and cases from Australia and Botswana to show how accounting can help make an urgently needed paradigm shift in the planning processes and management of natural resources by government and business.

USING ACCOUNTING FOR BIODIVERSITY CONSERVATION

Biodiversity conservation is major challenge for governments and business. This is recognized at local, national and international levels and demonstrated internationally by biodiversity conservation targets in the Convention on Biological Diversity¹ and the SDGs (e.g. Goal 15; United Nations 2015).

The Aichi Target 2 states: “By 2020, at the latest, *biodiversity values* have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into *national accounting*, as appropriate, and reporting systems”. (Emphasis added)

Aichi Target 2 provides a clear entry point for biodiversity and accounting experts to work together. While discussion is underway, the valuation of biodiversity has proved difficult. The valuation work within the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) has focused on the different

¹ e.g. Aichi Biodiversity Target 2; see <https://www.cbd.int/sp/targets/>.

conceptions of value with respect to the environment (an important discussion) but is only now progressing to consider the value of biodiversity specifically or the integration of environmental and economic values into national accounting, which requires monetary valuation. On the one hand, placing monetary values on biodiversity can be seen as the “commodification of nature”, while others argue that without monetary values, the other values of biodiversity will always be dominated by economic values or, put differently, be given a value of zero in many decision-making contexts (Schröter et al. 2014).

What is clear is that there is an urgent need for agreed concepts and approaches to the monetary valuation of biodiversity if Aichi Target 2 is to be met by 2020. The platforms of the SEEA and the NCP provide starting points for this, but disentangling the multiple and strongly held notions of value remains a key question. Part of the way forward is to test the different conceptions of value and see which conceptions work in which decision-making contexts.

SDG 15 aims to “Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss”.

SGG 15 is broad ranging with several aspects that make it amenable to monitoring using accounting approaches. At its simplest, accounting for the number of species, their distribution, abundance and age structure would provide a metric for measuring the component on biodiversity loss. However, the full potential of accounting emerges when addressing the sustainability aspects of the goal. This requires not just reporting on biodiversity loss but also on connecting to data on the extent and condition of terrestrial ecosystems (e.g. forests) and enabling assessment of levels of use of environmental stocks relative to the regenerative capacity of those stocks and the economic revenue. Such an accounting system would assist with the assessment and management of forests and address many of the issues identified by Repetto (1987) and others.

EXAMPLE OF ECOSYSTEM ACCOUNTS FOR FOREST MANAGEMENT IN AUSTRALIA

Ecosystem accounts for the Central Highlands of Australia demonstrated the comparison between the benefits of different uses of the environment against the impacts on biodiversity. This forest region supports several land uses and a range of biodiversity, including rare and Critically Endangered species, such as Leadbeaters’ Possum (*Gymnobelideus leadbeateri*) (Keith et al. 2017). In this case study, the economic activities and selected ecosystem services of the region—timber harvesting, water supply,

carbon sequestration, agriculture and tourism—were estimated and compared between different use scenarios including quantifying what would happen if the protected area network was extended. It was demonstrated that if logging native forests ceased, then USD\$10.9 million of industry value added (IVA; the contribution to GDP) would be lost directly but that this would be offset by expected gains to the water supply industry (USD\$ 7.4 million, IVA) through higher water yield, plus the ability to enter the carbon market (USD\$ 11.5 million IVA), plus possible increases in tourism and plantation timber production, plus the non-monetary benefit of reducing the extinction risk of species (all values for 2013–2014, average AUD\$ to USD\$ for 2013–2014 was 0.91). Significantly, the monetary information compiled from an accounting perspective was more readily amendable to making policy tradeoffs, than the previously estimated, stand-alone value of between USD\$53–110 million for Leadbeaters’ Possum using contingent valuations (Jakobsson and Dragun 2001), reflecting social welfare values that include consumer surplus. Such welfare-based valuations have attracted a range of concerns with respect to their comparability and credibility but, importantly from a decision-making perspective, cannot be directly compared to the values of economic production most commonly used in economic modelling and similar decision-supporting tools.

EXAMPLE OF ECOSYSTEM ACCOUNTS FOR WILDLIFE MANAGEMENT IN BOTSWANA

Ecosystem accounts in Botswana combined biodiversity at the species and ecosystem levels with assessment of the physical requirements to maintain the biodiversity, thus demonstrating their contribution to the economy and to human well-being. This application of accounting does not require monetary valuation. In Botswana, wildlife consumes 10% of all water, with elephants (*Loxodonta africana*) accounting for most use (Fig. 2). In 2013, tourism related industries (i.e. trade, hotels and restaurants) generated approximately USD\$2150 million of industry value added, six times more than agriculture, and was the largest income earner for the country, ahead of mining and financial and business services (Vardon et al. 2017).

Appropriate allocation of water and land to wildlife is a clear need. The allocation can be viewed as both an investment choice to support tourism-based industries rather than alternative land and water uses (and especially agriculture) as well as a broader statement of the value of wildlife not captured via standard economic approaches. The broader values include maintaining the existence of species and non-monetary values of benefits to people (such as the maintenance of ecological functions). The

Fig. 2 There is a need to include the use of natural resources like water and land by biodiversity explicitly in traditional accounting so that impacts of allocations of natural resources to economic activities on biodiversity and vice versa can be systematically assessed. Picture courtesy: Kirk Hamilton

presentation of information on multiple conceptions of value allow governments, businesses and individuals to express their preferences through economic means (e.g. spending on ecosystem management, accommodation, tours and travel to and from national parks, etc. as well as purchases of land) as well as other means (e.g. time spent appreciating wildlife, voting for candidates that support policies that protect wildlife). In these conceptions of value, biodiversity assets (i.e. elephants, other species and their habitats) are recognized as delivering services that support economic activity, such as tourism, which can be compared to alternative uses of water and land that generate income (e.g. agriculture), as well as services that do not need to be monetized to be included in management and investment decisions (e.g. cultural and recreational services).

SOME LESSONS FROM AUSTRALIA AND BOTSWANA

These examples from Australia and Botswana show that accounting for biodiversity can provide new information to support decision making by government and business. They also demonstrate how the production of accounts can stimulate discussion and lead to better understanding between different stakeholders. In Botswana, the Department of Water Affairs went to various public and private sector agencies to seek feedback on water accounts and in particular how they could be improved to better suit the needs of particular users (Pule and Galegane 2017). In discussions with the Department of National Parks and Wildlife, water use by wildlife was identified as an issue (Vardon et al. 2017). In the water accounts developed until

then (Department of Water Affairs 2017), wildlife use of water had not been considered. However, with the increasing numbers of animals, and especially elephants that consume around 225 l of water per day, and a drought resulting in less water being available for all users, it had become a management issue with elephants and other animals venturing out of conservation areas in search of water and food. With the new information on both water use by wildlife and the economic contribution of tourism to the Botswana economy, the Department of National Parks and Wildlife is able to argue that more water should be made available to wildlife.

Similarly, the accounts for the Central Highlands resulted in a range of discussions in the media and ultimately led to some of us (DL, HK and MV) being invited to discussions on the use and management of the forests as part of the process of reviewing the Regional Forest Agreement (a legal framework for long-term forest conservation, management and use in Australia).²

While these case studies are positive, for biodiversity accounting to become a mainstreamed part of decision making, accounts must be expanded to cover larger areas (e.g. river basins, countries), include more comprehensive metrics describing biodiversity, and be updated regularly, ideally annually. Indeed, availability of the most up-to-date information is essential when decisions must be made at short notice.

To support ongoing compilation of accounts, biodiversity data also will need to be collected regularly. Yet consistent, long-term, nationwide monitoring of biodiversity at the species or ecosystem level seldom occurs. While remote sensing offers some promise for landscape-scale monitoring for major ecosystem types (e.g. tropical savannahs, temperate forests, wetlands) and may be suitable for some applications (e.g. changes in ecosystem extent), remote sensing data are not suitable for local, context-specific assessments of species or ecosystem condition.

A few species have been the subject of long-term monitoring and the programs for them must be maintained. Monitoring programs need to be expanded to include additional species and robust indicators of key habitat attributes, indicators of ecosystem condition and drivers of degradation. Undertaking this work, although resource intensive, is directly analogous to ensuring that all parts of the economy (e.g. agricultural, mining, manufacturing, education, financial services) are covered by economic surveys or that all management units of a corporation are included in annual accounts. We take these economic and financial monitoring exercises for granted and allocate very

² <http://www.agriculture.gov.au/forestry/policies/rfa>.

substantial resources to the tasks. This also must be the case for ecosystems and biodiversity.

MAKING THE CONNECTIONS: BUSINESS, GOVERNMENT AND ACADEMIA

Reframing biodiversity conservation and sustainability as investment choices would represent a significant and fundamental change in approach from the current natural resource management. Such reframing will resonate with government economic planners and businesses that have so far struggled to understand the way economic activity degrades the environment. This lack of understanding is partly due to a lack of integrated environmental and economic information and a reliance on the existing systems that provide regular economic data in the form of accounts, but relatively little regular data on the environment.

International organizations and multi-stakeholder coalitions have established processes to develop environmental-economic accounting platforms for governments via the SEEA (United Nations et al. 2014a), and for businesses via the NCP (Natural Capital Coalition 2016). The SEEA in particular has been primarily a technical accounting exercise with limited interaction with policy and decision makers. An important milestone in making the connection to policy occurred in November 2016 with the establishment by the Government of the Netherlands and the World Bank of the *Forum on Natural Capital Accounting for Better Policy Decisions* that brought together accounting producers and policy experts and led to a summary of achievements and challenges as well as suggestions for moving forward (Bass et al. 2017). The Forum advanced understanding between account producers and users and enhanced communication between business and government accounting initiatives. Business and government linkages will be essential if a new paradigm of decision making, recognizing our dependence on ecosystems and biodiversity, not just the human impacts, is to be established to meet the real and present economic, social and environmental challenges of the modern world.

With greater understanding of the tradeoffs between the environment and the economy revealed by environmental-economic accounts, different parts of society are able to regularly review and modify their activities. It also enables different parts of society to hold each other accountable and for business and government to make institutional changes to enable information to be analysed more effectively and translated into policy and management responses. This was the key impact of the System of National Accounts (European Commission et al. 2009) and could be for the systems of environmental-economic accounting

(United Nations et al. 2014a; Natural Capital Coalition 2016).

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