NATURAL CAPITAL ACCOUNTING FOR BETTER POLICY

WAVES NCA Policy Forum

The Hague, 22-23 November 2016

The Aichi Targets and Biodiversity Conservation – The Role of Natural Capital Accounting

Michael Vardon[1,2], Steve King[3], Daniel Juhn[4], Steve Bass[5] Peter Burnett[1], and Stig Johansson[1]

[1] Fenner School of Environment and Society, Australian National University, [2] World Bank, [3] UNEP-World Conservation Monitoring Centre, [4] Conservation International, [5] IIED

Summary

Natural capital accounting has been identified as a vehicle to accelerate the mainstreaming of biodiversity into decision-making in a systemic manner. It includes a wide range accounts, including those for biodiversity, which is one of the most exciting areas of natural capital accounting.

Accounting for biodiversity poses several theoretical and practical challenges, however, including the need for a wide range of professions to work together to address the topic. All have different entry points and aims for biodiversity conservation as well as their own terminologies and ways of working. This can make discussions challenging and there is a need for more clarity and precision in the discussions of how accounting can address biodiversity conservation.

To assist collaborations between diverse groups of professionals in the application of accounting to biodiversity conservation we have started by mapping the Aichi Targets to the System of Environmental-Economic Accounting (SEEA)) (Table 1). Aichi Target 2 which is to 'integrate biodiversity values into national and local development strategies and plans *and national accounting systems as appropriate* is a general principal entry point'. To achieve this diverse agencies and professions will need to work together.

We also introduce a range of recent examples and literature to suggest specific ways of applying accounting to biodiversity conservation – with a focus on land, ecosystem and species accounts. This work is at early stages and there is plenty of room for new ideas and incorporation of further practical experience. We hope that this short paper provides a starting for discussions as well as indicating where countries and agencies may like to begin work.

1. Introduction

There has been considerable success in mainstreaming development issues in recently revised National Biodiversity Strategies and Action Plans (NBSAPs)[1] and some reciprocal recognition of biodiversity in national development strategies or sector plans. The latter has depended upon close collaboration of biodiversity, finance and development authorities, increasingly recognized as joint drivers of effective biodiversity mainstreaming.[2] These players are now recognizing natural capital accounting as a vehicle to *accelerate* mainstreaming of biodiversity in a more systematic way across a wide range of decision-making (Jean-Louis Weber, 2014; UNEP-WCMC & IEEP, 2014), and it can benefit from the collaboration achieved to date.

Such collaboration is important, as a wide range of professions (e.g. accountants, ecologists, economists, land and sea managers, etc. and the public and private sector) must work together closely to turn the promise of environmental – economic accounting into practical information that can be used by decision-makers in public and private sectors.

In the past few years a range of work on accounting for biodiversity has emerged. For example, turning existing indices of biodiversity and endangered species lists into accounts. Much of this is summarised in a very useful publication prepared by UNEP-WCMC (2016). This publication expands on the material included in the System of Environmental Economic Accounting - Experimental Ecosystem Accounting (SEEA-EEA)(UN et al 2014). Several projects have published ecosystem accounts or include aspects or measures of biodiversity that are relevant to accounting (e.g. ABS 2015, Burns et al. 2014, Eftec 2015, Keith et al 2016, Remme et al. 2014, Remme *et al*. 2016, Schröter et al 2015, Varcoe et al. 2015). The corporate sector has also addressed accounting for biodiversity in the past (e.g. TEEB) and more recently (e.g. Jones 2014).

The growing body of work has brought to light a number of practical issues concerning the data sources and methods needed to generate accounts. But, more importantly, it has also shown that the accounts need to be tailored to be relevant for management and policy decisions relating to biodiversity conservation.

This note is intended to generate discussion about the potential uses of accounting for biodiversity conservation. Three areas are examined briefly, applying accounting to: (1) the Aichi Targets, (2) land use planning and protected areas management in particular and (3) biodiversity offsets and payments for ecosystem services. These are clear uses within the biodiversity conservation community, with some experience to suggest that countries could apply accounting to these issues as a first step towards a more comprehensive or extended use of accounting.

A range of additional applications of accounting to biodiversity appear possible and we hope that these can be elucidated in the future. In particular, this is for the “mainstreaming” of biodiversity in the planning and management of government and the private sector.”. We return to this broader use later in the paper. This potentially extends to a more holistic and integrated land use planning regime that better considers biodiversity and the impacts of management on biodiversity and the ecosystem services that are derived from biodiversity. Such planning and management would be a significant break from traditional land planning regimes, and moreover could help land use planners to build the bridge that is too often missing between them and economic and development planners.

[1] https://www.cbd.int/nbsap

[2] Harare Statement. 2015. Mainstreaming Biodiversity into Development Policy and Planning (http://pubs.iied.org/G04010/)

2. Applying accounting to biodiversity conservation: The Aichi Targets

Under the CBD, 20 biodiversity targets were established, known as the Aichi biodiversity targets[3]. The aim of Aichi Target 2 is to place biodiversity into the mainstream decision-making frameworks of policy-makers (Rode et al. 2012). It also makes explicit that biodiversity is to be incorporated into national accounting (i.e. the System of National Accounts or SNA), which among many things, produces the indicator Gross Domestic Product (GDP)(see UN et al. 2009). The SNA is one of the chief sources of information for governments and others about the functioning of the economy. It has a central place in the economic analyses feeding into government and corporate decision-making and policy development. It is an integrated economic information system that is unparalleled in environmental information.

By integrating biodiversity information into the SNA, biodiversity can be considered in the main economic policy, resource allocation, fiscal and planning tools used in decisions of governments. To achieve Aichi Target 2 an obvious path is to join existing ecological and economic understanding to the accounting concepts and structures of the SNA via the SEEA. Indeed, the number of countries implementing natural resource accounts, excluding energy, within the SEEA is proposed as an operational indicator for the attainment of Aichi Target 2 as one of the draft decisions for the Conference of the Parties for the Convention on Biological Diversity in December, 2016.[4] Many of the other Aichi targets may be addressed via accounting described in either the SEEA Central Framework or SEEA EEA (Table 1).

3. Applying accounting to land use planning and threatened species management

Using ecosystem accounting in threatened species and protected area management

The management of threatened species and protected area management are cornerstones of conservation and policies, laws, practices and institutions have evolved for this purpose. Typically, scientists and public officials involved in threatened species and protected area management have little knowledge of environmental or ecosystem accounting and how it could be applied.

The spatially disaggregated approach implicit in ecosystem accounting can help to show the benefits arising from protected areas. This was done for State of Victoria (Varcoe et al. 2015). Ecosystem accounting may also prove helpful for deciding on areas for the establishment of additional protected areas, as is being tested with the accounts being developed for the Central Highlands of Victoria (Keith et al 2016.).

Accounting can also help to target particular areas, habitats or species for assistance. For example, habitats underrepresented in the protected area network (Aichi Target 11), and possible cost effective solutions for increasing these (e.g. expanding the protected area networks or implementation of schemes for the protection of habitats on private lands).

For threatened species, information on species distribution and abundance can be coupled with environment protection expenditures to help assess the efficiency of expenditures, and the optimum points of intervention (e.g. waiting until near extinction to act is likely to be more costly than action taken when declines are first apparent). This can be linked to Aichi Target 3.

[3] See Aichi Biodiversity Targets http://www.cbd.int/sp/targets/

[4] See cbd.int/doc/meetings/cop/cop-13/official/cop-13-02-en.pdf

Table 1: Links between Aichi Targets and environmental and ecosystem accounts

Aichi Target	Relevant environmental-economic and ecosystem accounts
1. By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.	-
2. 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.	All SEEA National Balance Sheet showing value of natural resources along with the value of other assets (SNA and SEEA CF) Ecosystem service accounts showing both physical levels and monetary values of services (SEEA-EEA)
3. By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.	Environmental activity accounts (SEEA CF) – these accounts cover environmental protection expenditure, taxes, subsidies, etc.
4. By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.	Physical asset and supply-use accounts for water, timber, aquatic resources, minerals and energy (SEEA CF) Ecosystem extent and condition accounts (SEEA-EEA)
5. By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.	Land cover/ecosystem extent accounts (SEEA CF/SEEA-EEA) Ecosystem condition accounts (SEEA-EEA)
6. By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.	Physical asset and supply-use accounts for aquatic resources (SEEA CF) Ecosystem condition account (SEEA-EEA) Biodiversity accounts (SEEA-EEA) – species accounts,- species diversity account

7. By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.	Land cover/ecosystem extent and land use accounts (SEEA CF/SEEA-EEA) Ecosystem condition account Biodiversity accounts (SEEA-EEA) - species diversity account
8. By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity	Ecosystem condition accounts (SEEA-EEA)
9. By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.	Possible links to Biodiversity accounts (SEEA-EEA) and Environmental activity accounts (SEEA CF)
10. By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.	Water emissions account (SEEA CF) Ecosystem extent account – of coral reefs and vulnerable ecosystems (Secades et al., 2013) Ecosystem condition account (SEEA-EEA) Ecosystem services account (SEEA-EEA) Biodiversity account – species diversity / population / extinction risk trends in coral and reef fish (adapted from Secades et al., 2013)
11. By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes	Land cover/ecosystem extent and land use accounts (SEEA CF/SEEA-EEA) Ecosystem condition account (SEEA-EEA) Ecosystem services account (SEEA-EEA)
12. By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained	Biodiversity accounts (SEEA-EEA) – species diversity / abundance accounts
13. By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.	Biodiversity accounts (SEEA-EEA) – genetic diversity account. Not described in SEEA-EEA but theoretically feasible, although practically difficult

14. By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable	Ecosystem condition account (SEEA-EEA) Ecosystem services account (SEEA-EEA)
15. By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.	Land cover/ecosystem extent account (SEEA CF/SEEA-EEA Ecosystem condition account (SEEA-EEA) Carbon asset account (SEEA-EEA) Ecosystem services account (SEEA-EEA)
16. By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.	Biodiversity accounts (SEEA-EEA) – genetic diversity account. Not described in SEEA-EEA but feasible Ecosystem services account (SEEA-EEA)
17. By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.	Possible role for a Biodiversity Account (SEEA-EEA) in NBSAPs
18. By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.	-
19. By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.	Possible roles for: Ecosystem condition account (SEEA-EEA) Ecosystem services account (SEEA-EEA)
20. By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.	Environmental activity accounts (SEEA CF)

Source: After Vardon et al 2015.

One process available to promote and disseminate the potential of accounting to help inform sustainable management of biodiversity is the Intergovernmental Platform for Biodiversity and Ecosystem Services (IPBES). IPBES:

> "provides a mechanism recognized by both the scientific and policy communities to synthesize, review, assess and critically evaluate relevant information and knowledge generated worldwide by governments, academia, scientific organizations, non-governmental organizations and indigenous communities.[5]"

So far the development of the IPBES has not significantly engaged with the processes surrounding SEEA-EEA but there may be opportunities going forward, particularly given the likelihood that the number of countries implementing SEEA will become an operational indicator for assessing progress towards Aichi Target 2 (and others). Furthermore, the recently commenced IPBES Regional Assessments, and upcoming Global Assessment, of Biodiversity and Ecosystem Services will serve as key foundations for the CBD's next Global Biodiversity Outlook assessing achievement of the Aichi targets in the lead-up to 2020.

4. Applying accounting to biodiversity offsets and payments for ecosystem services

There are more than 300 programs for payments for ecosystem services (Blackman and Woodward 2010) with a combined value of payment in excess of US$6.5 billion (OECD 2010). Linking accounts to these programs is a key opportunity.

As a specific example, biodiversity offsetting is a policy instrument that seeks to achieve sustainable development (Gibbons et al 2015). Biodiversity offsets are defined by the Business and Biodiversity Offsets Programme (BBOP 2012) as:

> "…measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development..."

Biodiversity offsetting is being implemented widely (ICMM and IUCN 2012, Madsen 2011). Offsetting, when applied to issues such as pollution or carbon dioxide is intended to represent a flexible alternative to command and control regulation because it theoretically allows development to continue or expand without detrimental net effect on the environment (e.g. Reid 2011). However, it has been argued that biodiversity can only be offset in a restricted range of circumstances because of the poor fungibility[6] of biodiversity, and thus no net loss is likely in only a narrow range of development scenarios (e.g. Gibbons et al. 2015). Thus, biodiversity offset policies have the potential to lead to the net loss of biodiversity if applied inappropriately (e.g. Curran et al. 2013).

In accounting terms, biodiversity offsetting represents a trade-off between assets in time and space. For example, a particular ecosystem may be lost in one place due to a development but is replaced by the protection and management of another ecosystem asset in another place, with no net loss of biodiversity over a defined time. Biodiversity offsetting in effect provides an exchange value for biodiversity, thus addressing one of the key challenges in ecosystem accounting.

Ecosystem accounting can help with the analysis of specifically proposed biodiversity offsets as well as providing an on-going framework for monitoring to check that there is no net loss of biodiversity

[5] About IPBES http://www.ipbes.net/about-ipbes.html

[6] **Fungibility** is the property of a good or a commodity whose individual units are capable of mutual substitution. That is, it is the property of essences or goods which are capable of being substituted in place of one another. https://en.wikipedia.org/wiki/Fungibility

over time. The monitoring would be to ensure that the overall extent and condition of ecosystems remains the same and extinction risks are not increased.

Biodiversity offsets are determined on the basis of equivalence of assets—there is no consideration of the service flows associated with them. The service flows from ecosystem assets with comparable composition, structure and function could be very different due to the ability of people to access these services. For example, Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) is a threatened species[7] in the city of Perth, Australia that is under threat from urban development. Biodiversity offsets for this species focus on habitat restoration beyond the urban area, reducing the availability of amenity and tourism values of this species to residents and visitors to Perth. In another hypothetical example, a particular woodland on the edge of a city may be comparable in terms of its composition, structure and function to another woodland in a remote place, but the service flows would be different. For example, regulating services like water and air filtration may not exist in remote areas as there are no beneficiaries.

5. Where to start?

Aichi Target 2: The Aichi Targets provide a useful entry point for applying accounting to biodiversity conservation. Target 2 is the most broadly stated target and may be a means by which other targets are made possible. Target 2 certainly provides an impetus for cross-agency and multi-disciplinary collaboration. If achieved, it could have a profound impact on macro-economic decision-making as never before has biodiversity been visible in the national accounts, one of the chief information sources of economic managers. As an initial step toward Target 2, countries could convene the relevant agencies to design a suite of accounts to meet this target and chart a path towards their creation. As part of this there would be an examination of the existing economic and environmental information. This would help to determine what accounts might be feasible in the short-term and to which targets these could be applied.

Land accounts: For example, Targets 5 and 11 can be addressed via the land cover account combined with a land use account, with use for conservation shown according the IUCN Protected Area Classification[8]. For Targets 5 and 11 not only can progress towards this target be measured by the land account, they can also identify additional areas in countries that could be added to the protected area network, how much this might cost to governments and which industries and communities would be affected (positively and negatively) by the establishment of additional protected areas. Accounts for the Central Highlands of Victoria, Australia (Keith et al 2016) have been used in this way.

Ecosystem accounts: At least some of the value of biodiversity is captured as part of the production of ecosystem services from particular ecosystems. As such the ecosystem service accounts in combination with other accounts from the SEEA Central Framework and the SNA provide a basis for integrating biodiversity into national accounting (Aichi Target 2). It is certainly possible to examine the value of past uses and hence what might be given up if land management was changed (e.g. the accounts could be used for scenario modelling).

[7] http://www.environment.gov.au/biodiversity/threatened/publications/factsheet-carnabys-black-cockatoo-calyptorhynchus-latirostris

[8] IUCN Protected Area Categories
http://www.iucn.org/about/work/programmes/gpap_home/gpap_quality/gpap_pacategories/

Species accounts: These also provide a mechanism for explicitly considering and managing the contribution of aspects of biodiversity to service delivery. This is particularly relevant for specific collections of species that underpin delivery of different ecosystem services (Luck et al., 2009). In this context species accounts – in combination with land and ecosystem accounts – can help to evaluate different public and private land–use options by identifying:

- Species hotspots and in particular their location in relation to infrastructure, urban development and important ecosystem services
- Where trends in species distribution and abundance infer a risk to current or future ecosystem service provision
- What regulations or investment are needed to maintain or increase biodiversity and species for natural solutions (e.g. reduced pesticides)
- Where agricultural and other industry practices might have the greatest impact (and hence where the biggest gains for minimum cost could be achieved)

A key aspect of accounting is it produces regular data that could be used to help implement the NBSAPs and refine the strategies and management actions based on the data in the accounts. They can also be used to show the importance of biodiversity to the economy and could be used to highlight risks to the economy and human well-being more generally. Thus the accounts could form a central part of the machinery of government that would draw together the NBSAP, the national development plan, land use plan, and economic growth plans. If this can be done, biodiversity will have truly entered the mainstream of government and corporate decision-making.

6. References

ABS 2013 Land Accounts Victoria, Experimental Estimates. ABS Cat. no. 4609.0.55.002 http://www.abs.gov.au/ausstats/abs@.nsf/mf/4609.0.55.002

ABS (Australian Bureau of Statistics). 2015. Information Paper: An Experimental Ecosystem Account for the Great Barrier Reef Region, 2015 ABS Cat. No. 4680.0.55.001 http://www.abs.gov.au/ausstats/abs@.nsf/mf/4680.0.55.001

BBOP (Business and Biodiversity Offsets Program). 2012 Standard on Biodiversity Offsets. Business and Biodiversity Offsets Program, Washington, D.C.

Blackman, A,. and Woodward, R.2010). User Financing in a National Payments for Environmental Services Program: Costa Rican Hydropower, Resources for the Future, Washington DC.

Boitani, L., Mace, G.M., and Rondinini, C. Challenging the Scientific Foundations for an IUCN Red List of Ecosystems. *Conservation Letters*, March/April 2015, 8(2), 125–131

Bond, S., McDonald, J. and Vardon, M. 2013. Experimental biodiversity accounting in Australia. Paper for 19th London Group Meeting, London, UK, 12-14 November 2013. http://unstats.un.org/unsd/envaccounting/londongroup/meeting19/LG19_16_1.pdf

Bull, J.W., Suttle, K.B., Gordon, A., Singh, N.J., Milner-Gulland E. 2013. Biodiversity offsets in theory and practice. *Oryx* 47, 369-380.

Butchart SHM, Resit Akçakaya H, Chanson J, et al. Improvements to the Red List Index. Lusseau D, ed. *PLoS ONE*. 2007;2(1):e140. doi:10.1371/journal.pone.0000140.

Eigenraam, M., et al. 2013 Victoria Experimental Ecosystem Accounts. http://www.dse.vic.gov.au/conservation-and-environment/ecomarkets/ecomarkets-science

Gibbons, P., Evans, M.C., Martine Maron, M., Gordon, A., Le Roux, D., von Hase, A., Lindenmayer, D., and Possingham, H.P. 2015. A loss-gain metric for biodiversity offsets and the circumstances in which no net loss is feasible. *Conservation Letters*. DOI: 10.1111/conl.12206

Hamilton, K. 2013. Biodiversity and national accounting. World Bank Policy Research Working Paper 6441.
http://papers.ssrn.com/sol3/Delivery.cfm/6441.pdf?abstractid=2264679&mirid=1

Heal, G., 2000. *Nature and the marketplace: Capturing the value of ecosystem services.* Island Press, Washington DC.

ICMM and IUCN. 2012. Independent Report on Biodiversity Offsets. The Biodiversity Consultancy, Cambridge, UK.

Jack B.K., Kousky, C., Sims, K.R.E. 2008. Designing payments for ecosystem services: Lessons from previous experience with incentive-based mechanisms. *Proceedings of the National Academy of Sciences of the United States of America* 105(28):9465-9470. doi:10.1073/pnas.0705503104.

Jean-Louis Weber (2014). Ecosystem Natural Capital Accounts: A Quick Start Package, Montreal, Technical Series No. 77, Secretariat of the Convention on Biological Diversity, 248 pages. https://www.cbd.int/doc/publications/cbd-ts-77-en.pdf

Keith, H., Vardon, M, Stein, John., Stein Janet, and Lindemayer, D. 2016. Experimental Ecosystem Accounts for the Central Highlands. Draft for Discussion. ANU Fenner School of Environment and Society.
http://fennerschool-associated.anu.edu.au/documents/Ecosystem_Accounts_full_report_v1.pdf

Luck, G.W., Harrington, R., Harrison, P.A., Kremen, C., Berry, P.M., Bugter, R., Dawson, T.P., De Bello, F., Díaz, S., Feld, C.K. and Haslett, J.R., 2009. Quantifying the contribution of organisms to the provision of ecosystem services. Bioscience, 59(3), pp.223-235.

Mace, G., K. Norris and A.H. Fitter, 2012. Biodiversity and ecosystem services: a multilayered relationship. *Trends in Ecology and Evolution* 27:1, 19-26.

OECD (Oganisation for Economic Cooperation and Development). 2010. Paying for Biodiversity. Enhancing the cost effectiveness of payments for ecosystem services.
http://www.oecd.org/env/resources/46131323.pdf

Polasky, S., C. Costello, A. Solow, 2005. *The Economics of Biodiversity*. Ch 29, Vol. 3, 1517-1560 in *Handbook of Environmental Economics,* eds. Mäler, K-G and J.R. Vincent, North Holland.

Polasky, S., E. Nelson, J. Camm, B. Csuti, P. Fackler, E. Lonsdorf, C. Montgomery, D. White, J. Arthur, B. Garber-Yonts, R. Haight, J. Kagan, A. Starfield, and C. Tobalske. 2008. Where to put things? Spatial land management to sustain biodiversity and economic returns. *Biological Conservation* 141:1505-1524.

Remme, Roy P., Lars Hein, and Chris AM van Swaay. "Exploring spatial indicators for biodiversity accounting." Ecological Indicators 70 (2016): 232-248.

Remme, R.P., Schröter M., Hein, L. 2014. Developing spatial biophysical accounting for multiple ecosystem services, *Ecosystem Services* 10: 6-18

Rode, J., Wittmer, H., Watfe, G., 2012, Implementation Guide for Aichi Target 2 – A TEEB perspective. German Federal Agency for Nature Conservation (BfN).

Secretariat of the Convention on Biological Diversity. 2014. Global Biodiversity Outlook 4. CBD, Montréal. https://www.cbd.int/gbo4/

Schröter, M, Remme, R.P., Sumarga, E., Barton, D.N., Hein, L. 2015. Lessons learned for spatial modelling of ecosystem services in support of ecosystem accounting. *Ecosystem Services* 13: 64-69.

Secades, C., O'Connor, B., Brown, C. and Walpole, M. (2014). Earth Observation for Biodiversity Monitoring: A review of current approaches and future opportunities for tracking progress towards the Aichi Biodiversity Targets. Secretariat of the Convention on Biological Diversity, Montréal, Canada. Technical Series No. 72, 183 pages. https://www.cbd.int/doc/publications/cbd-ts-72-en.pdf

UNEP-WCMC (2016) *Exploring approaches for constructing Species Accounts in the context of the SEEA-EEA*. UNEP-WCMC, Cambridge, UK. www.wcmc.io/Species_Accounting

UNEP-WCMC & IEEP (2013) Incorporating biodiversity and ecosystem service values into NBSAPs: Guidance to support NBSAP practitioners https://www.unep-wcmc.org/system/dataset_file_fields/files/000/000/004/original/Guidance_doc_NBSAP_A4_FINAL.pdf?1395066492

Varcoe, T., Betts O'Shea, H.J, Contreras, Z. 2015. Valuing Victoria's Parks. Accounting for ecosystems and valuing their benefits: Report of first phase findings. Parks Victoria.

Vardon, M. 2012. Lessons from environmental accounting for improving biodiversity monitoring. In: Biodiversity Monitoring in Australia (eds D. B. Lindenmayer & P. Gibbons) pp. 79–88. CSIRO Publishing, Melbourne.

Vardon et al. 2015. Progress, Challenges and Opportunities for Biodiversity Accounting. Paper for the 21st Meeting of the London Group of Environmental Accounting, 2-4 November 2015, The Hague, The Netherlands. http://unstats.un.org/unsd/envaccounting/londongroup/meeting21/Vardon%20et%20al_Biodiveristy%20Accounting%20for%20LG%20(reduced).pdf