PBL Netherlands Environmental Assessment Agency

NATURAL CAPITAL ACCOUNTING FOR MAINSTREAMING BIODIVERSITY IN PUBLIC POLICY

Natural Capital Policy Forum – 26–27 November 2018

Background Report

Arjan Ruijs, Michael Vardon

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Contents

Abstract

This report provides an overview of current and potential uses of natural capital accounting for biodiversity-related policy. The list of potential uses of the accounts is long, with many types of accounts from the System of Environmental-Economic Accounting (SEEA), both the Experimental Ecosystem Accounting and Central Framework, and the System of National Accounts relevant for assessing the importance of biodiversity for economic production, wealth and human well-being, as well as the effects of various government policies on biodiversity. Which accounts are most relevant depends on the policy and the policy questions raised. Accounting can be applied to obvious areas of biodiversity policy, such as the establishment and management of conservation areas. In addition, they are also useful for policies on sustaining the supply of ecosystem services, building resilient ecosystems and safeguarding food supply from agricultural biodiversity, or for policies promoting the sustainable use of ecosystem services by economic actors.

The ecosystem extent accounts have many policy uses, as do the ecosystem services and ecosystem condition accounts, and, together, these can be used to assess the effectiveness of existing biodiversity-related policies. The species accounts are especially useful for determining the effectiveness of policies aimed to protect rare and endangered species. The water, mineral and forestry accounts from the SEEA Central Framework or the supply and use tables from the System of National Accounts can be relevant for policy questions related to the impacts of resource exploitation or economic activity on biodiversity. These accounts allow comparison between the benefits of economic activity and the costs of biodiversity protection, and provide data for modelling the impacts of various policies. Furthermore, the environmental protection expenditure accounts are useful for keeping track of the effectiveness of public and private environmental protection expenditures.

The more advanced analytical approaches are not yet widely used, nor are analyses that combine multiple accounts to show synergies or trade-offs between biodiversity and economic changes, or changes in ecosystem resilience.

To more fully exploit the potential of ecosystem accounting, a number of issues should be addressed. These include:

- Integrating the accounts into national information systems and ensuring that the base data are regularly updated, just like the many other updates, such as on the economy and society, by statistical organisations.
- Ensuring demand-side guidance is provided to help policymakers and analysts understand how these accounts could be used. The list of possible accounts is long, and that of their possible applications for indicator development, analysis or policy use is even longer.
- Encouraging more practical experience in how the accounts could be used for trend analysis, econometric analysis, input-output analysis and bioeconomic modelling. Building the accounts is important, but actually using them is equally important, to provide insight into possible applications for policymakers. This requires external support for developing countries and closer cooperation between policymakers, account compilers and researchers in all countries.

A key aspect of ecosystem accounting is that it combines economic and biodiversity data. In this way, accounting can be used for implementing the National Biodiversity Strategy and Action Plans (NBSAPs) and refining existing or developing new strategies to conserve biodiversity. Maybe even more importantly, ecosystem accounting also shows the importance of biodiversity for the economy and can highlight the risks of biodiversity decline to the economy and human well-being, more generally. Finally, while there are challenges in producing biodiversity-related accounts, the work to date shows that producing them is possible and that the key task now is to embed biodiversity accounting into the machinery of government.

1 Introduction

This report provides a brief overview of how natural capital accounts—set up according to the System of Environmental-Economic Accounting (SEEA; UN et al., 2014a,b)—can be or are currently already used to inform biodiversity-related polices. It discusses, from a policy perspective, how Natural Capital Accounting (NCA) can be used both to inform policymakers and to identify common biodiversity-related questions they may have, and how NCA can be used in answering these questions. These questions may refer to biodiversity conservation or may be about the coherency between biodiversity policies and other policy fields and the economic importance of the sustainable use of biodiversity. The report is based on a literature review and a short questionnaire sent out to statistical institutes of various countries.[1]

The objective of this report is to provide a starting point for discussions about what government authorities, businesses and others can do to further integrate natural capital accounts and natural capital assessments into their biodiversity-related policies and related decision-making processes.

The United Nations (UN) and Convention on Biological Diversity (CBD) define biodiversity as:

> 'the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems' (UN et al., 2014b, www.cbd.int).

Biodiversity is a key determinant of ecosystem health, functioning and resilience (Santamaria and Mendez, 2012) and therefore essential for sustaining ecosystem services and human well-being. Yet, biodiversity levels are still declining, among other things due to deforestation, land-use changes, unsustainable land and water use, climate change and pollutant emissions to the air, water and land (GBO, 2014). For that reason, accounting for biodiversity, and explicitly showing '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' (Vardon et al., 2018) is important for delivering sustainable development.

Protecting biodiversity and the sustainable use of biodiversity are at the core of the Aichi targets of the CBD. These objectives are also covered in the Sustainable Development Goals, and, since the Millennium Ecosystem Assessment (2005), are high on the agenda of many governments and businesses around the world. More and more, it is recognised that the protection of biodiversity is increasingly recognised to have many benefits and as a necessary condition for lifting people out of poverty and improving wealth (World Bank, 2018). However, there is still a long way to go to mainstream biodiversity into day-to-day policies and governance decisions of governments and business.

Government authorities and businesses need information if they are to mainstream biodiversity into policy-making. This, for example, includes information about the trends in ecosystems and species occurrence, abundance and distribution. And, maybe even more importantly, it also includes information about the impacts or externalities of land and resource use related to biodiversity and about the importance of biodiversity for maintaining resilient ecosystems and the delivery of ecosystem services (incl. agricultural production, renewable resources, fisheries and water availability). Moreover, it also includes information on the broad range of benefits of conservation decisions and the effectiveness of current expenditures on biodiversity.

The SEEA provides an integrated framework for organising biodiversity-related statistics into a series of accounts. Biodiversity-related natural capital accounts provide a framework for collecting, systematically storing and regularly presenting this type of information (Hamilton, 2013).

[1] This report was presented during the 2018 Natural Capital Policy Forum. The policy forum was held on 26 and 27 November 2018 in Paris and was organised by the WAVES Partnership, the UN Statistics Department, the Combining Forces Initiative of the Natural Capital Coalition and the Government Dialogue on Natural Capital.

Standardised biodiversity-related accounts are being developed as part of SEEA Experimental Ecosystem Accounting (SEEA-EEA) (UN et al., 2014b; and see Text box 1). As SEEA-EEA is linked to the System of National Accounts (SNA), it integrates biodiversity information into national-level accounting frameworks and reporting systems. It, thus, allows for analysing trends in biodiversity, biodiversity use and the importance of its protection and use in the economy and society, more generally.

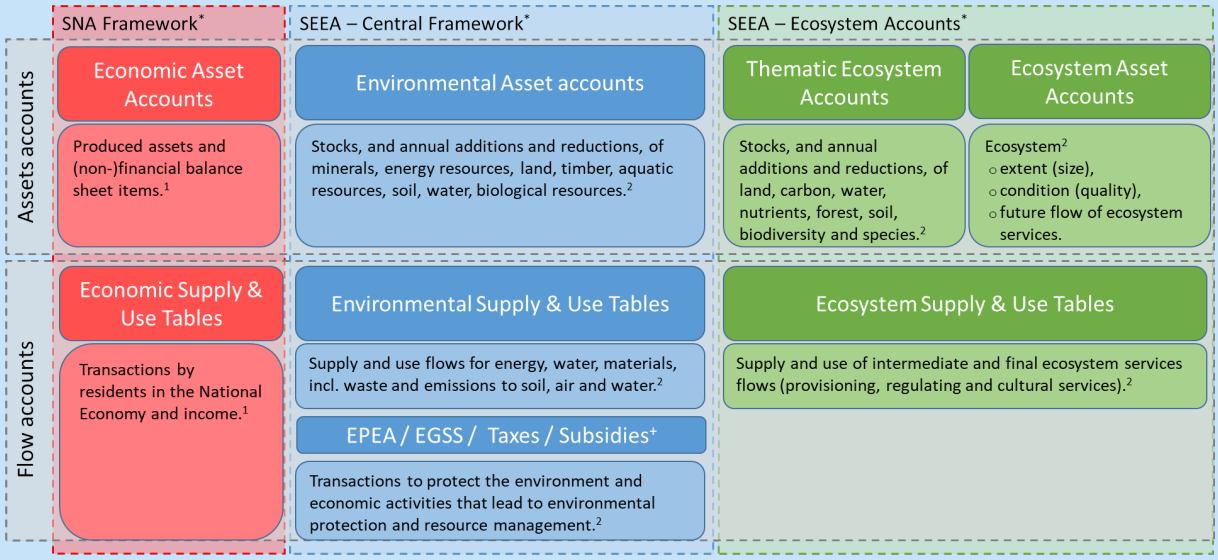
Box 1: Natural capital accounting and the System of Environmental-Economic Accounting

The System of Environmental-Economic Accounting (SEEA) is the internationally agreed methodology for natural capital accounting. The SEEA Central Framework (SEEA-CF) (UN et al., 2014a) and SEEA Experimental Ecosystem Accounts (SEEA-EEA) (UN et al., 2014b) contain the standard concepts, definitions, classifications, accounting rules and tables for producing internationally comparable statistics on the environment and ecosystems and their relationship with the economy. They guide the compilation of consistent and comparable statistics and indicators for policy-making, analysis and research.

The SEEA-CF enables compiling physical and monetary accounts for a range of natural resources, such as minerals, timber and fisheries, and linking these to the System of National Accounts. It distinguishes between supply and use tables representing flows of natural capital from suppliers to users, asset accounts representing stocks of natural capital and the annual additions or withdrawals and functional accounts representing, for instance, environmental protection expenditures (see Figure B1). SEEA-EEA add accounts that summarise information about the extent and condition of ecosystems, the status of biodiversity, and their changing capacity to operate as a functional unit and deliver a flow of ecosystem services. Some resources are included in both SEEA-CF and SEEA-EEA, such as land, water and agricultural production.

The SEEA supply and use tables, in physical and monetary terms, record the flows of natural inputs, products, ecosystem services and residuals within the economy as well as those between the environment and the economy. These include, for instance, water and energy used in production processes, pollination and soil formation necessary for primary production, and waste flows to the environment. Asset accounts, in physical and monetary terms, measure the natural resources available and changes in the available amount of these resources due to extraction, natural growth and regrowth, and other reasons. These include mineral, timber, aquatic, soil, water and land resources. SEEA-EEA (UN et al., 2014b) and related technical guidance (UN, 2017) add to these asset accounts for biodiversity, ecosystems and future and current flows of ecosystem services (see also Box 2 in Section 3.1). These help to track the impacts of land-use changes on some of the key inputs of primary production. Environmental protection expenditure accounts record the many environment-related transactions between industries, households and governments. Examples include green investments, jobs related to conservation or climate action, soil restoration and recycling.

Figure B1: Schematic representation of SNA, SEEA-CF and SEEA-EEA.



* The three frameworks partially overlap, especially for the environmental and ecosystem goods and services directly used in economic processes such as water, land, materials, energy, timber and agricultural crops. 1) In monetary terms ; 2) In physical or in monetary terms (ecosystem extent and condition accounts only in physical terms); + EPEA = Environmental Protection & Expenditure Accounts ; EGSS = Environmental Goods and Services Sector

This report discusses, from a policy perspective, how accounts can help policymakers to address biodiversity-related policy questions. Section 2 first provides an overview of relevant international biodiversity policy frameworks that guide most of the national biodiversity-related policies. Section

3 provides an overview of the accounts and discusses their various applications. A growing number of countries is experimenting with natural capital accounts to inform their biodiversity-related policies, and Section 4 discusses a number of recent examples. These experiences may inform other countries about the opportunities these accounts provide for compiling policy-relevant indicators to monitor biodiversity changes, or for using them as input into policy analysis. Chapter 5 draws conclusions and describes lessons learned.

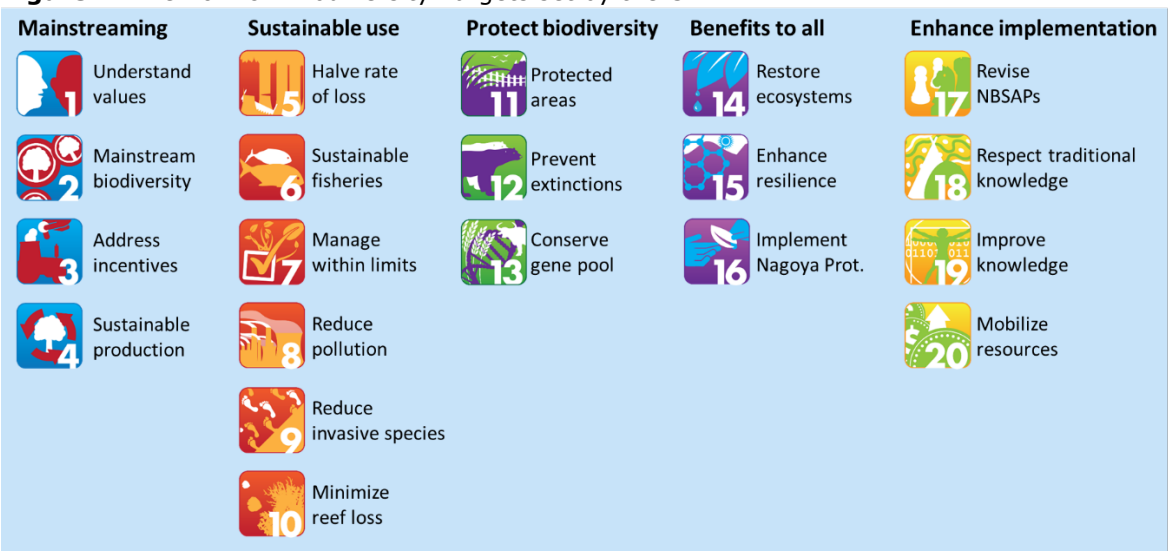
2 International biodiversity policy frameworks

Biodiversity is relevant to a range of policy areas. Conservation and the sustainable use of natural resources, such as forests and fish, are key policy areas. Increasingly there is recognition of the importance of biodiversity to other parts of the economy and human well-being. For example, the importance of: insect pollination to agriculture (e.g. Allsopp et al., 2008); natural areas and green spaces for human health (e.g. Aerts et al., 2018); and the importance of well-functioning ecosystems for the sustained availability of clean water (e.g. Bennett et al., 2009).

While biodiversity is applicable to a range of policy areas, the Strategic Plan for Biodiversity 2011–2020, agreed at the 10th meeting of the Convention on Biological Diversity (CBD) in Nagoya, forms the backbone of biodiversity policies, worldwide. This plan includes an ambitious set of 20 targets, the Aichi Biodiversity Targets—see Figure 1 and Appendix 1. These targets contribute to five strategic goals:

A. Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society (targets 1–4),
B. Reduce the direct pressures on biodiversity and promote sustainable use (targets 5–10),
C. Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity (targets 11–13),
D. Enhance the benefits to all from biodiversity and ecosystem services (targets 14–16), and
E. Enhance implementation through participatory planning, knowledge management and capacity building (targets 17–20).

Figure 1: The 20 Aichi Biodiversity Targets set by the CBD



Source: www.cbd.int, Icons: © BIP/SCBD

The two targets that especially focus on mainstreaming biodiversity into national policy-making processes are targets 2 and 17. Target 2 aims on the one hand at integrating biodiversity values into national and local development and poverty reduction strategies and planning processes. On the other hand, it aims at incorporating biodiversity values into national accounting and reporting systems. Target 17 specifies the formulation and implementation of National Biodiversity Strategy and Action Plans (NBSAPs). This is one of the key instruments to motivate countries to formulate biodiversity policies. To date, 190 out of 196 parties to the CBD have developed NBSAPs and have made a start to mainstream them into the activities of those sectors whose activities can impact biodiversity.

A second important policy driver are the Sustainable Development Goals (SDGs). The SDGs, adopted by the UN in 2015, are an ambitious set of seventeen development goals for all countries, covering all dimensions of sustainability. The SDGs recognise that sustainable development

requires integration of all pillars of sustainability into policy frameworks and programmes, including biodiversity protection. SDG 15, 'life on land', especially calls to halt biodiversity loss, to integrate biodiversity into development and poverty reduction strategies and to integrate it into accounting systems. Directly or indirectly all SDGs relate to biodiversity. This may be obvious for SDG 6 on 'clean water and sanitation', 12 on 'responsible consumption and production', 13 on 'climate action' and 14 on 'life below water'. Also related to biodiversity, either because they depend on its sustainable use or because they impact upon it are: SDG 2 on 'zero hunger'; SDG 3 on 'good health and well-being'; SDG 7 on 'clean energy'; SDG 8 on 'decent work and economic growth'; SDG 9 on 'industry, innovation and infrastructure'; and SDG 11 on 'sustainable cities and communities'.

These key policy drivers influence biodiversity protection policies and policies to improve sustainable use of biodiversity globally. A general element in the Aïchi targets and the SDGs is to mainstream biodiversity into policy through action plans and to integrate biodiversity into accounting and reporting systems. This is necessary for increasing awareness, monitoring progress, learning about causes of biodiversity loss or unsustainable use, and assessing the impacts of proposed policies. The next section shows how countries are making progress on this.

3 Potential contributions of NCA to biodiversity-related policies

The potential benefits of biodiversity-related accounts are manifold (UN et al., 2014b; UNEP-WCMC 2015). They are important for monitoring the status of biodiversity and for international reporting obligations related to the Sustainable Development Goals, the Aichi targets and climate change. But the possible use of biodiversity-related accounts go beyond reporting. As policies are increasingly considered in a more integrated and multidisciplinary fashion, ecological and biodiversity information will be used to identify issues, assess policy options and analyse the success or otherwise of existing policy or management.

In this, the biodiversity-related accounts can provide information that is needed for the assessment of sustainable economic growth, the contribution of ecosystems and their services to such growth as well as overall human well-being. This is achieved by linking the biodiversity and ecosystem accounts to standard economic accounts, allowing the tracking of interdependencies between the economy and the environment. Potentially, the accounts can be used for a broad range of biodiversity-related policy questions including, for example, adequacy of budget allocations to restore or protect biodiversity or economic incentives related to the stimulation of land management changes leading to the enhancement of different baskets of ecosystem services. Accounting for biodiversity may also be used in more general policies, including those related to sustainable production and consumption or to the use of alternative sources of energy and other resources. Finally, as the biodiversity accounts are spatially explicit, they allow for the assessment of policy responses at fine geo-spatial scales, and can be used, for example, for identifying and protecting hotspot areas, managing river basins or enhancing sustainability of agricultural land use (UN et al., 2014b).

To systematically consider how the ecosystem accounts can benefit biodiversity-related policies we will now discuss which biodiversity-related policy questions are pertinent, how the accounts can be of help, and what analytical methods are needed.

3.1 Biodiversity policies, policy questions and accounts

In this section, we distinguish between *policy categories* being implemented in relation to biodiversity, as well as the key *policy questions* that arise through the policy cycle. First, we distinguish the following three categories of biodiversity-related policies.

A. Protecting biodiversity, focusing on protection programmes for species and ecosystems and the selection of suitable areas to designate as protected area.
B. Sustaining the supply of ecosystem services and building resilient ecosystems by safeguarding agricultural biodiversity. These policies relate to the instrumental role of biodiversity and especially aim for maintaining the ecosystem conditions and for protecting the genes, species and ecosystems that are necessary for a sustained supply of ecosystem services. It includes for example the protection of bee populations for pollination, the protection of soil biodiversity to maintain soil productivity, the protection of hedges and vegetation that provide habitat to insects controlling pests and fungus, and the enhancement and organisation of protected areas to sustain eco-tourism. These services provide the necessary conditions for food production and eco-tourism.
C. Stimulating a sustainable use of ecosystem services and preventing further declines of biodiversity. These policies aim for preventing pollution crossing key thresholds or planetary boundaries and for preventing unsustainable land use, resource exploitation or harvest levels that exceed natural regeneration rates. This refers especially to policies regulating water use, industrial emissions, mining, agricultural land use, fisheries and forestry. It may include policies limiting emissions to soil, air and water, limiting water use in periods of water scarcity,

regulating the use of hazardous inputs and equipment and sustainably managing harvest concessions.

In short, policy category A concentrates on species and ecosystem protection for sake of their intrinsic value. Policy category B considers protection of functional biodiversity, whereas policy category C considers the regulation of economic activities that directly or indirectly result in biodiversity decline. Table 1 gives the links between these policy categories and the Aichi targets.

Table 1: Relation between the policy categories and the Aichi targets

Policy category	Aichi strategic goal
Policy A. Protect biodiversity	Aichi target C. Safeguard ecosystems, species and genetic diversity
Policy B. Sustain supply of ecosystem services and build resilient ecosystems	Aichi Target D. Enhance the benefits from biodiversity and ecosystem services
Policy C. Stimulate sustainable use of ecosystem services and prevent biodiversity declines.	Aichi Target B. Reduce the direct pressures on biodiversity and promote sustainable use

Note: See Section 2 for a description of the Aichi targets.

Policy analysts and policymakers need information for identifying which issues of the above policy categories are relevant in their situation and for preparing, implementing and monitoring policy instruments. We distinguish between three types of policy questions that arise throughout the policy cycle:

1. What is the status and are the trends in biodiversity and sustainable biodiversity use?
2. What are possible trade-offs and synergies of biodiversity policies?
3. What are the envisaged effects of biodiversity-related policies and policy instruments?

Table 2 gives examples of policy questions that may be raised for the three categories of biodiversity policies presented in Table 1. The questions listed in this table are not exhaustive but they give an idea about the possible questions that can be raised for each policy category. For monitoring the evolution of biodiversity and biodiversity use, policy analysts and policymakers firstly need insights into status and trends of biodiversity, species diversity, species abundance, species relevant for the delivery of ecosystem services, environmental pressures, resource use, emission levels, etc. This is necessary for identifying where problems are most pressing, what to protect, and which pressures are causing biodiversity decline. It is also necessary for raising awareness at the beginning of the policy cycle and for assessing policy success or failure at the end of the policy cycle.

Secondly, for preparing effective policies, policy analysts and policymakers need understanding of the trade-offs and synergies between the multiple effects of their policies. How is biodiversity impacted by changes in land use, resource exploitation or emissions and how do ecosystem services depend on biodiversity? Knowing this, they can assess whether the net benefits of conserving land for biodiversity outweigh those of converting land to other uses (e.g. agriculture), especially if externalities across space and time and social aspects are properly included.

Finally, for ex ante analysis of policy plans, questions relate to where to locate protected areas or how effective or efficient are expenses incurred to demarcate/designate protected areas. For this, policy analysists would also like to learn how the behaviour of people changes with policies aimed at promoting sustainable biodiversity use or punishing or prohibiting behaviour that damages biodiversity. This covers a broad range of possible industrial policies, especially on forestry, agricultural and fisheries, as well as those that promote ecosystem services, mitigating climate change and managing water. All these can be done through a range of standard policy instruments including subsidies, taxes, and regulations.

Table 2: Policy categories related to biodiversity-related policy questions

	1. STATUS AND TRENDS	2. TRADE-OFFS AND SYNERGIES	3. EFFECTS OF POLICIES AND INSTRUMENTS
A. PROTECT BIODIVERSITY	What are trends of species, habitats and ecosystems?	What are trade-offs and synergies between biodiversity and protection measures; which species/ecosystems benefit or lose from conservation measures?	How do hotspot areas affect biodiversity, are of protection expenses effective, and what effects does biodiversity offsetting have?
B. SUSTAIN SUPPLY OF ECOSYSTEM SERVICES AND BUILD ECOSYSTEM RESILIENCE	What are trends in species affecting ecosystem services, such as bee populations, insects for pest control, soil biodiversity, charismatic species and eco-tourism habitats?	What are trade-offs and synergies between biodiversity, land-use intensity and ecosystem services delivery and use? What are externalities of loss of resilience over space and time?	What are effects of land use, forestry, agricultural, and fisheries regulating and stimulating policies? What is the effect of payments for the use or protection of services (PES))?[1]
C. STIMULATE SUSTAINABLE USE OF BIODIVERSITY	What are trends in indicator species that are affected by pollution, overexploitation or land-use change? What are trends in resource use rates and emissions to soil, air and water>	What are trade-offs and synergies between biodiversity and resource use / emissions / environmental quality? What are externalities of sustainable and unsustainable resource use over space and time?	What are the effects of industrial, climate, water, or nitrogen policies? What is the effect of payments for damages caused to ecosystem services (PES)*

[1] PES policies can be part of policy category B and C. Under policy category B, they stimulate biodiversity enhancing behaviour, whereas under category C they punish biodiversity damaging behaviour.

A broad range of accounts can be useful for answering the above questions; accounts from the System of National Accounts, natural capital accounts from the SEEA-CF and ecosystem accounts from the SEEA-EEA (see Box 1). Those unfamiliar with natural capital accounting will almost certainly not understand which accounts are relevant for their situation or where to start applying natural capital accounts to biodiversity-related policies. To address this, Table 3 shows which accounts are useful for which policy questions and which policy categories. This overview is not necessarily complete, but provides an overview of the main biodiversity-related policy questions.

For status and trends, the key accounts are those on *biodiversity, ecosystem extent, land use and land cover*. Box 2 explains in more detail which accounts can be distinguished for tracking changes in biodiversity. Other accounts are also useful for signalling whether rates of resource use exceed regeneration rates. In this, the *supply and use tables* of resources such as energy, water, materials and ecosystem services are important, as are the *waste and emissions accounts* that show the hazardous substances released to air, water and soil and the amounts of waste dumped into the environment. Finally, the monetary *environmental activity accounts* and the information from the *System of National Accounts* are relevant for estimating resource efficiency, i.e. to calculate whether more or fewer resources are used or waste is produced to generate a certain economic return. Chapter 4 discusses which countries are currently experimenting with these accounts.

Box 2: Accounting for changes in biodiversity

Biodiversity has many dimensions and there is no single indicator that captures all of them. The CBD agreed that the state of biodiversity can be measured using trends for four indicators (UN et al., 2014b): a) extent of selected ecosystems, b) abundance and distribution of selected species, c) status of threatened species and d) genetic diversity. Information on the basic steps and choices necessary for producing accounts for these indicators is given in the SEEA-EEA (UN et al., 2014b), guidelines by UNEP-WCMC (2015, 2016) and SEEA-EEA Technical Recommendations (UN, 2017). Indicators for biodiversity accounting have also been explored in general by Garnåsjordet et al. (2012) and by Remme et al. (2016).

The basis of the **ecosystem extent accounts** are the land cover accounts, supplemented with a range of data on various ecosystem characteristics. So far, there is no internationally accepted classification for ecosystem types and the SEEA-EEA Technical Recommendations (UN, 2017) shows a basic set of nine (9) ecosystem types. It is almost certain that for policy or management applications of biodiversity accounts more detailed classifications of ecosystems will be required. For example, Conservation International et al. (2016) had 17, Eigenraam et al. (2013) 23 and Keith et al. (2017) 47.

For preparing **species accounts**, species can be grouped by taxonomy (e.g. mammals, birds, insects), species extinction risk as per the IUCN species status classifications or national counterparts or other characteristics (e.g. distribution area, reproductive strategy). A key finding of Bond and Vardon (2018) was that species accounts needed to show more than just conservation status and that groupings of species by endemic/non-endemic or specialist/generalist were useful.

What dimensions are useful to show within species accounts depends very much on the policy question. This also includes choices regarding spatial unit size and aggregation, measurement approaches (e.g. remote sensing data, measures on the ground, or both) and classifications. For example, if species accounts are used for conservation purposes, UNEP-WCMC (2016) recommends setting up accounts for threatened species, endemic species, migratory species or phylogenetically unique species. For accounts to monitor ecosystem services, it is advised to set up accounts for species that deliver direct use benefits (e.g. for consumption, recreation, or that are culturally or socially important) or for species that provide indirect use benefits (e.g. pollination, water purification, carbon sequestration, hazard protection, pest control, soil formation). Finally, for analysing ecosystem condition, it is advised to use accounts considering keystone species and species groups that are important for ecosystem functioning (e.g. nitrogen fixing plants, herbivores, predators), which help to signal unsustainable use of biodiversity.

Data availability is one of the major barriers to setting up biodiversity accounts, especially for species accounts. Land-use and land-cover accounts can be reasonably well compiled based on remote sensing data. Combined with modelling or detailed sampling data, ecosystem-extent accounts can be made. However, for species accounts, spatially explicit species data are needed at a resolution that is suitable for management, is temporally relevant, and comparable to a defined reference condition (UNEP-WCMC, 2015). Few species have such data available, and it often requires years and many volunteers to collect such data (see e.g. Bond and Vardon, 2018). For accounts on species abundance, primary data availability may be particularly problematic. For that reason, Schipper et al. (2017) experimented with the use of GLOBIO model data of the Mean Species Abundance indicator to set up mean species abundance accounts for Mexico.

Trade-offs and synergies pertain policy questions relating to the dependency of biodiversity on different land uses and the dependency of human activity and wellbeing on biodiversity—i.e. the natural resources (e.g. timber, fish, medicines) and ecosystem services biodiversity provides. For this, data from the *biodiversity accounts* are related to data from several of the SEEA-CF and -EEA accounts, depending on the specific question. For example, biodiversity data may be compared with data from the *land-use/land-cover accounts* to learn how different land uses and land management activities affect biodiversity and from the monetary *environmental activity accounts* to assess the effectiveness of environmental management expenditure. For the reverse case, of economic activity dependant on biodiversity, the *natural resource and ecosystem service accounts* are key, showing how agricultural, timber and fish production as well as water quality and availability depend on biodiversity.

Table 3: Overview of SEEA-CF or -EEA accounts that are useful for biodiversity-related policy questions. *

BIODIVERSITY POLICIES AND NATURAL CAPITAL ACCOUNTING		SNA	SEEA Central Framework							SEEA Ecosystem Accounts			
	Account category	National accounts	Environ. protect. expend. accounts	Supply and Use Tables		Asset Accounts / Thematic Ecosystem Accounts				Ecosystem Asset Accounts			Ecosystem Services Accounts
	Content of account[a]		Transactions to protect the environment	Flows of energy, water, materials	Flows of waste and emissions to soil, air and water	Stocks of minerals, resources, timber, water	Land use and land cover	Stocks of carbon, soils and nutrients	Stocks of biodiversity and species	Extent of ecosystems (size)	Condition of ecosystems (quality)	Future flow of ecosystem services (stock)	Supply and use of ecosystem services
	Unit [(a)]	P / M	M	P / M	P / M	P / M	P	P / M	P	P / M	P	P / M	P / M
Status and trends	**(b)**												
Biodiversity / species change	A / B / C												
Resource efficiency	C												
Synergies and trade-offs													
Relation biodiversity – land use / protection	A												
Relation biodiversity – ecosystem services use	B												
Relation biodiversity – resource use / emissions / environmental quality	C												
Policy response/implementation/review													
Determine and protect hotspot areas	A												
PES / biodiversity offsetting	A / B												
Policies to restrict resource use/emissions													
- Nitrogen policy	B / C												
- Water policy	B / C												
- Forestry policy	B												
- Sustainable agriculture	B												
- Climate policy	B / C												

Notes: * The black cells show which accounts can be applied for answering the respective policy questions. The white cells indicate that the accounts do not provide relevant information for that policy question. The accounts coloured green and blue are covered both in the SEEA-CF and SEEA-EEA. a) P = in physical terms, M = in monetary terms; b) A = Policies to protect biodiversity, B = Policies to sustain supply of ecosystem services and build resilient ecosystems, C = Policies to stimulate sustainable use of ecosystem services.

The effects of biodiversity-related policy instruments also can be investigated via accounts. As will be shown in Section 4, not many countries use the accounts for these purposes. For example, for selecting hotspot areas, spatially explicit *biodiversity accounts*, *ecosystem extent and condition accounts* and *land-use accounts* are useful, showing areas suitable for protection. Furthermore, two widely used economic instruments to protect biodiversity are Payments for Ecosystem Services (PES) and Biodiversity Offsetting and accounts can be used to analyse the impacts of such policy instruments. Here, the *land-use/land-cover* and *biodiversity accounts* are key, along with the *ecosystem services accounts* that relate resource use or emissions to biodiversity impacts. The *environmental activity accounts* track the financial or budgetary consequences of such programmes. Finally, a broad range of policy instruments exists that regulate particular resource uses or polluting activities with the objective of reducing negative impacts to the environment or stimulating positive impacts. For this, *biodiversity accounts* and *land-use/land-cover accounts* are key. These are supplemented with *supply and use tables, asset accounts*, *ecosystem services accounts*, and the *environmental protection expenditure accounts*, depending on the activity or sector on which they focus. For example, for policies on reducing nitrogen deposition, information is needed from the *energy* (fuel mix)*, emissions, agricultural* and *land-use accounts*.

3.2 Relevant analytical methods

To analyse the policy questions (Tables 2 and 3), policy analysists can choose from a broad set of approaches. The three types of policy questions identified—status and trend, synergies and trade-offs, and policy effects—each require different approaches. In general, the analysis of policy effects is analytically much more demanding than the analysis of status and trends. Table 4 shows which types of analysis may be useful for which questions.

For analysing status and trends of biodiversity change and resource efficiency, numerous indicators can be directly taken from the accounts (Annex 1). This may include international reporting obligations about biodiversity, specific species or habitats, or about biodiversity protection expenditure. Similarly, resource efficiency indicators can directly be computed from the economic data in the System of National Accounts and the information on biodiversity in the natural capital accounts. Regression analysis can be used to trace trends in resource efficiency or supply of ecosystem services and relate this to trends in biodiversity change.

More detailed regression or econometric analysis can provide evidence about synergies and trade-offs between biodiversity on the one hand and land use, ecosystem services supply, resource use and ecosystem conditions on the other. For instance, the accounts provide the necessary data to estimate causal relationships between:

- biodiversity status and budgetary expenditures,
- biodiversity status and land-use intensity,
- fruit production and pollination services,
- soil biodiversity and net primary production,
- land cover and carbon sequestration,
- water use efficiency and ecosystem conditions, or
- economic growth, sectoral energy use and carbon emissions.

As will be discussed in the next section, there are only few examples of countries using the accounts for these purposes so far. Yet, they are very suitable for these purposes. The consistency of the accounts—in terms of economic sector, ecosystem categories, or spatial boundaries—enables analysts to take data from multiple accounts. This is not usually possible with data taken from multiple data sources that use different concepts, sources and methods.

The same applies for the third type of policy questions—evaluating policies and policy instruments. The accounts can be used both for ex post and ex ante policy evaluations. For ex post evaluations of biodiversity-related policy instruments, data about the impacts of the instruments for particular ecosystems, regions or sectors are needed that can be taken from the accounts. For example, for comparing effectiveness of three potential policies to conserve biodiversity—Payments for

Ecosystem Services, biodiversity offsetting or expanding protecting areas—costs, biodiversity impacts and economic development impacts can be estimated from the accounts. Similarly, for ex ante policy assessments, bio-economic models can be applied that use information from the accounts as input.

Several modelling approaches use the natural capital accounts, often in the form of a Social Accounting Matrix, to calibrate the model. An example includes the Integrated Environmental-Economic Model (IEEM) (Banerjee et al., 2016). Other approaches, can use information from the natural capital accounts for estimating functions that relate, for example, land use to species abundance or economic development to ecosystem conditions. Many of these approaches can also be used to explore future scenarios of change, cost-benefit analysis of future investments, or assessing impacts of biodiversity-related policies.

Table 4: Overview of analytical approaches

BIODIVERSITY-RELATED POLICIES *		TYPES OF ANALYSIS
STATUS AND TRENDS	*	
Biodiversity /species change	A/B/C	Estimate indicators for biodiversity and species and estimate trends in species, habitats and biodiversity budgets using regression analysis.
Resource efficiency	C	Estimate indicators and trends in the relationship between resource use or ecosystem services use and biodiversity, ecosystem/resource quality or ecosystem services supply using regression analysis.
SYNERGIES AND TRADE-OFFS		
Relation biodiversity – land use / protection	A	Regression/econometric analysis of biodiversity vs land-use relationships
Relation biodiversity – ecosystem services use	B	Regression/econometric analysis of biodiversity vs. ecosystem services use relationships
Relation biodiversity – resource use / emissions / environmental quality	C	Regression/econometric analysis of biodiversity vs. resource use / environmental and ecosystem quality relationships
POLICY RESPONSE/IMPLEMENTATION/REVIEW		
Determine and protect hotspot areas	A	Estimate spatial indicators of presence of species and habitats, indicators of pressures affecting ecosystem extent and quality, indicators of carbon sequestration
PES / biodiversity offsetting	A/B	Econometric analysis to assess potentials and historic effects of PES on ecosystem services use and supply, biodiversity effects and payment involved
Policies to restrict resource use/emissions: nitrogen, water, forestry, sustainable agriculture, climate policy	B/C	Bio-economic modelling to assess behavioural impacts of policies on resource use and emissions in various economic sectors, and resulting impacts on biodiversity, ecosystem conditions and resource conditions, and estimation of economic costs involved. Focus on a particular resource or sector depends on the policy.

Note: * Policy categories: A = related to biodiversity protection; B = related to sustaining supply of ecosystem services and to building resilient ecosystems; C = related to stimulating sustainable use of ecosystem services.

4 Experiences with NCA for biodiversity-related policy-making

This section briefly outlines the current situation of compilation and use of biodiversity-related accounts. A global assessment of environmental economic accounting (UNCEEA, 2018) concluded that the number of countries experimenting with ecosystem accounts remains limited. About 14 countries officially compile SEEA-EEA accounts or modules. However, about 40 countries are experimenting with the SEEA-EEA accounts, often on a subnational level or not by national statistical agencies. A group of countries is also planning to initiate ecosystem services accounts. Many more countries compile accounts from the SEEA-CF but developed and developing countries focus on different areas. Developing countries focus on energy, water, environmental protection expenditures, timber and land accounts, whereas the developed countries focus on energy, material flow, and environmental taxes and subsidy accounts.

Table 5 lists examples of countries experimenting with the SEEA experimental ecosystem accounts.[2] The table shows that experience is growing but that, so far, the accounts have not been used to their full potential. This is understandable given that the ecosystem accounting guidelines are still very recent (see Text boxes 1 and 2).

Among the countries that already use ecosystem accounts for policy are:

- Mexico that uses it for monitoring purposes;
- Peru that applies the accounts for assessing the economy-wide effects of ecosystem degradation and;
- The Philippines that use their ecosystem accounts for assessing the importance of its mangroves for, among other things, coastal protection and fisheries (Table 5).

The Peruvian example is interesting as the species, ecosystem extent, ecosystem condition and ecosystem services supply and use tables for the area of San Martin in Peru show equity issues associated with access to resources, impacts of degradation and trends of threatened species and of sustainable ecosystem use (Conservation International, 2016; Portela et al., 2018; UNEP-WCMC, 2016). Indicators from these tables are deemed critically important for biodiversity conservation and sustainable water use, allowing for more holistic resource management, enabling improved monitoring and policy implementation. Importantly, the accounts were produced to make explicit the importance of natural capital to the economy.

In Australia, ecosystem accounting was used in: the Central Highlands of Victoria to assess the economic and ecological impacts of conserving versus those of exploiting the area (Keith et al., 2017); in the Great Barrier Reef region to assess the relationship between the environmental condition of the area and economic and other benefits (ABS, 2015, 2017); and for informing the public about the status and trends of environmental change in the State of the Environment Report of the Australian Capital Territory (Smith et al., 2017).

In other countries, such as South Africa, produced ecosystem extent accounts are used for spatial planning purposes, for example, for locating new protected areas and for identifying strategic water source areas (Driver et al., 2015). This experience shows that the accounts allow for more holistic and integrated land-use planning, that better consider biodiversity and the impacts of land-use management on biodiversity. The United Kingdom uses the ecosystem accounts to monitor changes in ecosystem services supplied and, so far, they have dedicated studies for protected

[2] These examples result from a literature search by the authors, a survey among a group of countries with whom the UN Statistics Department and the WAVES partnership hold contacts, the UNCEEA global assessment (2018) and examples from the UNSD/UNEP-TEEB programme Advancing Natural Capital Accounting (ANCA). See Appendix 2 for a brief summary of the survey results.

areas as well as for particular ecosystems (farmland, fresh water and woodland) and for urban areas.

As the examples of Australia, Peru, the Philippines, South Africa and the United Kingdom show, several of the policy applications are at the subnational level. Also notable is that in some cases the policy applications are performed outside of the statistical offices and government agencies.

Many of the ecosystem accounts currently produced are experimental, with the objective to gain experience with the SEEA-EEA guidelines and not yet with a clear policy use in mind. This refers to the search for classifications of ecosystem, land cover or species, for indicators and units, the spatial and temporal scales that are relevant for policy-making and data sources that are practical and trustworthy. In this way, experience is gained with setting up accounts for species, ecosystem extent, ecosystem condition and ecosystem services.

For instance, the ecosystem accounts in Uganda show that by overlaying information on land-use decisions from the ecosystem extent accounts and information from the species accounts, entry points can be identified for biodiversity protection and eco-tourism policies in Uganda (UNEP-WCMC and IDEEA, 2017). The Mexican ecosystem extent, ecosystem condition and ecosystem services accounts provide information about soil and vegetation, at different points in time and at different spatial scales—nationwide, state-wide, municipal and special studies for Natural Protected Areas and Ramsar Sites. For ecosystem condition accounts, they focus on the 'priority components' soil, water, carbon and biodiversity. For biodiversity, they use an Ecological Integrity Index that measures the importance of the existence, protection and conservation of biodiversity, as well as the consequences of its decline or disappearance. Next, they present supply-and-use tables of ecosystem services in physical units and hybrid tables and experiment with tables in monetary terms, showing the relationship between ecosystems and the economy. Furthermore, Bond and Vardon (2018) set up butterfly accounts to experiment with alternative species classifications and spatial categories.

In addition, the European Commission pushes the member states to set up natural capital and ecosystem services accounts. Several experiments are being undertaken to set up ecosystem accounts, such as the ecosystem services, carbon and biodiversity accounts by Statistics Netherlands (yet to be published), to set up EU wide species accounts (UNEP-WCMC, 2017) or to set up monetary and physical ecosystem services supply-and-use tables for pollination and outdoor recreation (Vallecillo et al., 2018).

Table 5 shows that many countries use the SEEA Central Framework accounts for biodiversity-related questions. Among the most popular accounts are the land, water, forest and mineral accounts. Among other things, they are used for assessing whether water, land or forest management practices are conducive to sustainable growth and resilience. In Sweden, the land accounts are used to identify which landowners are responsible for biodiversity management on a specific plot, while in Botswana water accounts have been used to assess the water needs of wildlife on which a large tourism industry relies (Vardon et al., 2017b). Indonesia has used natural capital accounting in their medium-term development plan, which is committed to sustainable development and Indonesia's green growth trajectory. In this, the natural capital accounts are linked to a number of socio-economic issues, including forest resource management, water use, food production and security, and environmental degradation.

Several countries also integrate biodiversity more in the environmental protection expenditure accounts (EPEA) and in the environmental goods and services sector (EGSS). This includes France, Germany and Sweden. Sweden is working on environmental protection expenditure accounts and accounts of environmentally motivated subsidies with specific breakdowns for biodiversity and landscape. Sweden has also published land accounts that connect statistics on land use with economic actors and that can be used for analysing investments done in the agricultural sector.[3]

[3] See http://www.scb.se/mi1302-en and http://www.scb.se/en/finding-statistics/statistics-by-subject-area/environment/environmental-accounts-and-sustainable-development/system-of-environmental-and-economic-

These breakdowns also help to learn more about the importance of the environment and ecosystems for the wider economy. France, for example, uses their accounts for a new wealth indicator, that goes beyond GDP (Service d'information du Gouvernement, 2017).

These examples show that monitoring and trend analysis are among the first policy uses of biodiversity-related accounts. This may be monitoring threatened species or changes in ecosystem extent or condition. It may also be related to changes in land use or in water or forest management, both of which relate to economic activities having negative impacts on biodiversity. Table 5 shows that only few countries use the accounts for monitoring how changes in the biodiversity affect the supply of ecosystem services. Moreover, the examples in Table 5 show that only a few countries use the accounts for the more data demanding policy questions, such as showing the economic importance of biodiversity, evaluating the impacts of economic activity on biodiversity, analysing impacts of different policy options using modelling or scenario exercises. For this type of use to gain momentum, more countries need to compile the accounts, for longer timeframes, along with developing the expertise for analysing them.

accounts/pong/tables-and-graphs/environmentally-related-subsidies/total-environmentally-motivated-direct-subsidies/.

Table 5: Examples of biodiversity-related accounts

COUNTRY	ACCOUNT TYPE[A]	FOCUS	INTENDED POLICY USE
AUSTRALIA[1]	EA: biodiversity accounts	Species accounts for 5 regions that drain into the GBR for several animal, plant, fungi and protista groups.	To test setup of species accounts
AUSTRALIA, PORT PHILIP BAY[2]	EA: Marine and coastal ecosystem accounts	Ecosystem extent accounts (per broad habitat level, habitat complex and biotope compiles) and condition accounts (dissolved oxygen) for the entire area and for seagrass production. For ecosystem services provided by sea grass values are estimated (maintenance of nursery populations and provision of habitat) as well as carbon sequestered per hectare.	Pilot study to test accounting, but results help to understand the relationships between the marine and coastal environment and the social and economic wellbeing of Victorians
AUSTRALIA, ACT REGION[3]	CF accounts	Land-use/land-cover accounts, environmental condition accounts (indices for land, water and atmosphere), biodiversity accounts (trends in threatened species), water accounts (PSUT and assets), air emission accounts (greenhouse gasses and PM), solid waste accounts, environmental expenditure accounts.	Accounts to be used to meet the statutory obligations of the Commissioner for Sustainability and the Environment. The study shows what extra information the accounts provide, compare to alternative studies and expert judgement.
AUSTRALIA, GBR REGION[4]	EA: ecosystem accounts for GBR	Biodiversity, land cover, water pollution and a selection of ecosystem services (crops, fishing, aquaculture, timber, carbon, visitors) for the Great Barrier Reef. 2017 accounts also include condition accounts (marine condition scores, climate variables and pollutant loads) and expenditures on EGSS	Relate environmental condition to economic and other benefits provided by the region in order to reach ecologically sustainable use of the region.
AUSTRALIA, VICTORIAN CENTRAL HIGHLANDS[5]	CF + EA accounts	Land, water, carbon, timber accounts and production and use of ecosystem services, and information on biodiversity, tourism and agricultural production	Analyse the synergies and trade-offs between water supply, forestry, tourism and biodiversity conservation
AUSTRALIA, ACT REGION[6]	EA: Species asset account	Butterflies presence and abundance by species class, habitat type and season	State of the Environment Reporting
BOTSWANA[7]	CF: Water, mineral and energy accounts + EA: ecosystem account	Water accounts are finished; work on ecosystem, mineral and energy accounts is underway.	Accounts have helped to show the need for improved water demand management that avoids future water shortages, keeps water affordable and ensure water is available for wildlife.
BRAZIL[+]	CF + EA (pilots)	Water, energy and land accounts have been compiled. Pilots for ecosystem services accounts and for timber accounts.	
BHUTAN[# +]	CF + EA (ANCA project)	Material flow account and energy account. Pilot EA accounts under UNEP ANCA project. Plans for water and SEE AFF (agriculture, fisheries, forestry) accounts.	
CANADA[*]	CF: Land cover and land use	Land cover and land use for selected geographic areas, 1991 to 2011, incl. land cover and land-use data for selected geographic and track changes in the extent of built-up area in Canada's major cities	
CHILE[#]	CF + EA (ANCA project)	AFF accounts (agriculture, forestry, fisheries), air emissions and EPEA. Pilot EA accounts under the UNEP ANCA project.	Results will be reported regularly; environmental objectives will be monitored and they plan to include the results in their sustainable development plans.
COLOMBIA[*]	CF accounts; EA experiments	Land accounts, forestry accounts (in physical and monetary terms forest products, non-timber forest products and products derived from the transformation of wood logs), water use accounts in physical terms, solid waste accounts, air emission accounts. Environmental protection expenditure and resource management expenditure for the government, industries and public services, since 2009 to 2017, including environmental jobs and environmental taxes. Experiments with ecosystems services accounts for Orinoquia.	
COSTA RICA[* +]	EA: Ecosystem accounts; CF: water, energy accounts	Experiment with ecosystem accounting associated to tourism, crop production and carbon sequestration. Ecosystem extent, AFF, EPEA, timber, energy and water accounts finished.	Use accounts for monitoring policy progress.

COUNTRY	ACCOUNT TYPE[A]	FOCUS	INTENDED POLICY USE
EUROPEAN UNION[8]	EA: accounts for pollination and outdoor recreation	Experimental accounts at the EU level, currently focusing on outdoor recreation and crop pollination, looking at service potential, demand and use in a spatially explicit way.	Test how to set up these accounts, and how they differ per type of account
FRANCE[*]	CF: Environmental protection expenditure accounts; Forest accounts	Focus on biodiversity in the environmental protection expenditure accounts; Forest accounts	Used for calculating a new indicator on wealth: the artificialised land ratio
GERMANY[*]	CF: Environmental protection expenditure accounts, environmental goods and services; EA experiments	EPEA shows expenditure concerning 'Protection of biodiversity and landscape' (CEPA 6). Environmental goods and services sector (EGSS) with data on turnover, exports, gross value added and employment of corporations—except corporations of the agricultural sector—concerning protection of biodiversity and landscape (CEPA 6). Experiments with ecosystems and ecosystem services accounts.	
GUATEMALA[9]	CF accounts	Forest, water, fisheries, subsoil resources (hydro carbons, metallic, minerals, non-metallic minerals)	Accounts are used in modelling studies with IEEM, dealing with forestry and the SDGs.
INDIA[+]	CF + EA (pilots)	Land, water, minerals, forest (asset) accounts of the SEEA-CF and pilot projects with ecosystem accounts	
INDONESIA[10] [+]	CF (SISNERLING)	SISNERLING contains timber, energy and mineral resources asset accounts, land-use/land-cover accounts in Sumatra and Kalimantan, water accounts for a watershed in Java, and EPEA/EGSS statistics. Currently work on land and water accounts. Experiment with account for peatlands,	Uses accounts in its medium-term development plan
NETHERLANDS, LIMBURG PROVINCE[11]	EA for broad selection of ecosystem services and ecosystem condition and extent accounts	Physical supply of ecosystem services (crops, fodder, meat, groundwater, PM10 capture, carbon sequestration, recreation, nature tourism), ecosystem condition accounts, and monetary supply and use tables of ecosystem services.	Monitor interdependencies between ecosystems and economic activities
NETHERLANDS[12]	EA for broad selection of ecosystem services and ecosystem condition and extent accounts	Biodiversity and condition accounts, monetary accounts for the EGSS and EPEA containing information on expenditures related to biodiversity and landscape protection	Test setup and usefulness of classifications
MAURITIUS[# +]	CF + EA (pilots under the ANCA project)	Material flow, water, energy and air emission accounts. Within the ANCA project, they pilot ecosystem accounts on ecosystem extent, ecosystem condition, water and biodiversity.	
MEXICO[13]	EA: Biodiversity account and ecosystem extent account	Ecosystem extent per ecosystem type and mean species abundance per ecosystem type	Test applicability of the GLOBIO model for preparing species abundance accounts
MEXICO[*]	EA: extent, condition and ecosystem services accounts.	Land account and ecosystem extent (coverage of soil and vegetation and changes over time for several scales); Condition accounts (for soil, water, carbon and biodiversity, and an ecological integrity index); Supply and use accounts of ecosystem services (in physical units, hybrid tables and experiments with valuation)	Obtain indicators for monitoring changes in biodiversity and ecosystem services
PERU[14]	EA: Ecosystem accounts	Ecosystem extent, condition accounts (fragmentation, biodiversity retained), biodiversity (invertebrates, vascular plants and vertebrates retained and biophysical and monetary ecosystem services supply and use tables for the region of San Martin.	Indicators from the accounts can be used to identify (i) ecosystem sources of water-related benefits; (ii) effects of ecosystems' degradation; and (iii) water use per beneficiary, in this way showing equity issues related to resource access or degradation. Biodiversity indicators show

COUNTRY	ACCOUNT TYPE[A]	FOCUS	INTENDED POLICY USE
			the status and trends of threatened species, as well as the status of ecosystems.
PHILIPPINES[15]	CF + EA: Minerals and ecosystem services accounts	Mineral accounts to learn about the value of subsoil assets; mangrove accounts and ecosystem and water accounts for the Laguna Lake basin to learn about the value of ecosystem services.	Mangrove accounts help the policy dialogue on the benefits of mangroves for coastal zone protection, disaster risk management, fisheries and tourism.
P.R. CHINA[+%]	CF + EA (pilot)	Natural resources balance sheets on land, forestry, water and mineral resources (equivalent to the SEEA-CF asset account). Pilots in eight areas from 2015–2016, and currently expanded to the national level. Currently piloting ecosystem accounts in 2 pilot provinces, Guangxi and Guizhou, for 6 ecosystem types (agricultural land, forest, grassland, inland water ecosystem, urban, marine). To be completed by 2020.	Energy accounts have their highest policy priority. Their main policy drive is on eco-compensation and 'ecological civilisation' for sustainable development.
RWANDA[9]	CF: Water and land accounts	Water and land accounts in Rwanda	Land accounts used for improving resource management.
SOUTH AFRICA[16]	EA: Land and ecosystem extent accounts	Land cover accounts, ecosystem extent accounts and land accounts	Test setup of these accounts and search for useful classifications. Showed that land cover not always corresponds with ecosystem unit.
SOUTH AFRICA[17]	EA: River extent and condition accounts	Extent accounts and condition accounts for South Africa's river ecosystems. Condition accounts showing the degree of modification using an aggregate ecological condition category and an ecological condition index. Extent accounts based on length of the river network, per river and river type.	Test the setup of the accounts (classifications and scale) and their use for monitoring and trend analysis of ecosystem conditions.
SWEDEN[18]	CF: Land accounts	Link land ownership to habitat type	To be used to define actors whose actions impact biodiversity and identify who is responsible for biodiversity management on each piece of land
SWEDEN[19]	CF: Monetary environmental protection accounts	Environmental protection expenditure accounts—specific breakdowns available for biodiversity and landscape expenditures since 2016; Environmentally motivated subsidies for the period 2000–2017.	For monitoring expenditures and subsidies.
SWEDEN[20]	EA: Land accounts including some ecosystem services and biodiversity	Land accounts by industry and experiments with ecosystem accounts (sequestration, blueberry production) and biodiversity accounts (groups of organisms per habitat)	Test the possibilities to setup the accounts
UGANDA[21]	EA: Ecosystem and biodiversity accounts	Land cover, ecosystem extent, 3 NTFPs, Chimpanzees, Elephants	Provide insight in state and trends in ecosystems and biodiversity in Uganda
UNITED KINGDOM[22]	EA: Ecosystem accounts for protected areas	Extent and condition accounts of 6 pilot areas, physical and monetary ecosystem services flow accounts (crops, livestock, wild foods, drinking water, timber, energy, air quality, flood protection, climate regulation, recreation, aesthetic). Condition accounts contain biomass/carbon, biodiversity (butterfly abundance and richness), accessibility (trail length, tranquillity) and conservation status (sites of favourable special scientific interest). Also studies available on land cover, land use and carbon stocks.	Test setup of the accounts (classifications and scale) and their use for monitoring, trend analysis, identifying hotspot areas and decision-support tools.
UNITED KINGDOM[23]	CF: UK Natural Capital Accounts	Ecosystem services accounts for the period 1997–2015 in physical and monetary terms, including energy (renewable and non-renewable), minerals, timber, crops, fish, water, air filtration, sequestration, recreation.	Test the setup of the accounts and monitor changes in ecosystem services
UNITED KINGDOM[24]	EA: Ecosystem accounts for farmland, freshwater and woodland	Ecosystem extent account, condition account, physical and monetary ecosystem services accounts and value of future flow of ecosystem services. Ecosystem services include crops, water, fish, timber, hydro and solar, peat, sequestration, air pollutant removal, recreation, and education.	Test the setup of the accounts and monitor changes in ecosystem services
UNITED KINGDOM[25]	EA: Ecosystem accounts for urban areas	Ecosystem extent (for various classifications), condition (favourable/ unfavourable; accessibility) and physical/monetary ecosystem services accounts (crops, water, fish,	Provides insights in differences between cities and importance of green areas for cities.

COUNTRY	ACCOUNT TYPE[A]	FOCUS	INTENDED POLICY USE
		timber, sequestration, air filtration, noise regulation, urban cooling, recreation, aesthetic interactions, physical health) for urban areas.	
VIETNAM[#]	CF + EA (within ANCA project)	One-time compilation of material flow and timber account. One-time pilot project with ecosystem services supply. Part of ANCA project.	
ZAMBIA[*]	Water accounts	Physical and monetary supply and use tables for water. Preliminary forest accounts are being finalised	Accounts to be used for assessing whether water management practices are conducive to sustainable and resilient growth

Note: A) CF = from SEEA Central Framework, EA = from SEEA-EEA.

Note on sources: The information in this table was compiled by the authors based on the survey sent to countries and literature reviewed. * From own survey; [+] from UNCEEA (2018); % from personal communication with UNSD; [#] from ANCA project – http://www.teebweb.org/areas-of-work/advancing-natural-capital-accounting/; 1) Bond et al., 2013; 2) Eigenraam et al., 2016; 3) Smith et al., 2017; 4) ABS, 2015, 2017; 5) Keith et al. 2017; 6) Bond and Vardon, 2018; 7) Department of Water Affairs, 2017; 8) Vallecillo et al., 2018; 9) from WAVES Partnership website; 10) WAVES Partnership, 2017; 11) De Jong et al., 2016; 12) Statistics Netherlands, to be published; 13) Schipper et al., 2017; 14) Conservation International, 2016; 15) WAVES Partnership, 2016; 16) Driver et al., 2015; 17) Nel and Driver, 2015; 18) Steinbach and Palm, 2014; 19) www.scb.se; 20) Statistics Sweden, 2017; 21) UNEP-WCMD & IDEEA, 2017; 22) White et al., 2015; 23) ONS, 2017a; 24) ONS, 2017b; 25) ONS, 2018.

Two final observations are that, the examples show that most countries are not yet at the stage where SEEA-related issues can be referenced explicitly in legislation or biodiversity strategies; they may currently be used for that, but not very visibly. Furthermore, less attention seems to be paid to species abundance accounts and, to our knowledge, no attempts have been made to generate genetic diversity accounts. For this information to find their way in policy, more experimental accounts are needed. Species abundance accounts may be especially important if overall biodiversity change is to be monitored more carefully.

5 Conclusions

In this paper, we provide an overview of potential and current uses of the SEEA natural capital accounts for biodiversity-related policy uses. This may be protecting biodiversity in conservation areas, sustaining the supply of ecosystem services, building resilient ecosystems, safeguarding food supply from agricultural biodiversity, and promoting sustainable use of ecosystem services by economic actors. The list of potential uses of the accounts is long and accounts from the SEEA Experimental Ecosystem Accounting, the SEEA Central Framework and the System of National Accounts are relevant for assessing the relevance of biodiversity for wealth, production, income and the effects of biodiversity on various government policies.

The review of activity shows that a growing group of countries is producing biodiversity-related accounts from the SEEA Experimental Ecosystem Accounting, for example accounts for ecosystem extent, threatened species and ecosystem condition. Ecosystem extent accounts are the most common type of ecosystem accounts, almost certainly because they can be produced using remote sensing data. While species level accounts were produced in a number of countries, they are less common and have focused on endangered species. To our knowledge, genetic diversity accounts are yet to be produced anywhere in the world. While experience is relatively limited, a range of biodiversity accounts have been produced, demonstrating that while there are some data issues, these can be overcome.

Unfortunately, so far, only few countries use the biodiversity-related accounts in policy development, implementation, review or management. This is perfectly understandable, given that the SEEA-EEA guidelines are still relatively new and that developing the accounts requires considerable time and capacity investments using data that is not readily available in many countries. That said, the experience to date indicates that there are some key policy areas that biodiversity accounting might be able to address. The clearest application relates to land-use management and prioritising conservation areas. But maybe more importantly, in several countries the accounts have influenced policy-making by demonstrating the importance of biodiversity to economic activity and hence elevating its importance in the policy agenda.

Several potential uses deserve more attention. One of them is their use for keeping track of ecosystem resilience. However, the link between biodiversity and ecosystem service delivery is complex (UNEP-WCMC, 2015). In addition, while the use of ecosystem services by people is important, information on the role of biodiversity to intermediate services (or intra- and inter-ecosystem flows as they are known in the SEEA) and ecosystem functioning and resilience, which are a broader part of ecosystem accounting, is challenging. This is due to non-linear and threshold effects and also there will often be time lags between changes in biodiversity stocks and resulting changes to the level of ecosystem service provision. Time lags will also exist between social and economic development pressures and their effect on stocks of biodiversity.

Another potential application that deserves special attention is including the monetary ecosystem accounts in policy analysis. This would enable more detailed and integrated policy analysis and ease comparisons of economic and ecological effects. Yet, capturing the entire value of the contribution of biodiversity to ecosystem services is extremely difficult, if not impossible. However, ecosystem production functions and hedonic pricing methods can be used to isolate the monetary value of biodiversity to ecosystem service flows into the economy. Even though this is likely to be possible for only a subset of economically important ecosystem services, it would enrich policy analyses of ecosystem changes.

Finally, the review shows that most applications of the ecosystem accounts do not involve the more demanding regression, econometric or modelling approaches. Monitoring changes of indicators extracted from the accounts is a first step. But the main advantage of the accounting system, it's coherent structure and linkage with the System of National Accounts, is especially exploited if used

for analysing relationships between multiple indicators, analysing which economic sectors use or impact ecosystem services, or for forward looking analysis of future scenarios of change.

To fully exploit the potential of ecosystem accounts a number of issues should be addressed. These include:

- Integrating the accounts into national information systems and ensuring that the base data is regularly measured, just like many other measurements undertaken by statistical agencies (Portela et al., 2017).
- Demand-side guidance is necessary to help policymakers and policy analysist understand how to use accounts. The list of possible accounts is long, and the list of possible applications of each account for indicator development, analysis or policy use is even longer. The guidance would need to show how that the accounts can make a difference.
- More practical experience is needed on how the accounts can be used for trend analysis, econometric analysis, input-output analysis and bioeconomic modelling. Building the accounts is important, but actually using the accounts is equally important, also for policymakers to see how it may help them. Financial and technical assistance for countries undertaking such projects will be needed. It, moreover, also requires cooperation between policymakers, account compilers and researchers to learn which policy questions are most pertinent, which data are needed for that and how to analyse and report on them.

In conclusion, due to the characteristics of the biodiversity-related accounts, especially that it combines economic with biodiversity data, it can be used for several policy applications. Without many analytical steps, it can be used for implementing the NBSAPs, refining existing biodiversity strategies and management actions and, where necessary, developing new measures to conserve biodiversity. The accounts are also useful for showing the importance of biodiversity to the economy and for highlighting risks to the economy, and human well-being more generally, of declines in biodiversity. Finally, while there are challenges to the production of biodiversity the work to date shows that accounts can be produced and the key task is to insert biodiversity accounting into the machinery of government. In this it seems that biodiversity accounts can draw together information that will help achieve the Aichi Targets, NBSAP, national development planning and land-use planning. If this can be achieved, then biodiversity will have truly entered the mainstream of government decision-making.

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Appendix 1: Links between Aichi Targets and SEEA accounts

(Source Vardon et al., 2017a)

Aichi Target	Relevant SEEA accounts	Example indicators
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 values of natural resources along with the values of other assets (SNA and SEEA-CF); Ecosystem service accounts showing both physical levels and monetary values of services (SEEA-EEA); national development plans (or regional or State level)	Natural resources (land, fish, and timber) as a proportion of total wealth Ecosystem services as a proportion of GDP
3. By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out, or reformed to minimise 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 CBD and other relevant international obligations, taking into account national socioeconomic conditions.	Environmental activity accounts—these accounts cover environmental protection expenditure, taxes, subsidies, and so forth (SEEA-CF)	Level of subsidies to industries (forestry, fishing, mining, and fossil fuels) impacting biodiversity Public expenditure on biodiversity conservation as a proportion of all public expenditures Level of PES
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 the use of natural resources well within safe ecological limits.	Physical asset and supply and use accounts for water, timber, aquatic resources, minerals, and energy (SEEA-CF); ecosystem extent and condition accounts (SEEA-EEA)	Proportion of ecosystems with improving condition Harvest levels as a proportion of regrowth rates (for renewable resources)
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 are significantly reduced.	Land cover/ecosystem extent accounts (SEEA-CF/SEEA-EEA); ecosystem condition accounts (SEEA-EEA)	Proportion of ecosystems with declining extent Proportion of ecosystems with declining condition
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 and use accounts for aquatic resources (SEEA-CF); ecosystem condition account; biodiversity accounts –species accounts (SEEA-EEA)	Trend in harvest levels as a proportion of regrowth rates Trend in the number of species threatened by fishing

Aichi Target	Relevant SEEA accounts	Example indicators
7. By 2020, areas under agriculture, aquaculture, and forestry are managed sustainably, ensuring conservation of biodiversity.	Emissions accounts (SEEA-CF); land cover/ecosystem extent and land-use accounts (SEEA-CF/SEEA-EEA); ecosystem condition account; biodiversity accounts and species account (SEEA-EEA)	Levels of emissions Proportion of native vegetation cover on land used for agriculture, aquaculture, and forestry Proportion of land managed for biodiversity conservation used primarily for agriculture, aquaculture, and forestry
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)	Trend in pollution loads
9. By 2020, invasive alien species and pathways are identified and prioritised, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.	Possible links to ecosystem condition and biodiversity accounts (SEEA-EEA) and environmental activity accounts (SEEA-CF)	Trend in the area of distribution of alien species Trend in the expenditure on control of alien species
10. By 2015, the multiple anthropogenic pressures on coral reefs and other vulnerable ecosystems impacted by climate change or ocean acidification are minimised, 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. [2014]); 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. [2014])	Trend in pollution loads Trend in water quality Percentage of ecosystems in declining condition
11. By 2020, at least 17 percent of terrestrial and inland water and 10 percent 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 and ecosystem services account (SEEA-EEA); biodiversity accounts—species diversity/abundance accounts (SEEA-EEA)	Percentage of ecosystems in protected areas Percentage of ecosystems managed for conservation (that is, private conservation areas) Number of species found in protected areas
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—species diversity/abundance accounts (SEEA-EEA)	Number of threatened species Area of distribution of threatened species
13. By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socioeconomically as well as culturally valuable species, is maintained, and strategies have been developed and implemented to minimise genetic erosion and safeguard their genetic diversity.	Biodiversity accounts (SEEA-EEA)— genetic diversity account; not described in SEEA-EEA, practically difficult, but theoretically feasible	—

Aichi Target	Relevant SEEA accounts	Example indicators
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 and ecosystem services account (SEEA-EEA)	Trend in ecosystem service levels (for example, water provisioning and water filtration services)
15. By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including the restoration of at least 15 percent 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; ecosystem services account carbon asset account (SEEA-EEA)	Trend in carbon sequestration Trend in total carbon stocks
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—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 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 CBD with the full and effective participation of indigenous and local communities at all relevant levels.	—	—
19. By 2020, the knowledge that 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; ecosystem services account (SEEA-EEA)	—
20. By 2020, at the latest, the mobilisation of financial resources to effectively implement 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 the parties.	Environmental activity accounts (SEEA-CF)	Trend in expenditure on biodiversity conservation

Appendix 2: Survey results

1. WHICH ACCOUNTS HAVE BEEN PRODUCED IN YOUR COUNTRY THAT RELATE TO BIODIVERSITY PROTECTION OR SUSTAINABLE USE OF BIODIVERSITY? PLEASE PROVIDE DETAILS ABOUT THE TYPES OF ACCOUNTS.

NETHERLANDS	SEEA-EEA accounts are being developed, including the biodiversity and condition account. Both will be published as experimental accounts around November 2018. Furthermore, data on the monetary accounts for the EGSS and EPEA are compiled, containing information on the production and expenditure of services related to protection of biodiversity/landscapes.
SWEDEN	Environmental protection expenditure accounts have been compiled, with specific breakdowns for biodiversity and landscape expenditures. Also Land accounts and accounts showing the environmentally motivated subsidies are available.
MEXICO	SEEA-EEA accounts are being developed, which consist of the construction of progressive and successional accounts. The first are the land and ecosystem extent accounts, which will provide information on the coverage of soil and vegetation, as well as their changes in different points in time at nationwide, state-wide and municipal level; furthermore, special studies for Natural Protected Areas and Ramsar Sites are available. Furthermore, the condition accounts present how are the ecosystems through the so-called 'priority components': soil, water, carbon and biodiversity. The biodiversity account uses the ecological integrity index, generated by CONABIO, showing the importance of biodiversity, as well as the consequences of its decline. Supply and use account are compiled that present ecosystem services in physical units and in hybrid tables. These tables show the relationship between ecosystems and the economy. Finally, there are exercises of economic valuation of ecosystem services, whose objective is to assess the quantity of ecosystem services to the market prices that would have existed if the services were marketed and exchanged freely.
FRANCE	Biodiversity protection expenditure accounts and forest accounts
GERMANY	Environmental protection expenditure accounts (EPEA) show expenditures concerning 'Protection of biodiversity and landscape' (CEPA 6) for the general government and for partly non-specialised producers of ancillary services. The environmental goods and services sector (EGSS) module provides data on turnover, exports, gross value added and employment of corporations—except corporations of the agricultural sector—concerning protection of biodiversity and landscape (CEPA 6). The Federal Nature Conservation Agency (BfN) has initiated a project for the 'Integration of ecosystems and ecosystem services in the Environmental-Economic Accounts'.
AUSTRALIA	The ABS produced several publications that feature biodiversity accounts based on the SEEA. These include Experimental Environmental-Economic Accounts for the Great Barrier Reef (2017), Feature article in the publication Environmental-Economic Accounting for Agriculture (2015-16), London Group Paper – Butterfly Account for the ACT (2018), Another exampled based on SEEA but produced outside of the ABS: Experimental Ecosystem Accounts for the Central Highlands of Victoria (2017)
COLOMBIA	Colombia has asset accounts for 1) Mineral and energetic resources (iron, copper, nickel, energy coal, natural gas and oil) in physical terms from 2014 to 2016, 2) for land resource in physical terms for five coverage units (artificialised territories, agricultural territories, forests and semi-natural areas, wet areas and bodies of water) from 2002 to 2011, and 3) for wood resources in physical terms from 1990 to 2012. They also have flow accounts for 1) wood products in physical and monetary terms (timber forest products, non-timber forest products and products from transforming wood logs) from 2014 to 2016; 2) energy in physical terms (for natural energy inputs and energy products)from 2014 to 2016; 3) for water in physical terms for agricultural, manufacturing, public services and households, from 2014 to 2016 provisional; 4) for solid waste in physical terms for ordinary and dangerous waste, for manufacturing and households, and by treatment approach (landfills, incineration, recycling and new use and other treatments), from 2014 to 2016; 5) air emission in physical terms for combustion of energy and physical and chemical transformation, by gas (greenhouse effect, acidification, ozone precursors, air quality and heavy metals) from 2014 to 2016. Furthermore, they have Environmental activities account showing the environmental protection expenditure and resources management expenditure for the government, industries and public services, from 2009 to 2017. These also contain environmental jobs and environmental taxes. Finally, ecosystems accounts are being developed, jointly with the Institute of Hydrology, Meteorology and Environmental Studies and Ministry of Environmental and Sustainable Development.
SOUTH AFRICA	Land and ecosystem accounts in KwaZulu-Natal, and National River Ecosystem Account and Water Accounts (not yet published)
UNITED KINGDOM	A wide range of national level ecosystem accounts have been published in the UK, with more work underway. These include extent and condition accounts, ecosystem services accounts in physical and monetary terms, and asset values. In addition, a range of sub-national accounts have been compiled, both corporate accounts and ones for administrative areas. These have largely been based compiled using a Corporate NCA approach, but have used some data from the national level accounts and similar approaches to the SEEA.
ZAMBIA	Water Accounts: So far physical supply and use tables (PSUTs) for the period 2010–2016 have been compiled. There are plans to compile the pollution accounts and asset accounts for the same period. Furthermore, steps are being undertaken to have the water accounts produced annually.
CANADA	Land-cover and land-use accounts have been compiled for selected geographic areas, 1991 to 2011. These accounts include land cover and land-use data for selected geographic and track changes in the extent of built-up area in Canada's major cities
COSTA RICA	They are working on experimental ecosystem accounting associated to tourism, crop production and carbon sequestration.

MALAYSIA	The environmental expenditure accounts in the 5 years Malaysia Plan allocate a budget for biodiversity conservation.

2. HAVE THE ACCOUNTS BEEN USED IN POLICY PROCESSES RELATED TO BIODIVERSITY PROTECTION OR SUSTAINABLE USE OF BIODIVERSITY?
A. **WHAT POLICY NEEDS HAVE THE ACCOUNTS HELPED ADDRESS? HAVE THEY BEEN USED FOR PROBLEM IDENTIFICATION, POLICY PREPARATION, POLICY REVIEW OR MONITORING?**
B. **WHICH INDICATORS WERE BASED ON THE ACCOUNTS?**
C. **HAVE THE ACCOUNTS BEEN USED IN ADDITIONAL ANALYSES, SUCH AS TREND ANALYSIS, MODELLING, EX ANTE POLICY ANALYSIS OR ANY OTHER ANALYSIS?**

NETHERLANDS	The SEEA-EEA accounts are not yet available for policy use. These accounts will contain information from out nature statistics that are being used in policy. As the accounts will also contain spatial information and will contain information in an integrated way, it is expected that they will provide additional policy uses.
SWEDEN	
MEXICO	The Experimental Ecosystem Accounting will offer several types of indicators; for example, the water condition account provides information through three water quality indicators (Biochemical Oxygen Demand, Chemical Oxygen Demand, Total Suspended Solids), which are parameters generated by the National Water Commission (CONAGUA), for monitoring the country's water bodies. In addition, the sanitary indicator of faecal coliforms provides microbiological information and complements water quality analysis. For soil indicators will be generated on carbon stored in the different soil types (in physical and monetary terms). Also, supply of crops and livestock at municipal and state level are monitored. The trends of these indicators will be related to parameters such as erosion, vegetation condition, soil carbon, to learn how variations in these indicators affect the ecosystems.
FRANCE	The accounts are used for a *new Wealth indicator* monitoring: an artificial land cover ratio is determined.
GERMANY	Data on EGSS are shared annually with the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU).
AUSTRALIA	Accounts are not directly used for policy-making or reporting at this stage as biodiversity 'SEEA' accounting is a very new field of work in Australia.
COLOMBIA	Recently, the Ministry of Environmental and Sustainable Development regulated the Compensatory Rate for Timber Forest Utilization in Natural Forests. During this process, they used information on wood stocks and the flow of forest products from the Forest Account. The Forest Account has contributed to address the political need to standardise the collection of taxes aimed at conserving and managing natural forests harvested for timber purposes. The Forest Account was used specifically during the policy preparation process, and it is expected to be used as be input for monitoring the implementation of the TCAFM. Actually, the environmental economic accounts produce approximately 30 indicators related with different topics: http://www.dane.gov.co/index.php/estadisticas-por-tema/cuentas-nacionales/cuentas-satelite/cuenta-satelite-ambiental-csa/cuenta-satelite-ambiental-csa-indicadores. These indicators are used for the SDGs, Colombian Green Growth Policy and Solid Waste Integral Policy. Moreover, is an input for the Colombian Computable General Equilibrium Model for Climate Change.
SOUTH AFRICA	
UNITED KINGDOM	The accounts were widely cited in the UK Government's 25 Year Environment Plan published in January 2018, and also in the accompanying evidence annex. The plan endorses a 'natural capital framework' which closely follows the SEEA-EEA accounting framework, with the examples taken from the accounts used to illustrate the importance of the services we get from natural capital. It is intended that the plan will be monitored through a range of indicators, and that in due course—once the accounts are more firmly established—the indicators will include ones on the levels and values of ecosystem services taken from the accounts as well as a range of indicators on the condition of the assets which will be part of the accounts. They are also looking at using the environmental accounts more widely to create new indicators.
ZAMBIA	The initial draft results are being used to develop models for Water and forestry accounts by the Modelling TWG though these are WIP.
CANADA	
COSTA RICA	
MALAYSIA	The requirements for such accounts have been stipulated in the National policy on Biological Diversity (NPBD) for 2016–2025. It is essential that the accounts reflect the value biodiversity and ecosystem services generate to the economy and to wellbeing. The objective of the accounts is to come up with indicators that help to measure policy achievements and can become part of the reviewing and monitoring process. By 2025, the funds for biodiversity conservation from both government and non-government sources will have increased significantly compared to 2016.

3. HAVE THE ACCOUNTS INFLUENCED DECISIONS MADE OR THE ADOPTION OF POLICIES RELATING TO BIODIVERSITY?

NETHERLANDS	Not yet
SWEDEN	Not yet
MEXICO	Not yet
FRANCE	Not yet
GERMANY	Not yet
AUSTRALIA	Not yet
COLOMBIA	Not yet

SOUTH AFRICA	Not yet
UNITED KINGDOM	The two main impacts of the national level accounts to date have been to help to raise awareness of the importance of natural capital in terms of non-provisioning services (in particular, of the role of vegetation in urban and peri-urban areas), and to change the language of stakeholders (ecologists now much more routinely refer to stocks of assets and flows of services). In other words, they have changed the perceptions and language of those stakeholders involved in the formulation of policies and decisions which affect biodiversity. At sub-national level the accounting approach is used as a means to ensure that we not only preserve the natural assets owned by organisations compiling the accounts, but that we look to increase the value of the benefits we get from holding such assets. The twin objectives of conservation and value of services are key to this change in management style: land owners are now looking for estate managers to provide evidence that they are managing the estate in order to provide a wider range of services and to provide explanations if the total value of the services appears to be declining.
ZAMBIA	Not yet
CANADA	Not yet
COSTA RICA	Not yet
MALAYSIA	Yes, certain goals, targets and action in the policy need to be reviewed based on the financial report.

4. IS THE SEEA MENTIONED IN ANY LEGISLATION RELATED TO BIODIVERSITY POLICIES? PLEASE SPECIFY.

NETHERLANDS	No
SWEDEN	No
MEXICO	The National Development Plan highlights the measurement of the GPD, which is an indicator derived directly from SEEA Mexico. Similarly, in several public policies such as LGEEPA, ENBIOMEX, PROMARNAT, among others, mention is made of the results of SEEA Mexico.
FRANCE	No
GERMANY	No
AUSTRALIA	No
COLOMBIA	SEEA is not mentioned in any law. In 2017, some policy documents mention the need for environmental economics accounts for the environmental policies, such as policy documents of green growth and solid waste.
SOUTH AFRICA	No
UNITED KINGDOM	The 25 Year Environment Plan commits the UK Government to complete the development of natural capital accounts: the merits of placing the 25 Year Plan or the monitoring of the plan on a statutory basis are still being considered.
ZAMBIA	No
CANADA	No
COSTA RICA	No
MALAYSIA	No

5. HAS IMPLEMENTATION OF THE SEEA RESULTED IN THE ESTABLISHMENT OF NEW INSTITUTIONAL MECHANISMS AND ARRANGEMENTS? HAS THIS IMPACTED HOW THE ACCOUNTS ARE USED FOR POLICIES RELATED TO BIODIVERSITY PROTECTION OR SUSTAINABLE USE OF BIODIVERSITY? THIS MAY INCLUDE, BUT IS NOT RESTRICTED TO, FOR EXAMPLE NEW INSTITUTIONAL COOPERATION, NEW BUDGETARY RULES OR NEW POLICY-MAKING PROTOCOLS.

NETHERLANDS	No
SWEDEN	No
MEXICO	During the development of the Experimental Ecosystem Accounting, proposals and agreements have been generated with institutions interested in the project approach. For example, with the CONANP, with whom accounts were made at the level of Ramsar Sites and Natural Protected Areas. The Biofin Project (Finance for biodiversity) has been one of the projects in which the recommendations of an international initiative such as Biofin and the Aichi goals have been consolidated, together with the implementation of the SEEA-CF. The project has resulted in inter-institutional cooperation with representatives of several administrative units such as Biofin Mexico, UNDP, SEMARNAT, CONANP, CONABIO, CONAFOR, INECC, INEGI and sundries representatives in the technical group of both these institutions and other public entities, academia and the private Sector. In the same way, for the development of the Experimental Ecosystems Accounting in the country, a high-level group and a technical working group have been created with representatives from several institutions and agencies such as UNSD, GIZ, SEMARNAT, CONANP, CONAFOR, INECC, UNAM, CONAGUA, INEGI, among others, this with the purpose of broadening the project with contributions of information and opinions of experts of the environmental sector.
FRANCE	No
GERMANY	In general, the implementation of SEEA resulted in a more intensive cooperation with the German Environment Agency (UBA) and the Institute of International Forestry and Forest Economics of Thünen Institute (TI).
AUSTRALIA	The Australian Government recently finalised and published a strategy and action plan for a common national approach to SEEA-based Environmental Economic Accounting. The strategy sets out how a common national approach to the implementation of the United Nations System of Environmental-Economic Accounting will provide coherent and integrated data for

	decision-making by governments, business and the community. It is too early for this strategy to have had an impact on policies related to biodiversity protection or sustainable use of biodiversity, however the potential is certainly there.
COLOMBIA	In 2016 Colombia established a regulatory decree for regular production of statistical information. The policymakers recognise need of the new technical advances in environmental economic accounts, and this has been incorporated in the action plan of the institution. This need has been related with the water accounts, economic valuation of natural capital, materials flows accounts, green employments, etc.
SOUTH AFRICA	Through the development of the Land and Ecosystem Accounting in KwaZulu-Natal, and National River Ecosystem Account, there was the development and strengthening of the institutional cooperation between SANBI and Stats SA.
UNITED KINGDOM	No
ZAMBIA	No
CANADA	In the past, temporary funding to explore ecosystem accounts had led to a productive multi-department project (Measuring Ecosystem Goods and Services). StatCan and the Canadian Department of Fisheries and Oceans are working towards the development of limited Ocean Accounts, which include ocean ecosystem assets and services, which will therefore relate to marine and coastal biodiversity.
COSTA RICA	No
MALAYSIA	No

6. IS THE SEEA USED FOR OR MENTIONED IN YOUR NATIONAL BIODIVERSITY STRATEGY AND ACTION PLANS (NBSAPS) TO THE CONVENTION ON BIOLOGICAL DIVERSITY (CBD)? IF SO, PLEASE ELABORATE.

NETHERLANDS	No
SWEDEN	No. We are now included in the scientific council for biodiversity IPSEP, and CBD are discussed or part of the agenda.
MEXICO	The results of SEEA Mexico are considered in several sections of the National Strategy on Biodiversity of Mexico and Action Plan 2016–2030. On the one hand, on the Strategic Axis 4. Attention to pressure Factors. The results obtained from both the measurement of the expenses in environmental protection and the estimation of the CTADA are highlighted. On the other hand, SEEA results are also mentioned in the section on the project Biofin Mexico Strategic Axis 5. Implementation of the 2016–2030 action Plan.
FRANCE	No
GERMANY	No
AUSTRALIA	Although SEEA is not mentioned, 'National biodiversity accounting' is mentioned in 'Australia's Biodiversity Conservation Strategy 2010–2030'. One of the outcomes identified in this strategy for implementing robust national monitoring, reporting and evaluation is 'an increased representation of biodiversity and ecosystem services and goods within national accounts' and action A20 in the report is 'develop a national biodiversity account, in conjunction with broader national environmental accounting and reporting systems.'
COLOMBIA	No, in Colombia the official information reported to the Convention on Biological Diversity (CBD) is the responsibility of the Research Institute of Biological Resources Alexander von Humboldt.
SOUTH AFRICA	No
UNITED KINGDOM	No. The progress in developing accounts will be referenced in 6th National Report to the CBD (including their use in managing the natural resources of the Overseas Territories).
ZAMBIA	No
CANADA	Yes. Coinciding with the requirements to meet Canada Target 17 of the 2020 Biodiversity Goals and Targets for Canada ('By 2020, measures of natural capital related to biodiversity and ecosystem services are developed on a national scale, and progress is made in integrating them into Canada's national statistical system'), Statistics Canada is working to validate and further develop the concepts and methods described in the SEEA-EEA. Since the adoption by Statistics Canada of the 'Framework for Environmental Statistics' in 2013, the agency has released new natural capital data for Canada's ecosystems in the publication Human Activity and the Environment. The publication includes data on ecosystem assets and flows of ecosystem services, analysed in the context of Canadian society. The publication presents analysis, data tables, charts, infographics and maps based on data from Statistics Canada and from other federal departments and the provinces. The publication provides useful information for policymakers and the general public, and is also used as an educational resource in school systems. In addition to releases through the above mentioned publication, data are released through Statistics Canada's publicly available online database, CANSIM (see, for example, the time series of renewable water stocks). Relevant publication include: 1) Statistics Canada, 2013, 'Measuring ecosystem goods and services in Canada,' Human Activity and the Environment, 2013, Catalogue no. 16-201-X. 2) Statistics Canada, 2014, 'What is the value of an ecosystem? Teacher's Kit for Human Activity and the Environment 2013: Measuring ecosystem goods and services in Canada,' Human Activity and the Environment – Teacher's kit, Catalogue no. 16-507-X. 3) Statistics Canada, 2014, 'Agriculture in Canada,' Human Activity and the Environment, 2014, Catalogue no. 16-201-X. 4) Statistics Canada, 2016, 'The changing landscape of Canadian metropolitan areas,' Human Activity and the Environment, 2015, Catalogue no. 16-201-X. 5) Statistics Canada, 2017, 'Freshwater in Canada,' Human Activity and the Environment, 2016, Catalogue no. 16-201-X. 6) Statistics Canada, 2018, 'Forests in Canada,' Human Activity and the Environment,2017, Catalogue no. 16-201-X.
COSTA RICA	No
MALAYSIA	No