DEPARTMENT OF ECONOMIC AND SOCIAL AFFAIRS
STATISTICS DIVISION
UNITED NATIONS

System of Environmental Economic Accounting

System of Environmental-Economic Accounting—Ecosystem Accounting

Section 13.3 on Accounting for Biodiversity

of the draft document submitted to the Global Consultation on the complete document

October 2020

Note: This is just an extract from the complete draft of the SEEA EA that can be accessed at: https://seea.un.org/sites/seea.un.org/files/documents/EEA/Revision/1._seea_ea_complete_draft_for_global_consultation_oct_2020.pdf

13.3 Accounting for biodiversity

13.3.1 Introduction

13.12 Achieving a coherence with existing national biodiversity objectives and associated international commitments will be fundamental if the SEEA EA is to support 'Accounting for Biodiversity' in a meaningful way. This will be a reciprocal process, in that the compilation of SEEA EA accounts will be using and integrating information from existing national and international biodiversity reporting frameworks, as well as delivering information to inform them. As such, the ministries responsible for the development of the National Biodiversity Strategy and Action Plans, delivering on the Convention on Biological Diversity (CBD) commitments and achieving other biodiversity objectives must be involved in the accounts design at an early stage. This will be essential for the SEEA EA to deliver an effective tool to support mainstreaming biodiversity into economic and other planning processes.

13.13 This subsection aims to support such cooperation by illustrating the role of the SEEA EA and national accounts when 'Accounting for Biodiversity'. This includes informing conservation and enhancement of biodiversity as an environmental management objective in its own right, as well as for securing ecosystem services supply. The subsection considers both the CBD emphasis on biological variability, as well as the array of different components of biodiversity valuable to society (e.g., natural ecosystems, pollinators, iconic species, threatened species and genetic material) and the links between economic activity and changes in biodiversity. This subsection also introduces one particular class of accounts, 'species accounts', demonstrating the potential of accounting approach to support co-ordination of data on biodiversity.

13.3.2 Using SEEA accounts to support assessment of biodiversity

13.14 The SEEA EA provides a link between biodiversity and economic activity by providing an articulation of the relationship between ecosystems, and the species that comprise them, and the SNA and non-SNA benefits that ecosystems provide. Description of this relationship is complemented by data from the SEEA Central Framework, where the focus is on tangible material and financial flows about the environment and the economy (e.g., provisioning ecosystem services, pollutant emissions, environmental protection expenditure). Accordingly, across this suite of accounts many aggregates and indicators are relevant to accounting for biodiversity. A non-exhaustive set of key indicators and aggregates are summarized in Table 13.1.

13.15 Supplementary accounts showing the extent of ecologically important areas that support significant biodiversity will also provide useful information to supplement the indicators presented in Table 13.1. These include areas determined by: policy designations such as concerning Ramsar wetlands or the European Union Habitat Directive areas, scientific determinations such as Key Biodiversity Areas (KBAs, including Alliance for Zero Extinction (AZE) sites), and broad scale regional prioritizations such as biodiversity hot-spots identified by Conservation International. Similarly, compiling accounts showing the extent of important ecosystems for biodiversity in protected areas is a relatively straightforward step in identifying where biodiversity is most a risk and where the risk of biodiversity loss is managed. Ecosystem condition accounts track changes in several biodiversity indicators which can also be used to understand trends in biodiversity.

13.16 The physical and monetary values presented in ecosystem service flow accounts reveal to decision-makers the importance of different species and their diversity, particularly in relation to provisioning services[1], and ecosystems to economic activity and well-being. In this way, in some cases, data on ecosystem services can be used to make the case for investment in biodiversity conservation and restoration. Publicly available information on the multiple ways ecosystems support well-being can inform more holistic planning approaches. For example, by encouraging nature-based solutions that benefit multiple sectors, deliver better social outcomes and achieve conservation objectives.

Table 13.1: Linking SEEA accounts to biodiversity

Framework	Account	Aggregate / Indicator	Relevance
SEEA EA	Extent	Extent of Ecosystems	Trends in the extent of ecosystems important for biodiversity can be used to infer implications for species and species loss.[2] They also provide an insight into habitat loss, a key driver of biodiversity loss.
SEEA EA	Condition	Biotic characteristic indicators	These indicators distinguish ecosystem assets of higher biodiversity value. For example, identifying areas of grassland with high values for species-based indicators or patches of forest with 'good' structural characteristics. They can also provide indicators of where biodiversity threatened, based on trends or on indicators of poor condition (e.g., invasive species abundance).
SEEA EA	Condition	Abiotic characteristic indicators	These indicators can track where pressures on biodiversity may be manifesting (e.g., where pollutant concentrations are increasing). They can help highlight potential relationships between ecosystem degradation and species loss.
SEEA EA	Services	Physical Supply and Use	Aggregates for provisioning services can identify where overexploitation of biodiversity is occurring (e.g., where sustainable yields are being exceeded). This can also include illegal use, such a poaching, where sustainable yield may be zero.
SEEA Central Framework	Land Use	Areas of biodiversity impacting or enhancing activities	Data on land use and land use change allows information on spatial biodiversity loss to be linked to different sectors and economic activities.
SEEA Central Framework	Emissions Accounts	Spatially disaggregated emission flows	Emission flows can identify where pollutant pressures on biodiversity are likely to manifest. These insights are enhanced by (potentially) linking to spatially disaggregated accounts.
SEEA Central Framework	Environmental Protection Expenditure	Expenditure on biodiversity conservation and enhancement	Where these financial transactions can be linked to changes in ecosystem and species status or indicators of biodiversity at scale can have significant policy implications. In particular, they will be useful in understanding the ecological and economic benefits from public and private expenditure on the environment and biodiversity
SNA	Production and consumption	Monetary transactions involving biodiversity related goods and services	A number of monetary aggregates relevant to biodiversity exist in the SNA (e.g., provisioning services, wildlife tourism, recreational activities in nature). These aggregates can also be linked to the elements of biodiversity supporting their supply via the SEEA EA. They can also inform on the opportunity costs for biodiversity conservation (e.g., revenues foregone). They can also inform on monetary trade-offs / opportunity costs associated with different

[1] See for example, (FAO, 2019).

[2] Even without ongoing species monitoring, the species-area curve can reasonably estimate species loss based only on change in ecosystem extent.

			management approaches for biodiversity (conservation versus development)

13.17 Indicators for ecosystem resilience, insurance, option, existence and bequest values: It is also the case that some aspects of biodiversity that are essential to consider for development to proceed in balance with nature will not be well-reflected in ecosystem service flow accounts. Two major means by which biodiversity contributes to maintaining future ecosystem-service delivery are worth distinguishing here:

- The diversity of species constituting an ecosystem may be vital to the long-term maintenance of fundamental ecosystem processes (or 'ecological functions') underpinning services supply, particularly in the face of significant environmental fluctuation and/or change (e.g., climate change). This characteristic of ecosystems is often referred to as 'ecosystem resilience' and has an 'insurance value'.
- Elements of biodiversity (e.g., particular species) which may not provide services at present could be needed to provide these same services, or new services not yet envisaged, in the future. This is the concept of "option value" (Faith, 2018; Weitzman, 1992).

13.18 It is likely that assessment of ecosystem assets with respect to insurance and option values will need to be based on the assumption that the overall level of species diversity and abundance present within an ecosystem is a reasonable indicator. Accordingly, the ecosystem biotic condition indicators highlighted in Table 13.1 can be employed to reflect resilience and insurance values of ecosystem assets. Ideally, these indicators should be supported within additional indicators that reflect the diversity of ecosystem assets (and redundancy of the functional units) at scale.

13.19 Further, as noted in Chapter 6, society also places significant value on the continued existence of biodiversity for spiritual, religious or non-use reasons. Related to this are bequest values, associated with endowing future generations with adequate biodiversity. Services such as "Ecosystem and species appreciation services" are grounded in the biophysical characteristics of ecosystems but are hard to quantify in terms of a 'flow'. Thus, biophysical indicators will often need to be relied upon to reflect changes in the elements of biodiversity relevant to these types of values (e.g., natural ecosystem extent, as highlighted in Table 13.1). Indicators from the species accounts will also be highly relevant.

13.20 Combined presentations. A key advantage of the SEEA EA is that it adds an integrated systems approach to how the many existing indicators of biodiversity can support decision-making. Combined presentations of indicators for the different components of biodiversity with wider economic statistics is an immediate means of using information organized by the SEEA EA for mainstreaming biodiversity. Presenting trends for ecosystems of high biodiversity value in their economic context can assist in making informed decision-making for biodiversity conservation. For example, presenting the opportunity costs of conserving mangrove forests and their biodiversity in terms of forgone value from establishing shrimp farms as an alternative land use. In these ways, multiple stakeholders in biodiversity can be mobilized and more cost-efficient solutions for delivering on economic and environmental objectives realized.

13.21 The broad intention of using the SEEA EA as part of a biodiversity measurement and mainstreaming system is to inform macro level decision making, rather than detailed conservation planning. However, at landscape scales, government policies alone are often unable to resolve trade-offs or mobilize synergies that emerge between different stakeholders. There is clear potential for the SEEA EA to provide an effective, transparent and robust information system to inform sustainable development planning at these finer scales. In this way the SEEA EA can support integrated landscape management approaches that deliver multifunctional landscapes, building resilience to climate change and help reconcile trade-offs and recognize synergies across multiple users of ecosystem assets.

13.3.3 Role of species accounts in supporting decision making about biodiversity

13.22 In order to provide a more coherent picture on different components of biodiversity, species accounts may be compiled. Species accounts measure changes in species stocks (e.g., abundance), distribution or status / extinction risk over an accounting period.[3] Three possible, high level, species accounting concerns emerge: species important for ecosystem services; species of conservation concern; and, species important for ecosystem condition (or functioning).

13.23 The logic of accounting for abundance and/or persistence of species important for ecosystem services is well established in the context of provisioning services (such as concerning harvest of fish and timber) via the SEEA for Agriculture, Forestry and Fisheries (FAO & UNSD, 2020). Clearly, for species to be harvested on a sustainable basis, their stocks need to be quantified and assessed in the context of the supply and use of the services. Commercial fishery species are an obvious example here. There are also some regulating services where understanding the stocks of particular species groups is important for understanding the sustainability of ecosystem services supply, populations of pollinator species being an important example.

13.24 As highlighted previously, species accounts provide indicators for cultural ecosystem services that are challenging to measure. For instance, providing indicators for services involving relations to sacred plants, totemic animals or other species linked to spiritual, symbolic and artistic services. Species accounts will also provide useful indicators to represent elements of biodiversity that society assigns other types of existence or bequest values too (e.g., via ecosystem and species appreciation services).

13.25 Species accounts can also be relevant for informing on ecosystem condition (e.g., concerning ecosystem asset's compositional, functional and landscape/seascape characteristics). Finally, they can provide a structure to organize information and derive indicators of ecosystem condition (e.g., abundance indexes, such as the Living Planet Index, synthesis into Red Lists documenting extinction risk; or diversity indicators, such as the Shannon's or Simpsons Indexes); and to track the status of invasive species and infer where associated pressures on biodiversity may be manifesting.

13.26 <u>Development of Species Accounts.</u> The compilation of SEEA EA accounts will commonly be based on existing data and monitoring programs. This 'Direct Observation' approach may be informed by large sample surveys (such as national surveys), stock assessments for commercially valuable species or more focused efforts (e.g., Census of Protected Areas and nature reserves). Where sampling densities are sufficient and spatially referenced, species accounts can be aligned to ecosystem types and, potentially, ecosystem assets and integrated with information in the ecosystem accounts.

13.27 Where 'Direct Observation' data on species are limited, an alternative approach based on observations of changes in the spatial extent and configuration of habitat required by individual species or communities of species may be employed (UNEP-WCMC, 2016). More sophisticated measures of associated species status can also be applied to estimate species

[3] It is highlighted that species assemblages are a defining characteristic of ecosystems, as such there is also a reciprocal relationship between species and ecosystem extent accounts.

persistence or proportions of species retained in communities. In this way, a relationship between ecosystem extent, condition and services with species status can be made explicit in the SEEA EA.

13.28 The general structure for a species account is shown in Table 13.2. The structure reflects a typical 'asset account', and is similar to the ecosystem extent account. The scale at which the species account is compiled is flexible. However, in practice, it is likely that species accounts will be compiled at the scale of EAAs, either in aggregate or by ecosystem type. The columns in Table 13.2 organize information on selected species (e.g., lions, elephants, gazelle, etc.) or species groups (i.e., taxa, functional groups such as pollinators, etc.). An opening measure and a closing measure for each column is recorded for the accounting period. Additions and reductions to those measures also recorded due to natural, management or reappraisal reasons. For example, additions could be due to population growth, reintroductions / translocations and improved population data estimates in an EAA. Although it is recognised this information is unlikely to be available in many situations.

13.29 Ideally, the species' measures recorded in each of the columns of the account should be comparable and aggregable. However, the heterogeneous nature of species data, is likely to preclude this form of comparison in most cases (hence the need to specify measurement units for each column in Table 13.2). The most pragmatic approach is to aggregate species data by using a consistent reference level. This is the approach used for the Living Planet Index, where species measures are normalised against their value at a reference point in time (i.e., 1970) and their trends aggregated over time. This approach reflects the method described in Chapter 5, with respect to ecosystem condition indicators.

Table 13.2: Species account for an Ecosystem Accounting Area, ET within an EAA or EA

	Species or Species Group 1	Species or Species Group 2	Species or Species Group 3	Species or Species Group 4	Species or Species Group 5	Species or Species Group 6	Species or Species Group 7	Species or Species Group 8	Species or Species Group 9	Species or Species Group 10
UNITS OF MEASURE										
Opening measure										
Additions										
Natural										
Managed										
Upward reapprisals										
Reductions										
Natural										
Managed										
Downward reapprisals										
Net change										
Closing measure										

13.30 <u>Adaptations of species and extent accounts.</u> The strong emphasis on biological "variability" or "diversity" is clear in the CBD definition of biodiversity. Generally, the SEEA EA applies this definition of biodiversity at the scale of ecosystem assets (technically a measure of alpha diversity). However, from the CBD biodiversity perspective, it is also important to assess not only species-diversity within ecosystem assets (as just discussed) but also the genetic diversity of species and the diversity in species assemblages between ecosystem assets (i.e., variation in the composition of assemblages both within and between ecosystem types).

13.31 Genetic diversity is the variety of genes between and within species populations. Maintaining genetic diversity overall (i.e., a gene pool) is important for various commercial activities. For example, further development of crops or livestock that are well-adapted to different and changing conditions. There are also option values linked to gene pools associated with future medical applications or other bio-mimicry technologies and their development. As IPBES identifies, maintaining phylogenetic diversity is a key indicator for maintaining these gene pool option. Further, genetic diversity within species populations is also linked to the condition of those populations. As meta-populations become fragmented and individual populations isolated, exchanges of genetic material are restricted.

13.32 Although an application is yet to be developed, the basic framing of a species account shown in Table 13.2 could be adapted to support discussion of these issues by recording the abundance of phylogenetically diverse species or species groups (where phylogenetically diverse reflects measuring sets of species with different evolutionary histories). In addition, if the results can be presented with appropriate spatial detail, species accounts could be used to help track trans-locations of species where meta-populations become isolated (e.g., transfers of iconic species between protected areas).

13.33 Concerning species assemblages, the focus is on accounting for their complementarity. In this sense, complementarity (beta diversity, the diversity between two ecosystem assets) regulates how the richness (alpha diversity) of the species assemblage in an ecosystem asset combines to generate the species diversity at the whole, larger scale (gamma diversity). This concept is totally scalable, for example in relation to species assemblages in the root systems and canopies of individual trees to the pattern of species assemblages in landscapes.

13.34 Since different species, and species assemblages, will perform different functional roles and have varying degrees of resilience to different pressures, understanding complementarity is a key long-term concern if ambitions for resilient multi-functional landscapes are to be realized. This includes the maintenance of capacity for future ecosystem-service delivery at landscape (rather than ecosystem asset) scale.

13.35 Measures of the diversity of ecosystem types derived from the ecosystem extent accounts may help in quantifying gamma diversity in EAAs, particularly when the ecosystem typology provides a reasonable representation of the distribution of different species communities (e.g., when typologies are well linked to vegetation communities and habitats). However, this is unlikely to yield a satisfactory metric of the variation in species-level assemblages at scale in EAAs, particularly when rather broad ecosystem typologies are employed (as is often the case in ecosystem accounting). To support improved measurement in this area, extensions of the current ecosystem extent and condition accounts may be considered that speak to issues of variation across the compositional, structural and functional perspectives of ecosystems.

13.3.4 Potential biodiversity indicators

13.36 Thematic accounts for biodiversity set out a general accounting approach for using SEEA EA, associated entities and relevant ecosystem account areas to support decision making about biodiversity. Biodiversity indicators from existing national and international biodiversity reporting framework provide useful summary-level information on the state and condition of biodiversity in terms of ecosystem diversity and species diversity that not only are standalone in their own rights to support decision making, but also be useful integrated into core accounts of the SEEA EA for further compilation and analysis. Indicators on biodiversity for SEEA EA can be selected based on the following characteristics.

- Species distribution and population abundance
- Taxonomic diversity, which could be split into species richness and species composition.
- Habitat structure
- Disturbance regime
- Ecosystem extent and fragmentation
- Ecosystem composition by functional type
- Biodiversity footprints