United Nations Committee of Experts on Environmental-Economic Accounting

The Role of the System of Environmental-Economic Accounting as a Measurement Framework in Support of the post-2020 Agenda

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System of Environmental Economic Accounting

ABSTRACT

While progress towards the Aichi Biodiversity Targets has been promising, traditional conservation interventions such as protected areas and species conservation will only be part of the solution for the future. A successful post-2020 biodiversity agenda must be developed in the context of growing economies and consider the underlying economic pressures and drivers of biodiversity loss as well as the vital contributions that healthy, biologically-diverse ecosystems make to human well-being.

The System of Environmental Economic Accounts (SEEA) is well-positioned to enable a transformative post-2020 biodiversity agenda. The SEEA is the internationally-adopted statistical framework that offers a comprehensive and multipurpose view of the interrelationships between the environment and economy and stocks and changes in environmental assets and ecosystems. It provides a consistent monitoring framework that produces actionable indicators on ecosystem extent and condition, as well as the supply and use of ecosystem services. The SEEA also can be used to track expenditures on conservation efforts in both the public and private sectors. Its integrated systems approach clarifies the major drivers of biodiversity loss and ecosystem changes, identifies key trade-offs, and supports the development of "win-win" conservation approaches.

Additionally, the SEEA provides the evidentiary basis to make the case for biodiversity protection to multiple audiences. Biodiversity and natural capital are essential for a well-functioning economy and sustainable development. By giving a full picture of its connection to the economy, SEEA accounts can help make the case for protecting and conserving biodiversity. The SEEA's ecosystem accounts used in combination with information on expenditures provide decision-makers with a clear picture of the return-on-investment from biodiversity protection.

Because of its integrated nature, the SEEA enables the establishment of partnerships among different stakeholders. It is a common approach for disparate data initiatives, so that policies can be evaluated through a unified system of environmental accounting. It offers a dependable measurement framework that has been adopted by the international community and enables an in-depth understanding of the connections between economic well-being and natural capital.

This paper gives an overview of the many ways that the SEEA can play a vital role in the post-2020 biodiversity agenda. It summarizes the SEEA methodological framework, reviews how it can serve as a measurement framework with reference to a variety of illustrative case studies and discusses how the environmental accounting community can assist the implementation of the post-2020 Agenda through participation in monitoring, review and verification discussions.

1 INTRODUCTION

1. At the core of the Strategic Plan 2011-2020 and the Aichi Biodiversity Targets is the recognition that biological diversity underpins ecosystem functioning and the provision of ecosystem services that are essential for well-being. Biological diversity ensures that "ecosystems are resilient and continue to provide essential services, thereby securing the planet's variety of life, and contributing to human well-being, and poverty eradication". [1] Conserving and wisely using biological diversity will be essential to achieving the Aichi Biodiversity Targets, post-2020 agenda and Sustainable Development Goals (SDGs).

2. A key aspect of achieving the Aichi Biodiversity Targets and the post-2020 agenda is the ability of countries to effectively and sustainably monitor progress towards meeting defined targets. Under the Convention for Biological Diversity (CBD) definition of biodiversity, measuring biodiversity targets entails measuring diversity within species, between species and of ecosystems. However, monitoring progress towards the Aichi Biodiversity Targets and relevant SDGs must go beyond measuring solely biological diversity. The Strategic Goals of the Aichi Targets and the SDGs also acknowledge the interrelationships between the environment, economy and society.

3. In the context of the abovementioned issues and corresponding policy needs, this paper considers the role of the System of Environmental-Economic Accounting (SEEA) as a measurement framework to support monitoring progress towards the post-2020 agenda at the national level. As a statistical framework that provides a comprehensive and multipurpose view of the interrelationships between the environment and economy and stocks and changes in environmental assets and ecosystems, the SEEA provides a measurement framework that considers the economic pressures and drivers behind biodiversity loss and degradation, as well as the effectiveness of economic responses towards threats to biodiversity. The SEEA additionally provides social information as it relates to the use of natural resources and ecosystems.

4. As the only international statistical standard on the relationship between the environment and the economy, the SEEA provides a standard set of definitions, concepts and classifications needed to generate rigorous data that can provide countries with consistent measurement of progress over time. The data generated according to the SEEA can therefore be used to construct reliable and dependable indicators that can inform national policy. At the same time, the SEEA provides countries with the flexibility to compile nationally relevant and policy-driven accounts. Thus, the SEEA provides a measurement framework that can be adapted to countries priorities and biodiversity strategies, including National Biodiversity Strategies and Action Plans (NBSAPs).

5. By harmonizing environmental and economic statistics, compilation of the SEEA further acts as a catalyst for bringing together different institutions. Data collection processes in countries are often fragmented, with different agencies being responsible for separate, yet often overlapping, domains. This fragmentation results in methodological inconsistencies in the base statistics that feed into the calculation of indicators. However, implementation of the SEEA

[1] See UNEP/CBD/COP/DEC/X/2, sect. III.

provides an impetus to harmonize the base data feeding into indicators. It acts as a catalyst for developing agreed institutional frameworks with clear roles and responsibilities that support integrated policies related to ecosystems, the economy and people.

6. The SEEA framework is readily accessible to countries. The SEEA documentation is freely available and downloadable from the United Nations SEEA website. [2] In addition, there are several free learning resources on the SEEA available through the United Nations Statistics Division, United Nations regional commissions, World Bank and others, which allow countries to learn more about the SEEA methodology. These learning resources range from introductory learning materials to technical notes supporting compilation. [3] To support implementation, the United Nations Committee of Experts on Environmental-Economic Accounting (UNCEEA), the inter-governmental body that was mandated to oversee the development and implementation of the SEEA globally, has also made SEEA implementation and national assessment guides freely available. [4]

7. The remainder of this paper is split into three sections. The second section of the paper introduces the SEEA methodological framework. The third section reviews how the SEEA can serve as a measurement framework for the post-2020 Agenda and includes a variety of illustrative case studies. The final section of the paper looks at how the statistical community, and in particular the environmental accounting community, can help with the implementation of the post-2020 Agenda in terms of participation in monitoring, review and verification discussions.

2 OVERVIEW OF THE SYSTEM OF ENVIRONMENTAL-ECONOMIC ACCOUNTING (SEEA)

2.1 SEEA: The International Statistical Standard for Measuring the Environment and its Relationship with the Economy

8. The SEEA was adopted in 2012 by the United Nations Statistical Commission as the international statistical standard for measuring the environment and its relationship with the economy. It is a statistical framework that brings together economic and environmental information to measure the condition of the environment, the contribution of the environment to the economy and the impact of the economy on the environment, in a structured accounting framework, in both physical and monetary terms.

9. As a statistical framework, the SEEA helps structure the production process for indicators describing the link between the environment and economy. By using a standard set of concepts, definitions, classifications, accounting rules and tables, countries compiling the SEEA are able to produce reliable data that can effectively track progress over time. The concepts and definitions

[2] For SEEA publications, see https://seea.un.org/content/methodology.
[3] For SEEA e-Learning resources, https://elearning-cms.unstats.un.org/course/category1.
[4] United Nations, Department of Economic and Social Affairs, "SEEA Implementation Guide", 25 June 2014. Available at https://unstats.un.org/unsd/envaccounting/ceea/meetings/ninth_meeting/UNCEEA-9-6d.pdf.

that constitute the SEEA are designed to be applicable across all countries, regardless of their level of economic and statistical development, their economic structure, or the composition of their environment. At the same time, the SEEA is flexible enough that countries can tailor their accounts to address their specific policy questions, thereby informing national initiatives such as NBSAPs.

10. The SEEA does not recommend specific indicators but focuses on providing a systematic and methodologically sound approach to compiling environmental-economic statistics, thus lending rigor to the calculation of many indicators used to assess specific aspects of sustainable development, including biodiversity. Therefore, the advantage of the SEEA is that it ensures that indicators are defined and compiled in a methodologically coherent way, so as to better serve their ultimate purpose of informing policy and supporting the monitoring of progress. Furthermore, the SEEA ensures that the data collection is an efficient process whereby data is collected once, used multiple times and is validated through the checks and balances inherent in the accounting approach.

11. The SEEA framework consists of two parts, the SEEA Central Framework (SEEA CF) and the SEEA Experimental Ecosystem Accounting (SEEA EEA). The SEEA CF takes the perspective of the economy and measures how the economy uses the environment as provider of natural resources and receiver of residuals in the form of waste and emissions into air and water resulting from economic activities. As such its structure is very close to the structure of the System of National Accounts. The SEEA EEA instead takes the perspective of the ecosystems and measures their functioning as integrated systems spatially explicit. As such the SEEA EEA framework is more loosely connected to the SNA, although fully aligned. Because of its structure, the SEEA allows for the integration of environmental information (often measured in physical terms) with economic information (often measured in monetary terms) into a single framework.

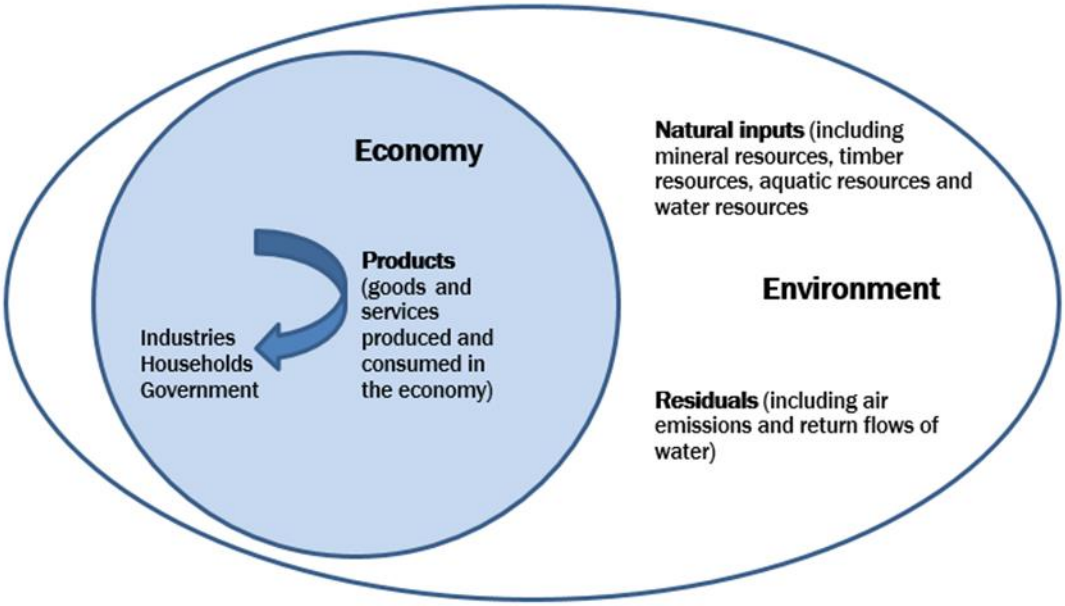
2.2 The SEEA Central Framework

12. The SEEA CF was adopted by the United Nations Statistical Commission as the first and only international standard for environmental-economic accounting in 2012. It was produced and released under the auspices of the United Nations, the European Commission, the Food and Agriculture Organization of the United Nations, the Organisation for Economic Co-operation and Development, the International Monetary Fund and the World Bank Group. The SEEA CF describes the interactions between the economy and the environment, and the stocks and changes in stocks of environmental assets (i.e. water, energy, timber etc). (see Fig. 1).

13. In practice, environmental-economic accounting includes the compilation of physical and monetary supply and use tables, functional accounts (such as environmental protection expenditure, taxes and subsidies accounts) and physical and monetary asset accounts. To assess how the economy supplies and uses natural inputs, SEEA accounts also disaggregate flows by different unit of production (industries as categorized by the International Standard Industrial Classification and households). Data for SEEA accounts is usually collected from business and household surveys related to resource extraction and use.

14. **Supply and use tables** in the SEEA CF record the flows of natural inputs (e.g. flows of minerals, timber, fish and water), products and residuals (e.g. solid waste, air emissions and return flows of water) in both physical and monetary terms. In recording these flows, the SEEA CF provides information on the amount and value of materials, water and energy that enter and leave the economy and flows of materials, water and energy within the economy itself. By providing information disaggregated by industries and households, supply and use tables provide valuable information on production and consumption patterns and changes in these patterns over time, as well as changes in the productivity and intensity of the use of natural inputs and the release of residuals.

Figure 1. Physical flow of natural inputs, products and residuals



Source: SEEA Central Framework (United Nations, 2014).

15. **Stocks and changes in stocks of environmental assets** (e.g. water, timber, fish, minerals and energy resources etc) are measured in the SEEA CF through asset accounts. In physical terms, the Central Framework focuses on recording the physical stocks and changes of stocks of individual environmental assets, such as tonnes of coal, cubic metres of timber and hectares of land. However, the SEEA CF also includes the measurement of stocks in monetary terms. The measurement of stocks in monetary terms focuses on the value of individual environmental assets and changes in those values over time. The valuation of these assets focuses on the net present value of the benefits that accrue to economic owners of environmental assets, and the use of monetary terms enables the analysis of tradeoffs between the conservation and use of different natural inputs.

16. **Environmental activity accounts** record transactions in monetary terms between economic units that may be considered for environmental purposes. Generally, these transactions

concern activity undertaken to preserve and protect the environment or activity designed to influence the behavior of producers and consumers with respect to the environment. Environmental activity accounts in the SEEA CF include environmental protection and resource management expenditure accounts (which include, for example, direct expenditures for the protection of biodiversity), environmental goods and services sector accounts, and environmental taxes and subsidies accounts. Used in tandem with other SEEA accounts, environmental activity accounts supply valuable information on whether economic resources are being used effectively to reduce pressures on the environment and maintain the capacity of the environment to deliver economic benefits.

17. The SEEA CF also includes various subsystems of the SEEA, which are fully elaborated frameworks for individual environmental assets. The purpose behind the subsystems of the SEEA is to explain the accounting frameworks as they apply to a specific domain, using subject-specific concepts and terminologies and bringing them together with the accounting structure. For instance, SEEA-Water[5] is the conceptual framework and set of accounts which presents hydrological information alongside economic information in an integrated manner. Other subsystems of the SEEA CF include SEEA-Energy[6] and SEEA-Agriculture, Forestry and Fisheries[7].

Applications of the SEEA CF: Water Accounts in Brazil

SEEA-Water provides the basis for analysing the consumption of water by different sectors of the economy for both production and consumption of goods and services. This can illuminate where inefficiencies lie and how to bring demand closer to supply. For instance, in 2018 Brazil published water accounts for 2013-2015, which highlighted the most efficient (and least efficient) users of water when it comes to the production of goods and services. The accounts showed that water usage per Brazilian real generated by the agricultural sector was more than 20 times that of the manufacturing and construction industry, at 91.59 litres/R$ compared to 3.72 litres/R$ (IBGE, 2018).

Similarly, SEEA-Water provides a basis for valuable consumption-side indicators. Water accounts can be used to calculate water footprints, which look at the volume of water needed to produce the goods and services consumed by a country. As SEEA-Water includes information for the calculation of both internal water footprints (for domestic water resources) and external water footprints (for both domestic and foreign water resources), SEEA-Water can help highlight the amount of water needed by countries when it comes to their consumption patterns, which are global in scope.

2.3 SEEA Experimental Ecosystem Accounting

18. The SEEA EEA provides a coherent framework for ecosystem accounting, which integrates measures of ecosystem extent, ecosystem condition and the flows of ecosystem

[5] For the SEEA-Water methodology, see https://seea.un.org/content/seea-water.
[6] For the SEEA-Energy methodology, see https://seea.un.org/seea-energy.
[7] For the SEEA-Agriculture, Forestry and Fisheries methodology, see https://seea.un.org/content/ag-for-fish.

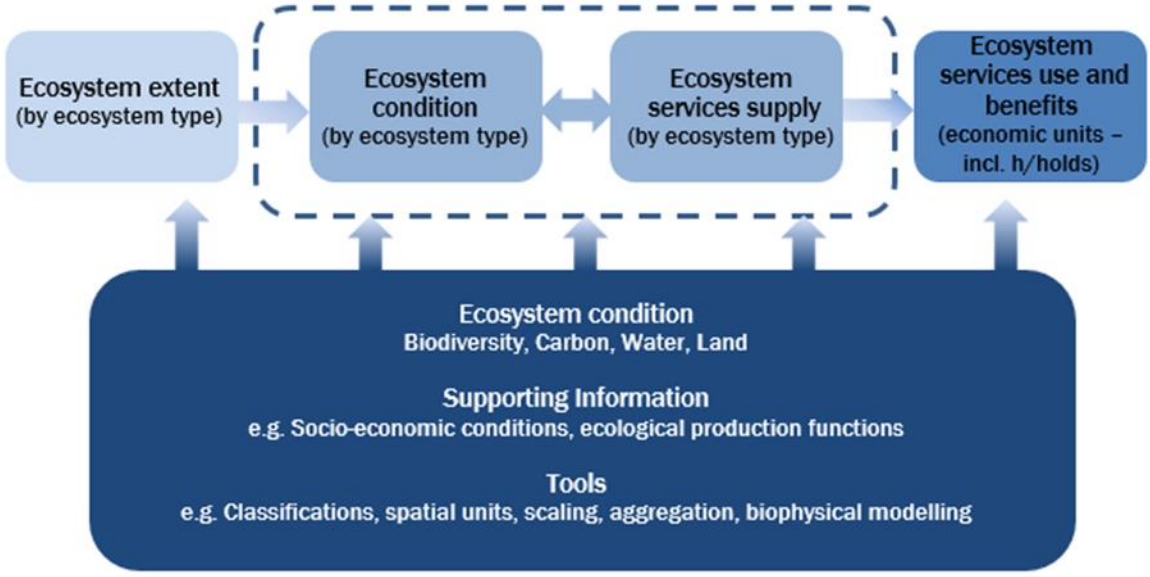
services with measures of economic and other human activity. The SEEA EEA provides a complementary approach to the SEEA CF by providing a consistent and coherent synthesis of current knowledge regarding an accounting approach to the measurement of ecosystems. It takes a spatially-explicit approach to natural capital accounting, building on the SEEA CF's approach to accounting for individual environmental assets.

19. In March 2013, the United Nations Statistical Commission endorsed the SEEA EEA as the basis for commencing testing and further development of ecosystem accounting. The SEEA EEA was formally published in 2014 under the auspices of the United Nations, the European Commission, the Food and Agriculture Organization of the United Nations, the Organisation for Economic Co-operation and Development, the International Monetary Fund and the World Bank Group.

20. In the SEEA CF, environmental assets are accounted for as individual resources such as timber, water, soil, etc. However, in the SEEA EEA, the accounting approach becomes spatially explicit through its recognition that these individual resources function in combination within a broader system. The SEEA EEA provides a common framework for integrating information on ecosystems (i.e. ecosystem extent, ecosystem condition, ecosystem services) as well as existing accounting information on economic and other human activity dependent on ecosystems and associated beneficiaries (households, businesses and governments) (see Fig.2).

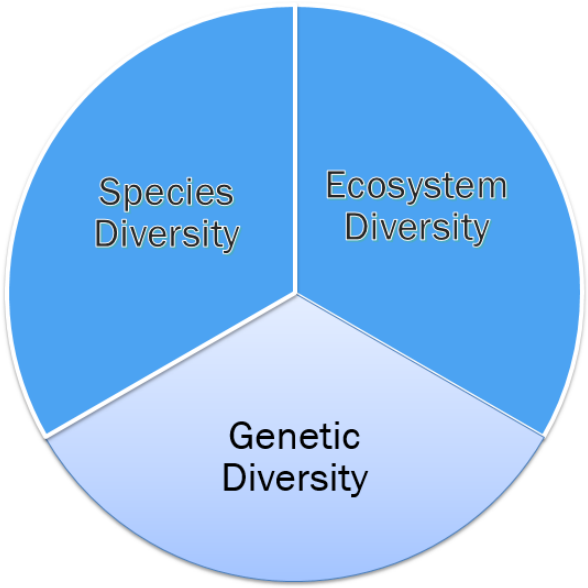
21. More specifically, in the SEEA EEA, each instance of an ecosystem (known as an ecosystem asset) is delineated by spatial areas containing a combination of biotic and abiotic components and other characteristics that function together. Each ecosystem asset provides a stream of ecosystem services, which are the contributions of ecosystems to economic and other human activity. To measure ecosystem assets and the services they provide, the SEEA EEA consists of four main types of accounts: extent accounts, condition accounts, supply and use accounts (in physical and monetary terms) and asset accounts (in monetary terms). In addition, the SEEA EEA includes thematic accounts, including those looking at stocks and changes in stocks of species, which are standalone accounts relevant to the measurement of ecosystems. To arrive at information that is both spatially explicit and ecologically grounded, SEEA EEA accounts often involve the use of Earth observation, remote sensing and biophysical modeling.

Figure 2: Relationship between SEEA-EEA accounts, support information and tools



22. It should be noted that the SEEA EEA follows the CBD definition of biodiversity. In this sense, biodiversity is considered an all-encompassing focus of the SEEA EEA accounts, rather than being considered an aspect of ecosystem condition accounts or as a specific ecosystem service. Taken as a whole, the SEEA EEA addresses two of the three components (see Fig.3) of biodiversity under the CBD definition of biodiversity—ecosystem diversity and species diversity.

Figure 3. The three components of biodiversity



Source: Exploring Approaches for Constructing Species Accounts in the Context of the SEEA-EEA (UNEP-WCMC, 2016).

23. **Ecosystem extent accounts** organize information on the extent of different ecosystem types and form the basis of ecosystem accounts. These accounts provide information on the occurrence of different ecosystem types (usually through land cover and land use) in a spatially explicit manner, using land cover maps and remote sensing. By providing spatially explicit information, the SEEA EEA allows users to identify the location of different ecosystems and hotspots and track changes in the extent of these ecosystems over time.

24. Closely linked to ecosystem extent accounts are **ecosystem condition accounts**. The spatial component of ecosystem extent accounts enables the identification and understanding of inter-ecosystem flows and is thus vital in understanding the condition of ecosystems. Ecosystem condition accounts present a nuanced picture of ecosystem health by providing information on a set of biophysical characteristics, such as water, soil, vegetation carbon and nutrient flows. These characteristics can then be used to derive various indicators, which can then be related to a reference condition to allow users to make an overall assessment of the ongoing function and integrity of different ecosystems, as well as how ecosystems may be affected by human activity and disturbances such as pollution. In providing multiple indicators for ecosystem condition, the accounts supply a multifaceted view of ecosystem condition and provide insight into the capacity of ecosystems to provide key ecosystem services in the future.

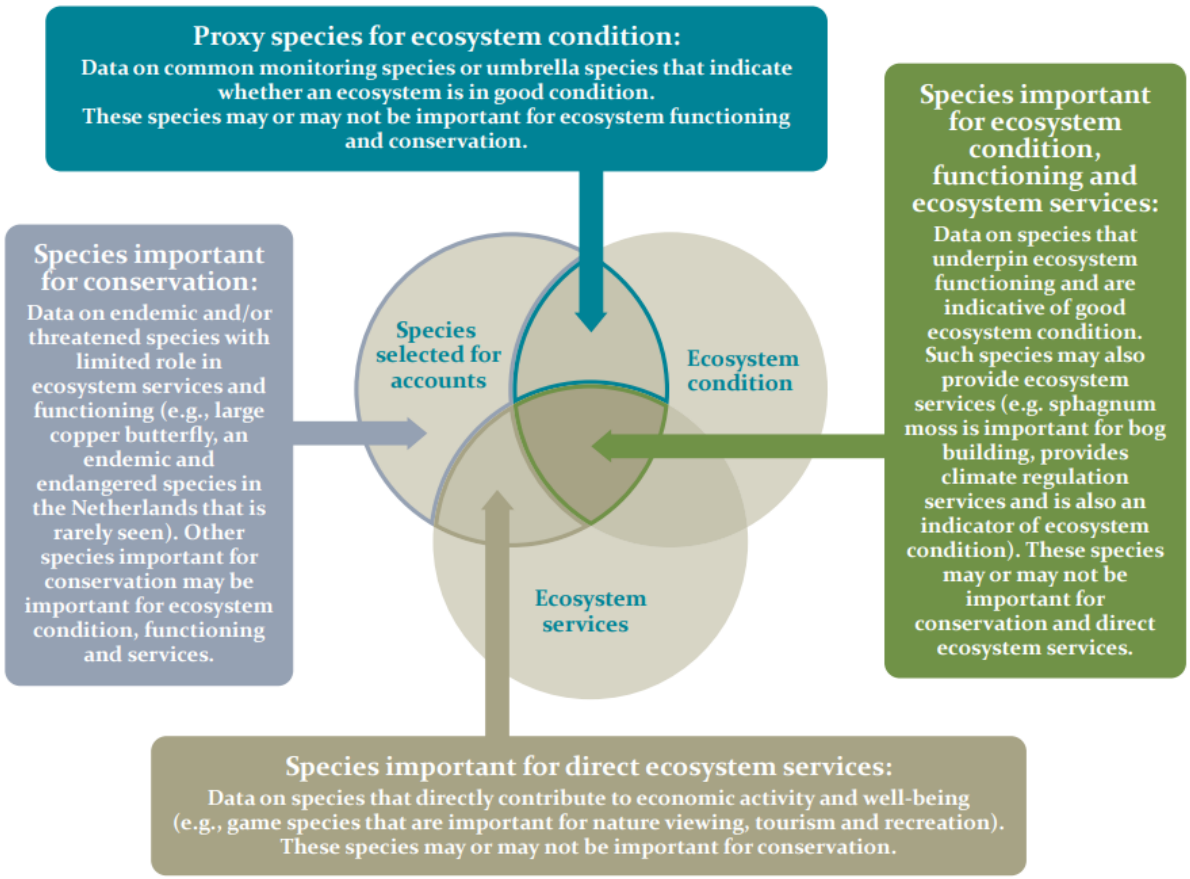
25. **Ecosystem service accounts** are central to the SEEA EEA framework, as they provide the link between ecosystems and the contribution ecosystems make to individual and societal well-being. Ecosystem service accounts in the SEEA EEA consist of physical and monetary supply and use tables of the ecosystem services which bring benefits to humanity. The scope of these accounts covers those services that contribute to the benefits accounted for in the System of National Accounts (e.g. water, timber, etc.) as well as those that are not currently accounted for and relate to the general functioning of ecosystems (e.g. water regulating services, cultural services relating to nature). Ecosystem service accounts measure the physical and monetary flows of the supply and use of ecosystem services, as well as their corresponding beneficiaries.

26. The potential for assessing trade-offs and complementarities among baskets of ecosystem services can lead to a powerful application of the ecosystem accounting framework as a whole. This potential arises from (a) a broad scope, which includes ecosystem services that contribute to current measures of economic activity together with other ecosystem services that are excluded from their scope, (b) the connections in the framework between ecosystem services and changes in the ecosystems themselves and (c) the links between the ecosystem accounting framework and measures of economic activity presented in the SNA (UN, 2014b).

27. The SEEA EEA also includes **monetary asset accounts**, which record the monetary value of opening and closing stocks of all ecosystem assets and the details of the additions and/or reductions in those stocks. To arrive at a monetary value for ecosystem assets, the accounts derive the net present value of future flows of ecosystem services. The estimates of each ecosystem asset in monetary terms provide a useful basis for comparing different ecosystem assets and their alternative uses. Additionally, when aggregated at a higher level, a decline or increase in the value of ecosystem assets may point to either unsustainable ecosystem use or improved ecosystem condition. The estimations in the ecosystem asset accounts can also be integrated with valuations for other types of assets to provide a more nuanced assessment of net wealth and can be incorporated into extended national balance sheets.

28. Lastly, the SEEA EEA includes **thematic accounts**, which include accounts **on land, water, carbon and species**. In particular, by providing information on the stocks and changes in stocks of species, species accounts in the SEEA provide important insight into ecosystem condition, services, functioning and capacity. There is significant flexibility in developing a species account, and countries can focus on the species relevant to key ecosystem services, species important for conservation and/or species indicative of ecosystem condition. For example, countries can focus on IUCN Red List species, endemic and/or restricted range species, functional species groups, migratory and/or congregatory species or phylogenetically unique species (UNEP-WCMC, 2016). The accounts provide information on the opening stock, changes in abundance and closing stocks of the chosen species. Depending on the species chosen, the accounts can provide important information on ecosystem condition, ecosystem services and conservation (see fig. 4).

Figure 4. Diagram illustrating how species selected for species accounts can also provide information on conservation, ecosystem condition and functioning and ecosystem services



Source: Exploring Approaches for Constructing Species Accounts in the Context of the SEEA-EEA (UNEP-WCMC, 2016).

29. Following the decision of the United Nations Statistical Commission in March 2017, a revision of the SEEA EEA is now taking place, with the intention to reach agreement on as many

aspects of ecosystem accounting as possible by 2020. The revision process will be based on the SEEA EEA published in 2014, the experiences of the many initiatives on ecosystem accounting in practice, and on the recently released Technical Recommendations in support of the SEEA EEA 2012 (white cover publication).

Applications of the SEEA EEA: Better Management of Natural Capital in the European Union

The European Union has set itself ambitious targets for the preservation and better management of natural capital in the 7th Environmental Action Programme of the EU and the EU Biodiversity Strategy to 2020. To build the knowledge base for achieving these objectives a shared Knowledge Innovation Project was set up at EU level to develop an Integrated system for Natural Capital and ecosystem services Accounting (KIP INCA). The organizations taking KIP INCA forward are Eurostat, the EU Joint Research Centre, the Directorate-General for Environment and the Directorate-General for Research and Innovation of the European Commission, and the European Environment Agency.

The methodological starting point of KIP INCA is the SEEA EEA. The KIP INCA project aims to develop accounts on the extent and condition of ecosystems present in the European Union, as well as accounts for selected ecosystem services from these ecosystems and their contribution to the economy and human wellbeing. The KIP INCA project began in 2015 and will run to 2020. Key results of Phase 1 of the project and a

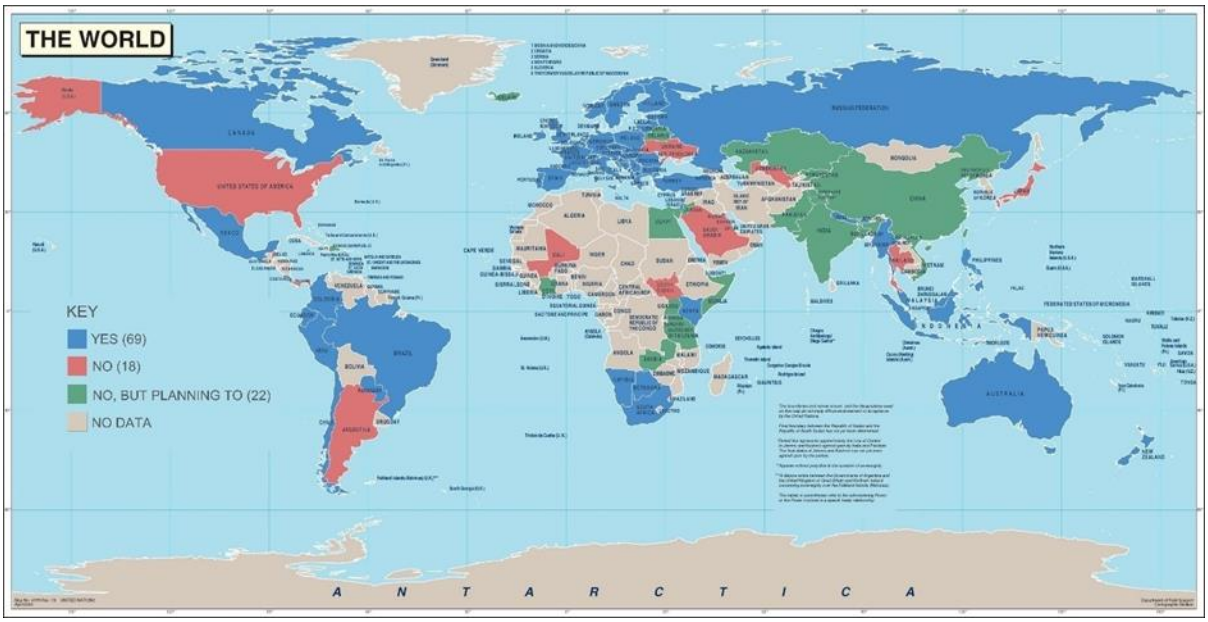
2.4 SEEA Implementation

30. As an international statistical standard and integrated framework supporting the measurement of sustainable development, both the SEEA CF and SEEA EEA play a vital role in measuring progress of the 2030 Agenda for Sustainable Development. At its 46th session in 2015, the United Nations Statistical *Commission 'Urged the Committee of Experts to advocate for and promote the scaling up of its implementation programme, exercising strong leadership in developing a concrete and well-resourced programme to support countries in implementing SEEA, with a clear timeline of objectives and deliverables'*[8]. In response, the UNCEEA updated its implementation strategy to place SEEA implementation in the broader context of the 2030 Agenda. As part of the updated implementation strategy, the Committee aims to support the global implementation targets of having at least 100 countries with ongoing, well-resourced programmes in the SEEA CF and 50 countries with ongoing, well-resourced programmes in ecosystem accounting by 2020.

31. The policy relevance of the SEEA has contributed to the steady growth in implementation seen over the last several years. According to the 2017 administration of the Global Assessment of Environmental-Economic Accounting and Supporting Statistics, there was a 28 per cent increase in the number of countries compiling SEEA accounts compared to the 2014 (UNCEEA, 2018).

[8] See E/2015/24, chap. I, sect. C, decision 46/108, para. (g).

Figure 5. Countries and territories compiling SEEA accounts



Note: This figure has been modified from a United Nations map. The boundaries and names shown, and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Source: Global Assessment of Environmental-Economic Accounting and Supporting Statistics 2017 (UNCEEA, 2018).

Several international and regional organizations have ongoing capacity building efforts and provide targeted technical assistance on the SEEA and are vital in reaching the implementation targets by 2020. At present, approximately 80 countries have compiled SEEA CF accounts and more than 30 countries have compiled SEEA EEA accounts (see Fig.5).

32. Both the SEEA CF and SEEA EEA have been implemented in support of global indicator frameworks, including indicators under the SDGs, Aichi Biodiversity Targets, United Nations Convention to Combat Desertification Targets, United Nations Framework Convention on Climate Change Targets, Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), Biodiversity Indicators Partnership and Ramsar Report (King et al., 2018b). The 2030 Agenda and the SDGs have been driving SEEA CF and SEEA EEA implementation in particular. As an integrated framework providing information on both the environment and economy, the SEEA informs more than half of the SDG goals. The UNCEEA has identified 40 priority indicators over nine different goals for which the SEEA can provide input or complementary data. [9] As an international statistical standard, the SEEA can ensure that data is internationally comparable, consistent and reliable, making the standard well positioned to support global indicator frameworks.

[9] For the analysis of priority indicators, see https://seea.un.org/sites/seea.un.org/files/sdg_cover_note_broadbrush.pdf.

3 SEEA AS A MEASUREMENT FRAMEWORK FOR MONITORING BIODIVERSITY

33. The CBD Strategic Plan is an effort to:

> *"Take effective and urgent action to halt the loss of biodiversity in order to ensure that by 2020 ecosystems are resilient and continue to provide essential services, thereby securing the planet's variety of life, and contributing to human well-being, and poverty eradication."* [10]

34. The measurement framework of the post-2020 agenda must be able to accurately measure progress towards the new targets by providing multiple measures across different spatial scales and ecological dimensions (Mace et al., 2018). However, any measurement framework used must also facilitate the development of policy to deliver improvements in biodiversity. While progress towards the Aichi Biodiversity Targets has been promising, traditional conservation interventions such as protected areas and species conservation will only be part of the solution for the future (Mace et al., 2018). Thus, the post-2020 agenda must also consider the economic pressures drivers of biodiversity loss and degradation.

35. The spatially explicit approach and ecological grounding of the SEEA EEA, combined with the SEEA CF's measurement of individual environmental assets and economic activity adds an integrated systems approach to the existing indicator processes and measurement frameworks. This systems approach allows, for example, a change in species to be understood in the context of changes in ecosystem extent, flows of ecosystem services, environmental expenditures, measures of energy use, or extraction of natural resources. Each type of account the SEEA informs an important aspect of measuring biodiversity, whether it is species diversity, the diversity of ecosystems or the measurement of economic activities affecting biodiversity. This is evidenced by the experiences and policy applications of several countries in various regions, both developed and developing, that have compiled the accounts. The remainder of this section details the experiences of Mexico, the Netherlands, South Africa, Australia and Indonesia.

3.1 The SEEA for Biodiversity in Mexico

36. Mexico has long understood the value of accounting for natural capital. Having begun regularly compiling SEEA accounts in 1996, the Instituto National de Estadística y Geografía (INEGI) has compiled several accounts for both the SEEA CF and SEEA EEA. To further expand their SEEA EEA accounts, Mexico is currently one of five partner countries[11] taking part in the E.U.-funded project, Natural Capital Accounting for Valuation of Ecosystem Services (NCAVES), implemented by the United Nations Statistics Division (UNSD), United Nations

[10] See UNEP/CBD/COP/DEC/X/2, sect. III.
[11] The E.U.-funded NCAVES project is taking place in Brazil, China, India, Mexico and South Africa.

Environment Programme (UN Environment) and the Secretariat of the Convention on Biological Diversity.

37. Under the NCAVES project, INEGI will be compiling ecosystem extent, condition and service accounts in order to obtain a comprehensive picture of the functioning of the country's ecosystems and their contributions to the economy. INEGI will be compiling ecosystem extent accounts for the entire country, with additional focus on protected areas and Ramsar Sites. In addition, their condition accounts will provide a basis for the construction of indicators by the National Commission for the Knowledge and Use of Biodiversity (CONABIO) on ecosystem resilience and health. Mexico's ecosystem service accounts will build upon the extent and condition accounts to focus on the contribution of key ecosystem services to the economy, including carbon sequestration, water yield and crop provisioning services.

38. The SEEA accounts are not only used to understand the state of ecosystems and biodiversity in Mexico, but they are also actively used to help craft effective responses to threats to biodiversity. The SEEA accounts are considered in multiple areas of Mexico's National Biodiversity Strategy and Action Plans. For example, the SEEA CF environmental protection expenditure accounts are used to calculate the total costs of depletion and environmental degradation (CONABIO, 2016). [12]

39. In addition, Mexico's environmental protection expenditure accounts play an important role in informing their response to threats to biodiversity, via their participation in BIOFIN, UNDP's biodiversity finance initiative. Mexico's environmental protection expenditure accounts categorize expenditures according to the Classification of Environmental Activities (CEA) in 16 categories. The BIOFIN biodiversity expenditure review (BER) process takes the SEEA environmental protection expenditure accounts as a starting point, to look at expenditures classified under CEA category of protection of biodiversity and landscapes. Mexico's BER furthermore looks at the CEA categories of wastewater management; protection and remediation of soils, groundwater and surface water; research and development for environmental protection; and other environmental protection activities.

3.2 The SEEA for Biodiversity in Australia

40. Australia has been compiling both SEEA CF and SEEA EEA accounts since the mid-1990s. As an incredibly ecologically diverse country and home to the world's largest coral reef ecosystem, Australia has long recognized the need to understand the benefits that ecosystems provide to humans through the generation and use of ecosystem services.

41. Australia has compiled SEEA accounts at a national level, but in 2017, the Australian Bureau of Statistics (ABS) published SEEA EEA accounts for the Great Barrier Reef (GBR) to better support informed decision making for this important World Heritage Site. The GBR is managed under the Great Barrier Marine Park Act of 1975, and management of the Reef is designed to provide for multiple uses of the Reef while protecting biodiversity and heritage

[12] For Mexico's National Biodiversity Strategy and Action Plan, see https://www.cbd.int/doc/world/mx/mx-nbsap-v2-es.pdf.

values, as well as the social and economic aspects of the environment. The ABS compiled ecosystem extent, condition and service accounts for the GBR.

42. Together, the accounts provide a comprehensive picture of the state of the GBR and how it contributes to and is affected by humans. For instance, the extent accounts highlight the large decrease in areas devoted to general use after a 2004 re-zoning effort that increased areas of habitat protection and the marine national park. However, the GBR species accounts indicate that the re-zoning effort was shown to have mixed results in terms of species diversity. While birds and reptiles showed very little movement between threat categories between 1994 and 2017, the same could not be said for other groups of fauna. In particular, ten species of frogs were added to the Endangered category, one species to Vulnerable and five to Near Threatened (ABS, 2017).

43. At the same time, the condition account indicated fluctuating ecosystem condition, particular for marine ecosystems. The accounts indicate an overall decline in condition following heavy rainfall events in 2010-11 after suffering several Category 5 cyclones, severe weather events, rainfall and pollutant run-off. However, marine ecosystems started to show signs of recovery from 2012-13 to 2014-15. While coral condition decreased, the trending decline of seagrass meadows has slowed (and in some cases reversed), and the abundance of selected fish species has remained relatively stable between 2001 and 2017, apart from one region (ABS, 2017).

44. Additionally, the ABS compiled physical and monetary ecosystem service accounts, which highlighted the importance and value of provisioning services of agriculture, forestry and fisheries; regulating services such as carbon sequestration; and cultural services such as tourism. The cultural services of the GBR provided by tourism, for example, was shown to provide important benefits to visitors, with the value of benefits rising from an estimated 8,093 million AUD in 2006-07 to an estimated 9,167.1 million AUD in 2014-15. At the same time, the value of the fishing industry has decreased (ABS, 2017).

45. The GBR accounts also include the SEEA CF environmental protection expenditure accounts. These accounts have tracked the response to threats to the health and resilience of the GBR by way of Government, private industry and household expenditures for protection and management activities. Taken together with the SEEA EEA accounts, the environmental protection expenditure accounts show the effectiveness of protection and management activities for the GBR. In particular, the accounts have proved vital in measuring progress of the objectives and targets for investment as described in the Reef 2050 Long-Term Sustainability Plan, which puts an emphasis on ecologically sustainable human and economic activities and a health Reef when it comes to environmental, economic and social planning.

46. It should also be noted, that in recognition of the SEEA's relevance and potential for policy and decision making, the Australian Government, in collaboration with state and territory governments, recently developed a National Environmental-Economic Accounting Strategy. In order to align the use of disparate account development approaches and lack of coordination between agencies, the strategy looks to achieve nationally consistent implementation of the SEEA. In recognition of the SEEA's flexible and modular approach, the Strategy avoids mandating specific accounts to compile, instead allowing different governments compile

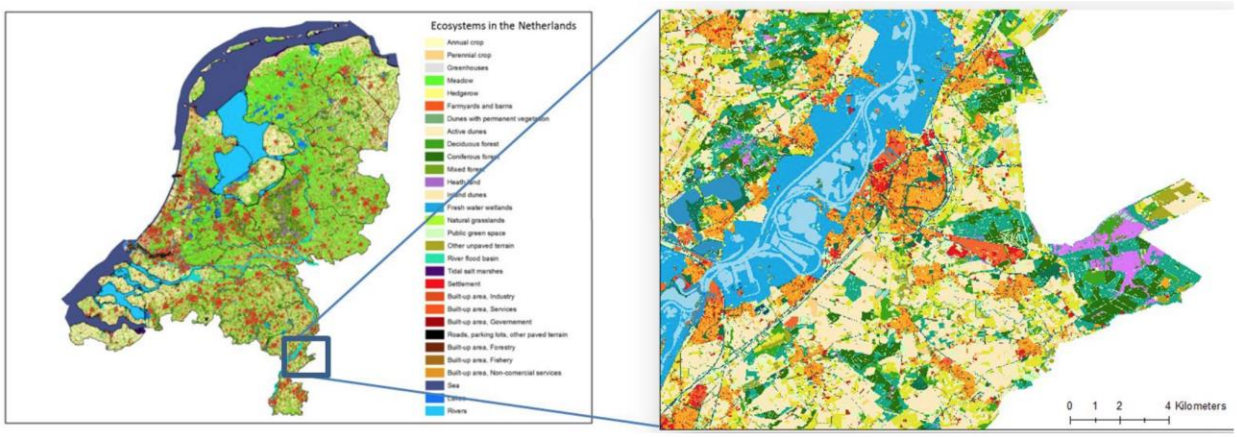
accounts to respond to policy needs when it comes to the environment and the relationship between the environment and economy. At the same time, the Strategy will adhere to the agreed SEEA standard, ensuring comparability and compatibility among the accounts and approaches (Commonwealth of Australia, 2018).

3.3 The SEEA for Biodiversity in the Netherlands

47. In 2016, Statistics Netherlands and Wageningen University embarked on a three-year project to test and implement the core suite of physical and monetary ecosystem accounts and thematic accounts for carbon and biodiversity at a national scale. At present, the Netherlands has completed ecosystem extent and physical ecosystem service accounts, and their effort for ecosystem service accounts represents the world's first national-scale effort at ecosystem services supply and use accounts developed in line with the SEEA EEA.

48. For ecosystem extent accounts, the Netherlands' experience demonstrates the rigorous yet flexible nature of the SEEA. Mapping of ecosystem type was done consistent with the SEEA EEA ecosystem types, which are based on land cover and land use classes. However, in a response to policy needs, the Netherlands also distinguished dunes and flood plains in their accounts. Flood plains along rivers are used as water retention areas, which are critical for controlling flood risks, and the land cover in these flood plains is mostly grassland. Using high resolution maps, accounts provide the basis for analysing the supply and use of ecosystem services, including water retention and storm protection services (UN, 2017b).

Figure 6. Map of ecosystem extent in the Netherlands



Source: Technical Recommendations in Support of the System of Environmental-Economic Accounting 2012—Experimental Ecosystem Accounting (UN, 2017b).

49. For their ecosystem service accounts, the Netherlands focused on specific ecosystem services of high policy relevance, including provisioning services such as crop production, regulating services such as pollination and cultural services such as nature recreation. To arrive at physical and monetary service accounts, the Netherlands developed spatial models for the ecosystem services to represent the spatial heterogeneity of ecosystem service provision

throughout the Netherlands. Based on these models, biophysical supply and use tables were developed, and additional data was applied to develop monetary models.

50. For example, to develop pollination accounts, the Netherlands plotted the pollination service of ecosystems (based on crop demands) and the potential pollination service of the ecosystems (based on the suitability of the ecosystem for pollination), to arrive at the avoided production loss from pollination from wild organisms, such as wild bees and bumble bees (Remme et al., 2018). By connecting the pollination accounts to crop provisioning, the Netherlands highlighted the economic contribution of this valuable ecosystem service. Furthermore, the accounts indicated that several parts of the country have a shortage of wild pollinators compared to crop requirements. The accounts indicated that pollination service often depends on small landscape elements such as hedgerows or forest patches. Thus, the results have important implications for land management and suggest the importance of preserving small landscape elements in maintaining the supply of pollination services (Remme et al., 2018).

3.4 The SEEA for Biodiversity in South Africa

51. Like Mexico, South Africa is also one of the partner countries taking part in the E.U.-funded NCAVES project. Under the project, Statistics South Africa and the South African National Biodiversity Institute (SANBI) plan to compile national land and ecosystem accounts, selected city-region accounts, protected area accounts, selected species accounts and marine ecosystem accounts.

52. The plans under the NCAVES project build off the work done under the Advancing SEEA Experimental Ecosystem Accounting project (ANCA), implemented by UNSD, UNEP and the CBD, with funding from the Government of Norway. As part of the ANCA project, Statistics South Africa and SANBI worked to compile land cover and ecosystem extent accounts for the KNZ region. These accounts illustrate important trends of changes in extent of ecosystems. For example, the accounts showed that the grassland biome of KZN showed a current extent of 2.6 million hectares relative to a historical extent of 4.6 million hectares—a decline of 43 per cent. Similarly, the Indian Ocean Coastal Belt was estimated to have a current extent of 0.3 million hectares relative to a historical extent of 0.9 million hectares—a decline of 67 per cent (Driver et al., 2015).

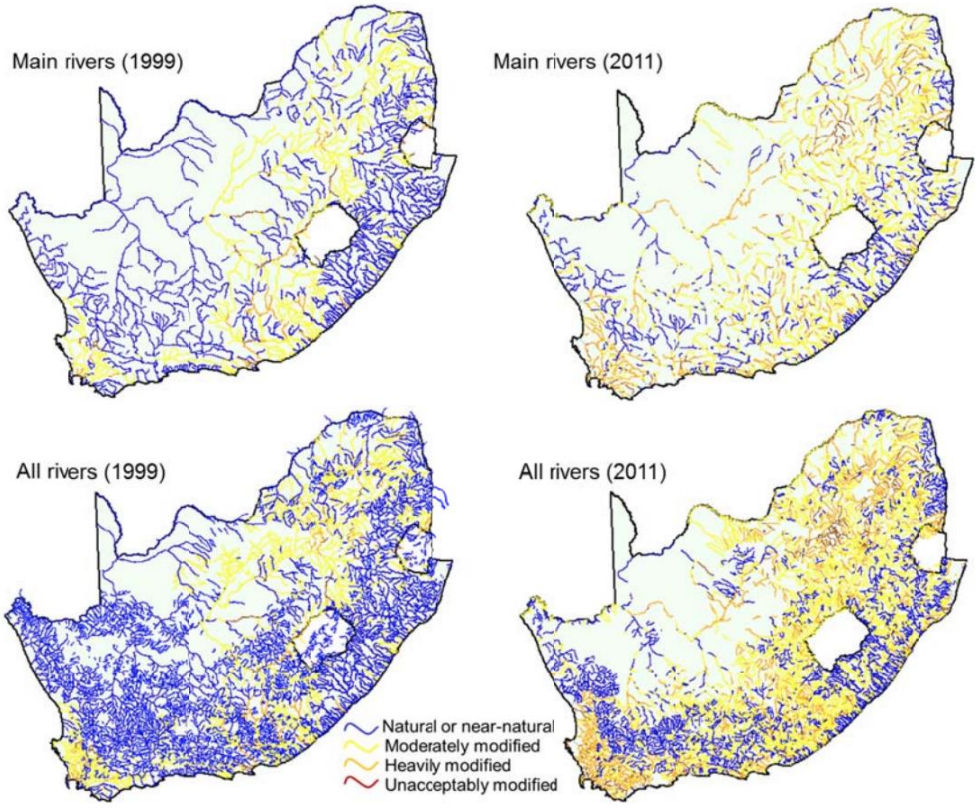
53. Combined with knowledge of land use and management, these findings have important implications for ecosystem diversity in the KZN region in the future. To understand how land use and management have impacted ecosystem extent, Statistics South Africa and SANBI integrated the land cover and ecosystem extent accounts. In doing so, they were able to illustrate that subsistence agriculture was the dominant cause of decline in extent for all biomes identified except for forests. They also found that in the Indian Ocean Coastal Belt, built-up areas from the expansion of coastal development also played a large role in the decrease in extent (Driver et al., 2015).

54. In addition, Statistics South Africa and SANBI have compiled national river ecosystem extent and condition accounts to better enhance management of South African rivers. By presenting the accounts in biophysical as well as administrative units, the accounts serve as a

measurement framework for monitoring Water Management Areas (WMAs) in South Africa, which are important administrative units for management of water resources.

55. Ecosystem condition accounts were provided for rivers using four ecological condition indicators: flow, water quality, instream habitat and stream bank/riparian habitat. As the SEEA framework can provide a basis for aggregate indicators, Statistics South Africa and SANBI used the condition account to calculate an aggregated, easily interpretable ecological condition index. By highlighting the degree to which rivers have been modified by human activity, the accounts provide vital information on the impact human activity has had in terms of ecosystem degradation (Nel and Driver, 2015).

Figure 7. Maps of the aggregated ecological condition category for main rivers and all rivers in South Africa, 1999 and 2011



Source: National River Ecosystem Accounts for South Africa Discussion Document (Nel and Driver, 2015).

3.5 The SEEA for Biodiversity in Indonesia

56. Indonesia has compiled SEEA accounts for several years and is currently a participant in the World Bank Wealth Accounting and the Valuation of Ecosystem Services (WAVES) project. Indonesia's participation in WAVES is an acknowledgement of the need to protect and

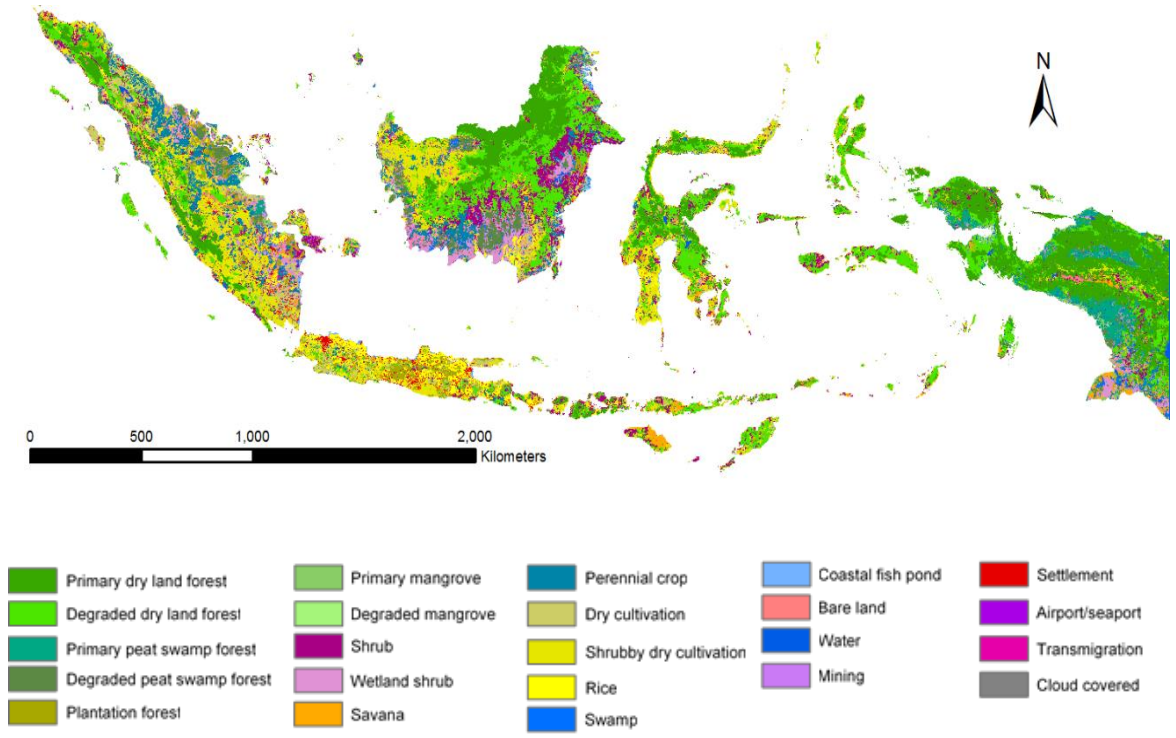
sustainably use natural capital. The Government of Indonesia's National Medium-Term Development Plan (RPJMN, 2015-2019) makes a strong commitment to sustainable development and the use of the SEEA in accounting for natural capital has been crucial to ensure that the targets of the RPJMN are met.

57. In 2016, the Indonesia Statistical Agency (BPS), with technical assistance from the ABS, compiled pilot land accounts for the whole of Indonesia. The physical land asset accounts were compiled for 2009 and 2014, allowing BPS to understand the extent of changes to Indonesia's land cover types and ecosystems, as well as where these changes were occurring. The accounts revealed that Indonesia lost nearly 2 million hectares of forest cover over the five-year period. The accounts also revealed a main driver of this change to ecosystems—the expansion of perennial crops, of which palm oil production is a main component, was linked to the high rate of forest conversion.

58. The spatially explicit nature of the accounts makes Indonesia's land accounts particularly policy relevant. The base maps, which come from the Ministry of Environment and Forestry, have a high resolution of 30 by 30m, meaning they can provide immense detail on changes in land cover and ecosystem extent. The maps revealed how land cover change has taken place throughout Indonesia. For instance, overall, Indonesia saw a one per cent decrease in forest cover between 2009 and 2014, but the accounts revealed that the decrease in forest cover was far from uniform across Indonesia. While the percentage of forest loss was only .2 per cent in Papua and .34 per cent in Maluku, it was 1.26 per cent in Sumatra, 2.19 per cent in Kalimantan and 2.41 per cent in Bali-Nusa Tenggara (BPS, 2017). The spatial variation in the rate of forest loss has important implications for determining where and how land management strategies should be applied.

59. BPS is also currently undertaking ecosystem accounts (extent, condition, service and carbon) for peatlands in the Indonesian islands of Sumatra and Kalimantan as part of the WAVES programme. Peatlands cover approximately 8 per cent of Indonesia's land surface and are vital for the cultivation of palm oil, one of Indonesia's main agricultural commodities. At the same time, there is concern that the degradation of peatlands will negatively impact sustainable development. As a result, Indonesia has set targets to restore approximately 2.5 million hectares of degraded peatlands by 2020. By compiling ecosystem extent accounts for peatlands, BPS hopes to demonstrate the potential of the accounts for informing policies for the rehabilitation of peatlands, commitments to reducing carbon emissions under the Low Carbon Development Plan and payment for ecosystem services (PES) schemes.

Figure 8. Land cover map of Indonesia for 2014



Source: Sistem Terintegrasi Neraca Linkungan Dan Ekonomi Indonesia 2012-2016 (BPS, 2017).

4 SUPPORTING MONITORING OF PROGRESS OF THE POST-2020 AGENDA

60. The UNCEEA and United Nations Statistics Division, as Secretariat of the UNCEEA, are well positioned to support monitoring of the Post-2020 Agenda. As mentioned previously, the SEEA EEA revision process is now underway, under the auspices of the UNCEEA. At the heart of the SEEA EEA is a methodology to account for ecosystem and species diversity, ecosystem services and the effectiveness of economic responses in support of biodiversity. The SEEA EEA revision is scheduled to be completed by the end of 2020. During the revision process, it is expected to reach an agreement on a substantial part of the methodology. The recording of biodiversity in the accounting framework will receive special consideration.

61. In recognition that the contribution of the scientific community will improve the science/policy interface to support research-based advice on biodiversity, the UNCEEA has taken considerable effort to bring together different communities as part of the revision process. In essence, the revision process is a collaborative effort of different communities, including the statistical community (in particular the environmental accounting community), the scientific community, the conservation community, the geospatial community and the policy community. This collaborative effort will strengthen the science/policy interface of the SEEA EEA and will

enhance the effectiveness of the SEEA EEA in providing a measurement framework for biodiversity that can complement other efforts, such as those from IPBES.

62. The UNCEEA is also well positioned to promote regional cooperation to monitor the implementation of NBSAPs and progress towards national targets through the SEEA. Regional cooperation is an effective means to deliver capacity building efforts and promote south-south collaboration to address national policy issues which may be similar across a given region. The five Regional Commissions of the United Nations are all represented on the UNCEEA and help coordinate efforts to develop capacity development and technical support at a regional level. In addition, the Gaborone Declaration for Sustainable Development (GDSA) can also promote regional cooperation to monitor the implementation of NBSAPs through its commitment to natural capital accounting. In particular, the GDSA commitment to natural capital accounting includes undertaking sub-national or national initiatives on ecosystem valuation and natural capital accounting according to the SEEA standard.

63. The establishment and strengthening of national institutional arrangements will be key for the promotion, coordination and monitoring of the implementation of NBSAPs. As an integrated framework, implementation of the SEEA necessitates strong national institutional arrangements and cooperation. By bringing together economic and environmental information, the production of SEEA accounts requires a multidisciplinary, cross-sectoral effort by nature. The national statistical offices play an important role in coordinating the national statistical systems and in integrating the information into the accounts providing credible, replicable and trusted data. A vast majority of countries that have compiled SEEA accounts have instituted cross-agency and/or cross-sectoral working groups or technical committees to harness synergies and promote data sharing. In turn, by presenting integrated data and indicators to policy makers, the SEEA promotes an integrated and multidisciplinary policy response.

64. Lastly, funding will be crucial to strengthening basic statistics and developing sustainable SEEA accounts. The Global Environmental Facility (GEF) has included natural capital and environmental accounting as one of its priorities in its latest round of investments (GEF-7). This represents a significant opportunity to increase the development and implementation of SEEA accounts in support of the post-2020 agenda, and members of the UNCEEA are ready to offer technical assistance to help build capacity in developing countries, in particular least developed countries and small island developing States, as well as countries with economies in transition.

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