Assessing the linkages between global indicator initiatives, SEEA Modules and the SDG Targets

Report of the NCAVES Project

photos : John Rodenn Castillo and Lavelle Gaither Du

United Nations | System of Environmental Economic Accounting

Citation and reproduction

Citation: UNSD (2019). Assessing the linkages between global indicator initiatives, SEEA Modules and SDG Targets. United Nations Statistics Division, Department of Economic and Social Affairs, New York

Acknowledgements

The report is an output of the European Union funded Natural Capital Accounting and Valuation of Ecosystem Services (NCAVES) project. The report has been authored by Steven King, Katherine Moul, James Vause and Claire Brown of the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) under the guidance of Julian Chow and Alessandra Alfieri of the United Nations Statistics Division.

The findings, interpretations, and conclusions expressed herein are those of the author(s) and do not necessarily reflect the views of the United Nations or its officials or Member States or the European Union.

UN environment programme WCMC

Funded by the European Union

Table of Contents

List of Tables

List of Figures

Indicators and Natural Capital Accounting

The Natural Capital Accounting and Ecosystem Service Valuation (NCAVES) project is a joint initiative launched by the United Nations Statistics Division, the United Nations Environment Programme and the Secretariat of the Convention on Biological Diversity and funded by the European Union. NCAVES is working in collaboration with the five participating partner countries, namely Brazil, China, India, Mexico and South Africa, to advance the knowledge agenda on ecosystem accounting.

The indicator workstream of the NCAVES project assesses the linkages of the System of Environmental-Economic Accounting Ecosystem Accounting (SEEA EA) to the existing global monitoring frameworks, such as those used for reporting on the Sustainable Development Goals (SDGs), the Aichi targets and emerging post-2020 Global Biodiversity Framework, as well as the national indicator initiatives from the NCAVES countries. This assessment is summarised in the following reports:

- **Assessing the linkages between global indicator initiatives, SEEA Modules and the SDG Targets (2019):** Presents an assessment of the potential to derive or align key global environmental and development indicators with the SEEA.
- **Assessing the linkages between national indicator initiatives, SEEA Modules and the SDG Targets (2021)**: Presents an assessment of the potential to derive or align national indicator sets of the NCAVES countries with the SEEA.

As part of the activities of the indicator workstream, a set of technical notes were produced to support the NCAVES countries to test the generation of a selected set of SDG indicators using the SEEA. The technical notes describe SEEA based approaches to calculate four of the global SDG indicators from the indicator framework developed by the Inter-Agency and Expert Group on SDG Indicators (IAEG-SDGs). The technical notes are in alignment with the methods described for calculating these global SDG indicators, as described in their associated metadata sheets.[1] The approach to implementing the technical notes and the countries experiences in testing them are summarised in the following reports:

- **Using the SEEA EA for Calculating Selected SDG Indicators (2020):** Presents a series of *Technical Notes* to support the calculation of 4 priority SDG Indicators using the SEEA EA framework.
- **Using the SEEA EA for Calculating Selected SDG Indicators – Project country testing experiences (2021)**: Summarises the experiences of the NCAVES countries in evaluating and implementing these technical notes.

The indicator workstream confirms the broad potential for the SEEA to support the calculation and mainstreaming of many global indicators. The assessment of linkages with global indicators, identifies that 34 of the 147 Aichi target indicators and 21 of the 230 SDG indicators can be aligned to selected modules of the SEEA. The usefulness of the SEEA as a tool to mainstream the environment and biodiversity into national planning processes is also explicitly recognised via SDG Indicator 15.9.1 and via Aichi Target 2. The potential for the SEEA EA to support other key international environmental conventions and platforms, including the UNCCD, Ramsar and IPBES, is also identified.

The assessments of linkages to national indicators confirms the strong potential for the SEEA to support national reporting on SDGs and the general measurement of national indicators in the

[1] https://unstats.un.org/sdgs/metadata/

NCAVES countries. An important collective observation from the national assessments is that the different SEEA accounting modules can inform on a range of environmental policy objectives, themes, development perspectives and analytical objectives (including indicator gap analysis). This illustrates a key advantage in using the SEEA as an organising framework for indicator calculation, as it is a multipurpose framework with a modular approach, allowing countries to focus on both policy and analytical priorities.

The development of four technical notes provided the opportunity to test the potential of the SEEA EA for SDG indicator generation in practice. Testing the technical notes across four NCAVES countries confirmed the strong potential of the SEEA to support the calculation of SDG Indicators. Most countries were able to generate a national version of SDG 15.1.1 (Forest area as a proportion of total land area), SDG 6.6.1 (Change in the extent of water-related ecosystems over time) and SDG 11.7.1 (Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities). in practice. Calculating SDG 15.3.1 (Proportion of land that is degraded over total land area) was found to be more challenging, typically due to data constraints. However, the potential for the SEEA EA to support the generation of this indicator, in due course, was highlighted by the NCAVES countries.

An important insight from the testing is that there is often a need to tailor global SDG indicator methods to make the indicators meaningful to national circumstances. The flexible nature of the SEEA as an organising framework was highlighted by the NCAVES countries as being very useful to aid calculating these nationally tailored SDG indicators in a rigorous and consistent manner. With regular updates, these can also be matched and integrated into different national policy cycles and planning strategies for various sectors. This will be key for fostering integrated policy making that is built on understanding of the interactions, synergies and trade-offs between the environment and economy. This is fundamental to informing sustainable development that proceeds in balance with nature.

The reports highlighted above are available from the UNSD SEEA webpages at: https://seea.un.org/content/indicators-and-natural-capital-accounting.

Glossary

There are a number of terms used to inform the analysis of indicators and ecosystem and other environmental accounts in this document that may cause some confusion to readers familiar with their use in different contexts. This glossary sets out these particular terminologies for the avoidance of doubt.

Global indicator initiative: A set of indicators for reporting on progress towards global commitments (SDGs, CBD Aichi Targets or the UNCCD) or other global environmental processes (e.g., IPBES).

Indicator ID: The unique alpha numeric identifier for a specific indicator from a global indicator initiative. The ID comprises an alphabetic prefix identifying the indicator initiative and numerical suffix representing the relevant goal or target. For example, SDG 15.1.1 identifies the first SDG indicator for goal 15 and Target 1.

SDG indicator: The indicator belonging to the SDG global indicators framework adopted by the General Assembly upon recommendation of the Statistical Commission for measuring progress towards a specific SDG Target.

Input indicator: An indicator that can contribute data or information that can be directly integrated into SEEA accounting modules (e.g., data on ecosystem condition).

Output indicator: An indicator that can be directly generated from the SEEA accounts.

Distinct indicators: Indicators that belong to more than one global indicators initiative should not be double counted (e.g., change in the extent of water related ecosystems is used as the indicator for both SDG 6.6.1 and Aichi Target 5.5.1). A set of distinct indicators is a set where a distinct environmental or economic indicator only features once.

Full Possibilities for Alignment with SEEA: Output indicators for which the SEEA has clear potential to provide all, or most, of the information required for their calculation and input indicators that provide data for SEEA accounts. Conceptual alignment based on the structure of the SEEA framework is implied.

Partial Possibilities for Alignment: Indicators for which the SEEA provide only some of the information for their calculation with substantial information required from other sources.

Indicator Methodological Gap: Proposed indicator from a global initiative for which there is no agreed methodology for measurement. Tier III SDG Indicators and the generic Aichi Targets indicators with no specific indicators are included.

Mainstreaming Opportunity: Possibility for the SEEA to generate an indicator that communicates progress of integrating the benefits provided by the environment / biodiversity into sustainable development planning (i.e., progress towards implementing an ecosystem approach to sustainable development).

1 Introduction

This document presents the results of assessing the potential to align selected SEEA with key global environmental and development indicators, as described in Section 1.2. The document is supported with a supplementary report: *Assessing the linkages between national indicator initiatives, SEEA Modules and the SDG Targets*, produced by UNEP-WCMC and UNSD (2020). This supplement assessing the linkages between national indicator sets of the NCAVES projects, with the SEEA.

1.1 Background to the SDG Indicators

In 2015 the UN Statistical Commission established the Inter-Agency Expert Group on SDG (Sustainable Development Goals) Indicators (IAEG-SDGs) to develop and implement a global indicator framework for the SDGs and their targets. This framework was developed and adopted by the General Assembly on Work of the Statistical Commission in July 2017 (as set out in the Annex of UN General Assembly Resolution A/RES/71/313).[2] To facilitate the implementation of this framework, all indicators are classified into three tiers based on their methodological development and availability of data at a global level, as follows:

- Tier I: indicator is conceptually clear, established methodology and standards are available and data are regularly produced by countries;
- Tier II: indicator is conceptually clear, established methodology and standards are available but data are not regularly produced by countries
- Tier III: no established methodology or standards are available for the indicator or methodology/standards are being developed or tested for the indicator.[3]

To inform the high-level political forum on progress towards the Sustainable Development Goals, annual reports are produced under the auspices of the Secretary-General in cooperation with the United Nations based on this global indicator framework (UN Economic and Social Council, March 2017).[4] The indicators presented in the progress report represent global, regional and sub-regional aggregates calculated from data produced by national statistical systems (para. 2 and as directed by Resolution A/RES/71/313).[5, 6] These data are aggregated by international agencies / custodians, who may adjust national data for international comparability or estimate missing values using Tier I or Tier II approaches outlined above when countries have no data on the indicators themselves.

National statistical offices face significant reporting requirements, with respect to the SDGs and other conventions and processes. The SEEA (System of Environmental-Economic Accounting) is a multi-purpose statistical framework and provides an opportunity to streamline the production of SDG Indicators with an environmental dimension with other demands for environmental-economic statistics. For example, mainstreaming the environment into development and economic planning, reporting under the other Rio conventions (United Nations Convention on Biological Diversity, Framework Convention on Climate Change and Convention to Combat Desertification) and understanding the distribution and status of a country's natural capital wealth. This will not only reduce the data processing demands on national statistical agencies,

[2] https://undocs.org/A/RES/71/313
[3] https://undocs.org/E/CN.3/2017/2
[4] https://unstats.un.org/sdgs/files/report/2017/secretary-general-sdg-report-2017--EN.pdf
[5] https://unstats.un.org/sdgs/files/report/2017/secretary-general-sdg-report-2017--EN.pdf
[6] https://undocs.org/A/RES/71/313

but also on custodian agencies who have to apply agreed global methodologies where national data gaps emerge.

1.2 Aims and objectives

The aim of the work presented in this report is to develop an integrated environment-economy focused sustainable development indicator set based on the SEEA Experimental Ecosystem Accounting (SEEA-EEA) modules and selected modules in the SEEA Central Framework (SEEA-CF), in the context of the 2030 Sustainable Development Agenda and the discussion on the Post 2020 Biodiversity Framework. The starting point for this work is to establish the role the SEEA can play in directly supporting the production of SDG Indicators. This is described in the left hand side of Figure 1, which illustrates the well-known information pyramid. As shown in right hand side of Figure 1, the work is extended to evaluate how the SEEA can be aligned with other existing global indicator initiatives and associated data. This includes how the SEEA can be used to organise the environmental, social and economic data currently used for calculating multiple indicators on an individual basis in a consistent, harmonised fashion (represented by the bottom arrow in Figure 1). Accordingly, the SEEA accounting modules can be used to readily generate a range of indicators to support multiple reporting commitments (represented by the return arrow to the tips of the smaller pyramids in Figure 1). The work also evaluates existing indicators from these initiatives could also input SDG data to the SEEA Modules (e.g., with respect to Ecosystem Condition Accounting, also represented by top arrow in Figure 1). This analysis is intended to facilitate and improve our understanding of how the SEEA can:

- Streamline multiple environmental reporting obligations and avoid repeated calculations of indicators from basic data.
- Improve consistency between multiple datasets and indicators for informing on progress towards the SDGs.
- Facilitate the integration of existing indicators into environmental-economic analysis to provide an improved evidence base to inform sustainable development.

In addition, to global indicator initiatives, national Indicators from Brazil, China, India, Mexico and South Africa have been assessed in the *Assessing the linkages between national indicator initiatives, SEEA Modules and the SDG Targets (2020)* report.

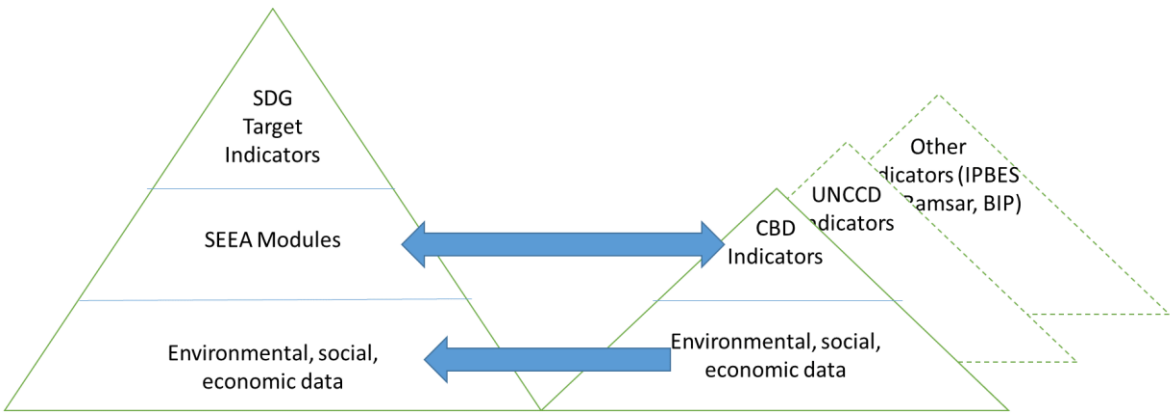


Figure 1: Structure of the analysis

There are five objectives for the analysis:

1. Which global indicators have the potential to be generated using SEEA accounts and support reporting on progress towards SDG Targets?
2. Which global indicators can provide input data for SEEA Modules in support of reporting on progress towards SDG Targets?
3. What are the gaps in current indicator initiatives that could be filled using the SEEA and existing global (and national) data?
4. Which global indicators that could be generated by the SEEA to support reporting on SDG Targets should be considered priorities for testing?
5. What are the most suitable economic instruments to stimulate progress towards SDGs and associated policy targets based on the set of identified priority indicators? (see Appendix D)?

2 Relevant SEEA Accounts

This analysis specifically focuses on the core and thematic accounts of the SEEA-Experimental Ecosystem Accounting (SEEA EEA) and those in the SEEA Central Framework (SEEA CF) that are most relevant to ecosystems and the services they provide (e.g., water provision, fish stocks, etc.). These comprise the following:

- **Ecosystem Extent and Ecosystem Condition Accounts:** These are the core biophysical accounts for measuring the stocks of ecosystem assets in the SEEA EEA. They measure the area of ecosystems by type and the biophysical characteristics that help understand the condition of the ecosystems.
- **Ecosystem Services – Supply and Use (Physical and Monetary) Accounts.** These accounts record the actual flows of goods and services from ecosystems to the economy in both physical and monetary terms. It should be noted that the ecosystem services accounts are an extension of the SEEA CF Physical Supply and Use Tables.[7]
- **The SEEA-CF Physical Flow (Supply and Use) Accounts.** These accounts measure the flow of natural resources supplied by the environment, their use within the economy and the returns of residuals in the form of solid waste, wastewater and emissions back to the environment. These accounts provide information on provisioning services and as such they should be integrated with ecosystem service supply and use accounts to support integrated ecosystem-economic analysis. The SEEA CF Residual Accounts are not considered in the analysis, although they do provide information on ecosystem condition pressures.
- **Thematic Biodiversity, Water, Carbon and Land Accounts**. Thematic accounts for land and water are presented in the SEEA EEA and are grounded in the SEEA-CF Asset Accounting approach / format.[8]
- **The SEEA-CF Physical Asset Accounts**. These accounts provide measures of 'Stocks' of natural resources and may be an explicit parameter in an SDG indicator. Those that align with relevant provisioning services (e.g., timber, water, fisheries) are specifically considered in the analysis

The Environmental Activity Accounts of the SEEA CF are recognised to have the potential to inform on several of the SDG Indicators related to Overseas Development Assistance and Government Expenditure on environmental protection. However, whilst these possibilities are acknowledged, this analysis does not attempt to make the links to these accounts. The need to align classification of biodiversity expenditures (e.g., under BIOFIN) and these accounts is acknowledged and a programme for advancing this is under development between

[7] See para 5.10 of the Technical Recommendations in support of the SEEA Experimental Ecosystem Accounts https://seea.un.org/sites/seea.un.org/files/technical_recommendations_in_support_of_the_seea_eea_final_white_cover.pdf

[8] See para 9.4 of the Technical Recommendations in support of the SEEA Experimental Ecosystem Accountshttps://seea.un.org/sites/seea.un.org/files/technical_recommendations_in_support_of_the_seea_eea_final_white_cover.pdf

environmental-economic accounting and biodiversity financing communities.[9] This will support indicator production for SDG 15a and 15b.

With a clearly defined set of accounts identified, the following sections set out a stepwise approach for assessing specific global indicator initiatives from a SEEA perspective and explicitly linking them to the above accounts. By adopting a systematic approach, gaps in the current global indicator initiatives can be identified and opportunities for the SEEA to generate indicators for priority SDG Targets can be developed. Indicator alignment is considered from two perspectives:

1. *Generated using SEEA*. These are indicators that can be derived directly from the above accounting modules, termed **output indicators** (e.g., *Forest area as a proportion of total land area* could be directly calculated from land cover or ecosystem extent accounts); and,

2. *Integrated into SEEA.* These area indicators that can contribute SDG data or information to any of the above accounting modules, termed **input indicators** (e.g., *Index of coastal eutrophication and floating plastic debris density* could be integrated as a data item into an ecosystem condition account for marine coastal ecosystems).

9 https://unstats.un.org/unsd/envaccounting/ceea/meetings/twelfth_meeting/Methodological%20alignment-biodiversity%20accounting%20Final.pdf

3 Global Indicator Review

To focus the analysis, an inventory of global indicator initiatives was compiled. The inventory included initiatives for the SDGs, Multilateral Environmental Agreements, biodiversity and the environment, Green Economy / Growth and Wealth Accounting. This inventory is presented as Appendix A, which provides a brief review of each indicator initiative and an assessment of their priority for analysis. This assessment is based on the relevance of the indicator to the SDGs and the accounts identified in Section 2. The review identified the following initiatives as high priority:

- Global Framework of SDG Indicators.
- United Nations Convention on Biological Diversity (CBD) Aichi Target Indicators (to be updated in 2020).
- United Nations Convention to Combat Desertification (UNCCD) Indicators.
- Possible Future United Nations Framework Convention on Climate Change (UNFCCC) Indicators.
- Biodiversity Indicator Partnership (BIP) Indicators.
- Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) Indicators.
- Sendai Framework for Disaster Risk Reduction (Sendai) indicators.
- The Ramsar Convention on Wetlands Indicators.
- United Nations Economic Commission for Europe (UNECE) Core climate-change related indicators

The assessment follows a stepwise approach. In Section 3.1 the SDG and other global indicator initiatives listed above are reviewed and assessment is made on the possibilities to fully or partially align individual indicators from these initiatives with the SEEA. This is based on metadata requirements or the possibilities for the indicators to be directly integrated into the relevant accounting modules set out in Section 2. Section 3.2 builds on this assessment by focusing on those indicators identified as full possibilities for alignment with the SEEA. Specifically, Section 3.2 resolves any repetitions of indicators (e.g., change in the extent of water related ecosystems is an SDG Indicator and an Aichi Target Indicator). This allows a set of distinct indicators to be identified and avoids having to assess the same indicator twice (or more). Section 3.2 then establishes the key SEEA accounting modules that each distinct indicator can be aligned to. Section 3.3 explores overlaps where SDG Indicators are also used for reporting on progress under other global indicators initiatives (e.g., Aichi Targets and UNCCD). Identifying these instances is important as it identifies those indicators that serve multiple purposes and will have high demand from policy makers and environmental managers. Section 3.4 is similar but focuses on where the Aichi Targets overlap with other global indicators (excluding SDG indicators). Section 3.5 explores the existing methodological gaps for calculating SDG and Aichi Target Indicators and identifies indicator development possibilities for the SEEA to address. Finally, Section 3.6 takes a broader environment-economy perspective by identifying the key biodiversity mainstreaming opportunities the SEEA can provide. This includes identifying a set of potential SDG Targets where the SEEA could generate indicators for measuring progress in implementing ecosystem based approaches towards their attainment.

3.1 Methodology for assessing SDG Indicators from a SEEA Perspective

The IAEG-SDG Indicators are the necessary starting point to assess global indicator initiatives form a SEEA perspective as they inform a set of SDG Targets to prioritise and initially focus on. From this assessment a common approach and format for organising information and assessing other global indicators form a SEEA perspective is achieved. This allows the findings from the assessments of different indicator sets to be combined in a way that allows a coherent picture of the global indicator landscape to be developed (e.g., where synergies might lie, where gaps may emerge, etc.).

3.1.1 Methodology for assessing SDG Indicators from a SEEA Perspective

To assess the IAEG-SDG Indicator set from a SEEA perceptive, we implemented the following stepwise approach (this is presented in Appendix B, SDG Indicators Tab, with reference to the columns as indicated below):

1. The official list of SDG indicators and associated metadata were reviewed.[10] Expert judgment was used to identify any indicators that could in part (e.g., ratio indicators) or completely, be generated by the SEEA framework (e.g., SDG Indicator 15.1.1 Forest area as a proportion of total land area), or that could provide input data to the SEEA framework (e.g., SDG Indicator 14.3.1 on marine acidity for ecosystem condition accounting) (Column B).[11]
2. A unique Indicator ID field to represent the indicator, comprising 'SDG' and the indicator number (e.g., SDG 15.3.1) was specified (Column A).
3. The Custodian Agency information (Column C) and information on the operational status of the indicator) (Column D) was added to the spreadsheet. The operational status was based on the Tier Classification provided by IAEG-SDG Members as of 15 December 2017[12] and updated to reflect the six requests agreed by the IAEG-SDG for reclassification of Tier III indicators to Tier II during the meeting of the group between 10 – 12 April 2018.[13]
4. Information on the indicator definition (Column E), computation method (Column F), data availability (including limitations) (Column G), and (where possible) frequency of production / data collection (Column H) for the indicator was added from the SDG Indicators metadata repository for Tier I and II and the Work Plans for Tier III Indicators. [14, 15]
5. Details on how the SDG Indicator could be aligned with the SEEA framework accounts in terms of their potential to be integrated into the SEEA framework (Column I) and / or

[10] https://unstats.un.org/sdgs/metadata/

[11] We took the SEEA alignment SDGs_24_01_18.xls provided by UNSD as our starting point and adapted this to include columns on alignment with SEEA ('Integrated into SEEA' and 'Generated by SEEA') and integrated the UNCEEA Comments to the IAEG as appropriate (SEEA and SDGs_Green_20 Nov.xls – provided by UNSD)

[12] https://unstats.un.org/sdgs/iaeg-sdgs/tier-classification/

[13] https://unstats.un.org/sdgs/files/meetings/iaeg-sdgs-meeting-07/7th%20IAEG-SDG%20Meeting%20tier%20reclassification%20requests_list%20of%20indicators_web.pdf

[14] https://unstats.un.org/sdgs/metadata/

[15] https://unstats.un.org/sdgs/tierIII-indicators/

generated using the SEEA framework (Column J) was added to the spreadsheet based on expert judgement.

6. With this information in place, the spreadsheet was reviewed and each indicator assigned a 'Full', 'Partial', or 'None' possibility for alignment with the selected SEEA accounting modules listed in Section 2. This was based on a consideration of the following factors:
    a. **Full:** Where the SEEA has clear potential to provide all, or most, of the information required to calculate the indicator or when the indicator clearly represents an input data for an accounting item of interest (e.g., an indicator of condition that could be directly integrated into an ecosystem condition account). This represents a conceptual alignment based on the structure of the SEEA framework.
    b. **Partial:** Where the SEEA could organise some of the information for calculating the indicator but:
        i. there were more efficient / accepted means already in place;
        ii. the indicator was derived from a statistical procedure to deal with missing data gaps (e.g., Living Planet Index); or,
        iii. the SEEA provides information that is essential or highly suited for calculating the indicator, but substantial additional information from non-SEEA sources is also required.
    c. **None:** where the identified accounts were not considered relevant to the issue the indicator is designed to inform on.
7. The penultimate column provides a short explanation of the above categorisation (Column K).

3.1.2 Methodology for Linking Other Global Indicators to the SEEA

The same approach and excel spreadsheet format employed for the SDG Indicators assessment was also applied for the other high priority global indicator initiatives. The data consulted to inform the indicator selection and its metadata, together with any methodological adaption is summarised below:

1. **Aichi Target Indicators:** The list of 147 indicators proposed at CBD COP 13 was reviewed.[16] Specific indicators that were quantitative in nature and not related to plans, management actions, policies or finance were captured in the spreadsheet. For instance, the specific indicators for Aichi Targets 16 to 20 were not included in the spreadsheet as they did meet these criteria. Where necessary additional information on information was collected from the BIP website.[17] Where an Aichi Target was also an SDG Indicator, this was recorded (Column M), or if there was a link, but not a direct match, to an SDG Target, this was noted in the spreadsheet (Column N).
2. **UNCCD Indicators:** The list of 14 progress indicators proposed at COP 13, Ordos, China 2017 was reviewed (note this is a draft decision at present).[18] All indicators relevant to Strategic Objective 1 (to improve the condition of affected ecosystems); Strategic Objective 2 (to improve the living conditions of affected populations), Strategic Objective 4 (to generate global environmental benefits through effective implementation of the UNCCD) and Strategic Objective 5 (To mobilize substantial and additional financial and non-financial resources to support the implementation of the Convention) were included

[16] https://www.cbd.int/doc/decisions/cop-13/cop-13-dec-28-en.pdf
[17] https://www.bipindicators.net/
[18] https://www2.unccd.int/sites/default/files/sessions/documents/2017-09/copL-18.pdf

in the spreadsheet. Strategic Objective 3 (to mitigate, adapt to, and manage the effects of drought in order to enhance resilience of vulnerable populations and ecosystems) was not included due their qualitative nature.

3. **Possible Future UNFCCC indicators:** The United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change.[19] 185 parties of the 197 parties to the UNFCCC have now agreed to work together to keep global temperature rise for this century to well below 2 degrees Celsius above pre-industrial levels, via the 'Paris agreement'.[20] The Paris Agreement requires all Parties to put forward their best efforts through "nationally determined contributions" (NDCs). Each party shall identify the indicator(s) to track progress towards the implementation and achievement of its NDC.[21] However, at this stage there are no established UNFCCC quantitative indicators with possibilities for alignment with the SEEA.
4. **BIP Indicators:** The list of all 54 BIP indicators was assessed along with additional indicators that have since been developed (list obtained from the BIP secretariat at UNEP-WCMC - identified in Column M).[22] A large majority of these indicators reflect the specific indicators of the Aichi Targets. Indicators were included in the spreadsheet if they were quantitative in nature and not related to plans, management actions, policies or finance. Where a BIP Indicator is also an SDG or Aichi Target Indicator, this was recorded (Column N and O, respectively). These indicators were not re-assessed on the BIP spreadsheet.
5. **IPBES Indicators:** The list of 81 core, highlighted and socio-economic IPBES indicators were all captured in the spreadsheet.[23] Where the IPBES indicator was also equivalent to an SDG Target, Aichi Target Indicator or BIP Indicator this was recorded (Column M, N; and O, respectively). These indicators were not re-assessed on the IPBES spreadsheet.
6. **Ramsar Indicators:** In order to track progress towards the Strategic Targets of the convention, a series of indicator questions are posed to countries in Section 3 of the national report template for the Ramsar Convention, which should be completed for each conference of contracting parties (CoP).[24] In total, this comprises of 118 questions and sub-questions arranged across 19 targets. The list of mandatory indicator questions was reviewed, all qualitative indicators (where the answer was coded as A=Yes; B=No; C=Partially; D=Planned; X= Unknown; Y= Not Relevant) were disregarded and the remaining captured in the spreadsheet. Where the Ramsar indicator question reflected an SDG Indicator this was captured in Column M. Where it reflected an Aichi Target Specific Indicator, this was captured in Column N.
7. **UNECE Core climate-change related indicators:** The UN Economic Commission for Europe created a task-force to define a set of internationally comparable key climate change-related statistics and indicators that could be derived using the SEEA Central Framework (SEEA CF) in 2014. It is highlighted that these indicators are in no way endorsed or adopted by the UNFCCC. The task force provided a final report in 2017.[25] The final report

[19] As set out in the Annex of UN General Assembly Resolution A/RES/71/313 - Footnote 4: https://undocs.org/A/RES/71/313
[20] Accessed 29th April 2019: https://unfccc.int/process/the-paris-agreement/status-of-ratification
[21] See the outcome of the Katowice climate change conference: https://unfccc.int/katowice
[22] https://www.bipindicators.net/system/resources/files/000/002/201/original/2827_A3_BIP_Indicator_matrix_2.0.pdf?1512640311
[23] https://www.ipbes.net/indicators-data-ipbes-assessments
[24] https://www.ramsar.org/document/national-report-form-for-cop13-offline-version
[25] https://unece.org/fileadmin/DAM/stats/documents/ece/ces/2016/mtg/19-Report_on_climate_indicators_final.pdf

proposes 39 core climate-change related indicators, all of which are captured in the spreadsheet. The core climate related indicators are supported by the SEEA CF and include indicators derived from a wider set of SEEA CF Accounting Modules than those specified in Section 2. As such these indicators were reviewed to see which could be aligned to the SEEA Modules in Section 2 and tested via the NCA & VES Project. Where the UNECE core climate-related indicator was also an SDG Indicator or Aichi Target, this was recorded (Column M and N, respectively).

8. **Sendai Indicators:** The 38 Sendai Framework indicators are set out in the UN Office for Disaster Risk Reduction (UNISDR) PreventionWeb website.[26] Given the nature of the targets and the specifics of the indicators themselves (e.g., number of countries implementing multi-hazard EWS), the SEEA is considered to have limited utility as a framework for generating Sendai indicators. As such the SEEA is not considered to be relevant to generating any of the specific indicators listed. Nonetheless, there is clearly a role for mainstreaming the environment into disaster risk reduction using the SEEA (this is explored in latter analysis).

3.1.3 Results of Global Indicator Review

After applying the initial selection criteria for including individual indicators from different global initiatives (as described above), it was possible to rationalise the number of indicators for review to 289. The distribution of these indicators is summarised in Table 1, together with the total number of indicators from each initiative reviewed.

Table 1: Distribution of global indicators reviewed

Global Indicator Intative	Total number of indicators	Number of indicators reviewed
IAEG-SDG Target Indicators	230	46
UNCBD Aichi Target Indicators	147	95
UNCCD Indicators	14	14
BIP Indicators	54	60
IPBES Indicators (Core, highlighted and socio-economic)	81	22
RAMSAR Indicators (mandatory national indicator questions)	118	13
UNECE SEEA Climate Indicators	39	39
SENDAI	38	0
Total	**721**	**289**

The results of the analysis for the SDG Indicators only, are presented in Table 2. This is a necessary starting point, as it directs attention to a set of priority SDG Targets to focus the assessment on. Table 2 identifies that out of the 46 SDG Indicators captured on the spreadsheet, 21 have the potential for full and only 2 for partial alignment with the SEEA. As would be expected, Table 2 identifies a number of full possibilities for alignment of the SDG 14 (life below water) and the SDG 15 (life on land) indicators with the SEEA. In addition, a number of full possibilities for alignment are observed for the SDG 6 (clean water and sanitation) and SDG 11 (sustainable cities and communities) indicators. However, the latter would likely require development of urban scale environmental accounts and this may not, necessarily, align with the remit of national statistical agencies (i.e., they may be more likely to be implemented by specific municipal authorities – this is discussed further with respect to SDG 11.7.1 in Section 3.6.2).

[26] https://www.preventionweb.net/drr-framework/sendai-framework-monitor/indicators

Table 2: SDG Indicators that have full or partial alignment with the SEEA[27]

	Full Alignment	Partial Alignment
1	6.3.1 - Proportion of wastewater safely treated	2.4.1 - Proportion of agricultural area under productive and sustainable agriculture
2	6.3.2 - Proportion of bodies of water with good ambient water quality	6.1.1 Proportion of population using safely managed drinking water services
3	6.4.1 - Change in water-use efficiency over time	
4	6.4.2 - Level of water stress: freshwater withdrawal as a proportion of available freshwater resources	
5	6.6.1 - Change in the extent of water-related ecosystems over time	
6	8.9.1 - Tourism direct GDP as a proportion of total GDP and in growth rate	
7	11.3.1 Ratio of land consumption rate to population growth rate	
8	11.7.1 Average share of built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities	
9	14.1.1 - Index of coastal eutrophication and floating plastic debris density	
10	14.3.1 Average marine acidity (pH) measured at agreed suite of representative sampling stations	
11	14.4.1 - Proportion of fish stocks within biologically sustainable levels	
12	14.5.1 - Coverage of protected areas in relation to marine areas	
13	14.7.1 - Sustainable fisheries as a proportion of GDP in small island developing States, least developed countries and all countries	
14	15.1.1 - Forest area as a proportion of total land area	
15	15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type	
16	15.2.1 - Progress towards sustainable forest management	
17	15.3.1 - Proportion of land that is degraded over total land area	
18	15.4.1 - Coverage by protected areas of important sites for mountain biodiversity	
19	15.4.2- Mountain Green Cover Index	
20	15.5.1 - Red List Index	
21	15.9.1 - Progress towards national targets established in accordance with Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011-2020	

[27] See Appendix B for explanation on how each indicator was assessed as Full, Partial or None Possibility for alignment

It should be noted that whilst there is considered to be a full possibility for aligning SDG Indicator 8.9.1 (sustainable tourism) with the SEEA, this assessment is based on the potential for the SEEA to provide information of the contribution of ecosystems to tourism activity and impact of tourism infrastructure on ecosystem extent (e.g., habitat conversion for infrastructure development). It is likely that the final SDG 8.9.1 indicator will also include sub indicators relevant to sustainable resource use, where the SEEA will have a wider role to play (e.g., with respect to quantifying energy use, waste flows and carbon emissions associated with tourism).

For SDG Indicator 15.5.1 (Red List), the level of detail on individual species required to generate the indicator is unlikely to be supported by the SEEA. However, in terms of integrating this indicator into the SEEA, national biodiversity accounts could possibly be informed via the Red List. Furthermore, the data on threat status collated via the Red List index could also be used to provide an aggregate indicator of ecosystem condition. This would require that a National Red List had been compiled, or global Red List data had been disaggregated to the national scale. Each with their advantages and disadvantages.[28] More specific alignment to the SEEA would be greatly increased by sub-setting the Red List data into species with particularly habitat affiliations (Aichi Target 10.2.1 is a good example here, providing a Red List for coral building species).

With respect to the 2 partially aligned indicators, SDG indicator 6.1.1 (Proportion of population using safely managed drinking water), requires understanding the level of drinking water supply at individual household scale. Whilst there may be challenges for the SEEA will provide this insight, there are clear opportunities for the SEEA Water to inform on household water consumption from mains supplies. For SDG indicator 2.4.1 (Proportion of agricultural area under productive and sustainable agriculture), the SEEA is considered to only provide the information on the agricultural area component of this ratio indicator.

The results of the assessment across all global indicator initiatives are summarised in Figure 2. In broad terms, around a quarter of the indicators are assessed as having full possibilities for alignment with the SEEA for the Aichi Targets, UNCCD, BIP, IPBES and Ramsar indicator sets. As such, there is a clearly a potential role for the SEEA to play in supporting reporting on a number of different conventions and national commitments beyond the SDGs.

In absolute terms, Figure 2 reveals 34 specific Aichi Target Indicators and 13 BIP Indicators were identified as full possibilities for alignment with the SEEA (in total 66 are identified across all global indicator initiatives excluding the SDG Indicators). However, a number of these will also be included as SDG Indicators and further analysis is required to identify the distinct indicators that satisfy multiple reporting requirements (provided in Section 3.2). This will help identify where synergies and gaps in global indicators exist. As a synergy example, the Red List Index is an SDG Indicator (SDG 15.5.1) and a Specific Aichi Target Indicator (AT 12.3.1). Overall, 78 indicators are identified as partial possibilities for alignment with the SEEA across global indicator initiatives (excluding the 2 SDG indicators discussed above).

[28] For international comparison disaggregated Global Red Lists are likely to be preferable. This reflects that National Red Lists are likely to vary considerably in coverage of taxonomic groups and to what extent the Red Lists cover the local species diversity (i.e. proportion of species covered).

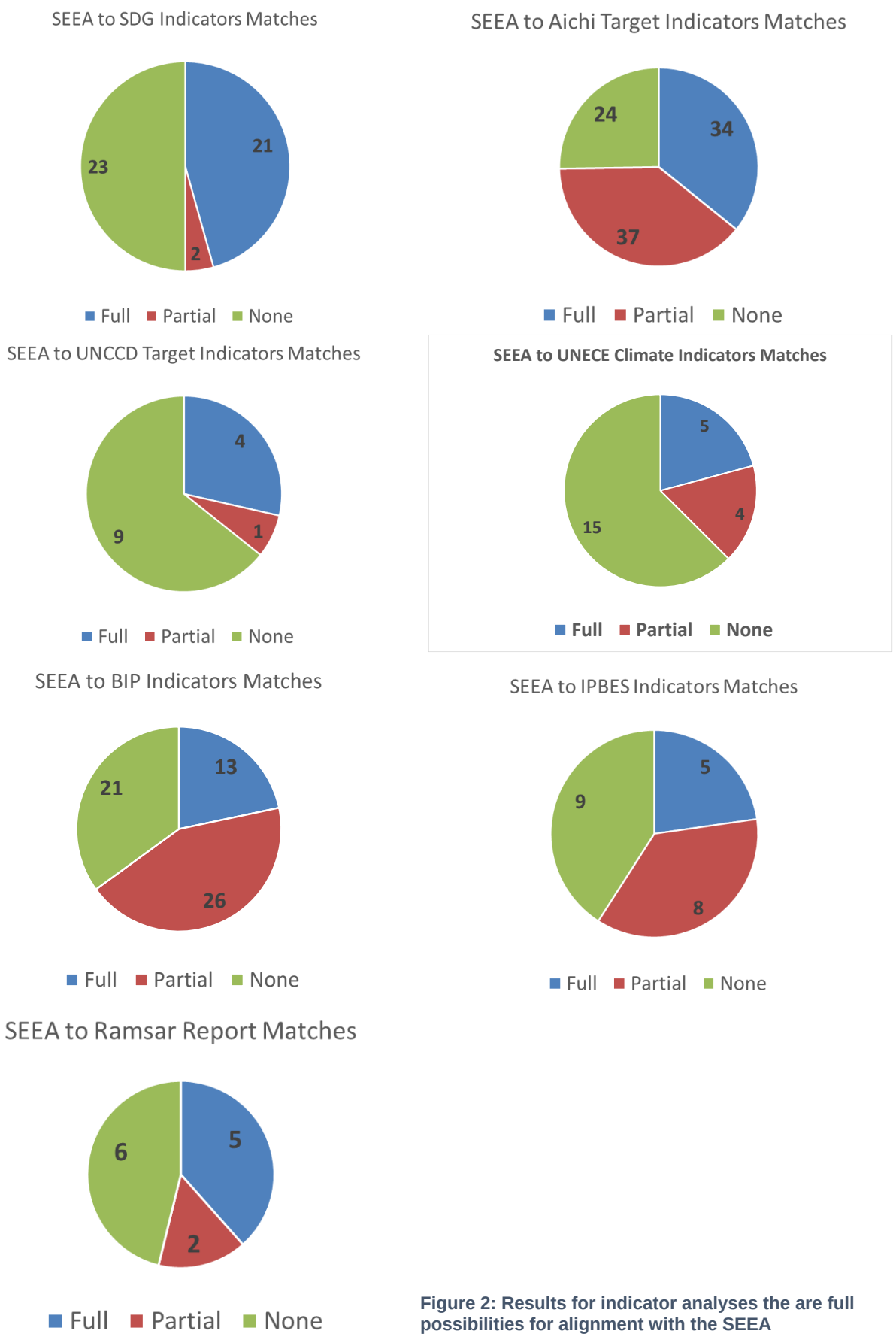


Figure 2: Results for indicator analyses the are full possibilities for alignment with the SEEA

3.2 Analysis of global Indicators with full alignment with SEEA

A key objective for the overall assessment is to identify a priority set of output indicators that can be fully aligned to the SEEA and generated using SEEA accounting modules. This requires identifying the set of distinct individual global indicators from across the global indicator initiatives reviewed (termed 'distinct indictors' in the methodological discussion below). This will also allow for a more focussed assessment of the role of the SEEA in generating or integrating such indicators and identify which indicators are relevant to multiple reporting processes.

3.2.1 Methodology

There is a common structure for organising information from the different global indicator initiatives in Appendix B, this allowed the indicators with 'Full' possibilities for alignment to be collated within the same spreadsheet (see 'Full Possibilities' tab in Appendix B). From this a set of distinct indicators can be identified for analysis from a SEEA perspective. In order to complete this analysis, the following steps were taken:

1. The information on the Indicator ID, Description, Custodian Agency, Operational Status, Definition / Source, Methodology, Data Needs & Availability, Frequency of Data Collection for those indicators with 'Full Possibility' for alignment were captured for each global indicator initiative in in Columns A to H. The information on how the Indicators could be aligned with the SEEA framework was also retained in Columns I to L.
2. Column K was updated to provide an assessment of how well the underlying data for calculating the indicator using the established methodology (if available) was aligned to the SEEA and whether significant methodological work would be required to achieve such an alignment.

Where the indicator was also an SDG Indicator this was captured in Column M. For example, Aichi Target Indicator AT 14.3.2 is the Mountain Green Cover Index, which is also the SDG Target 15.4.2 indicator. So SDG 15.4.2 is recorded in Column M for the AT 14.3.2 row in the spreadsheet. Similarly, where the indicator was also an Aichi Target Indicator this was recoded in Column N. For example, Ramsar indicator 8.6 is the extent of wetland, which is also Aichi Target indicator AT 5.5.3. So AT 5.5.3 is recorded in Column N. Where the indicator was noted to be related but not directly equivalent the prefix 'Related to' was made to the indicator ID in Column M or N (e.g., the indicator was a sub indicator of equivalent indicator but with a narrower ecosystem focus).

3. A field for 'Distinct' was created in Column O, this was populated with a 'Yes' if the indicator met the following criteria:
    - It was an SDG Indicator
    - It was an Aichi Target but not an SDG Indicator (excluding 'Related To' IDs)
    - It was an UNCCD, UNECE Core climate change-related, BIP, IPBES or Ramsar Indicator but not an SDG Target or Aichi Target Indicator (excluding 'Related To' IDs).
4. Where there was a clear linkage to an SDG Indicator this was noted in Column P
5. A field to capture if the indicator was an input indicator (i.e., the possibilities for alignment with SEEA were manly with respect to integration into a SEEA accounting module) or output indicator (i.e., the possibilities for alignment with SEEA were mainly with respect to generation by a SEEA accounting module) was created in Column Q.
6. Columns R and S captured the two most relevant account modules for generating or integrating the indicator. Where the SEEA-CF Flow and Asset Accounts were relevant to

the SEEA-Water, "SEEA Water" was used to represent the relevant account. Where only one account was required for the indicator, this entered into both columns R and S. From this information scores for the relative usefulness of different accounting modules can be calculated.

3.2.2 Results

In total, 54 distinct input and output indicators were identified from the set of global indicator initiatives reviewed that were full possibilities for aligning with the SEEA. Focusing on the output indicators that could be generated using the SEEA only reduced this number to 41. The distribution of these 41 distinct output indicators across the global indicator initiatives is presented in Figure 3. Figure 3 reveals that 17 SDG Indicators are full possibilities to be generated using the SEEA (i.e., output indicators).[29] Figure 3 also shows that 8 Aichi Target Indicators as output indicators that could be generated using the SEEA (this excludes Aichi Target indicators that are also SDG Indicators as these are not 'Distinct').

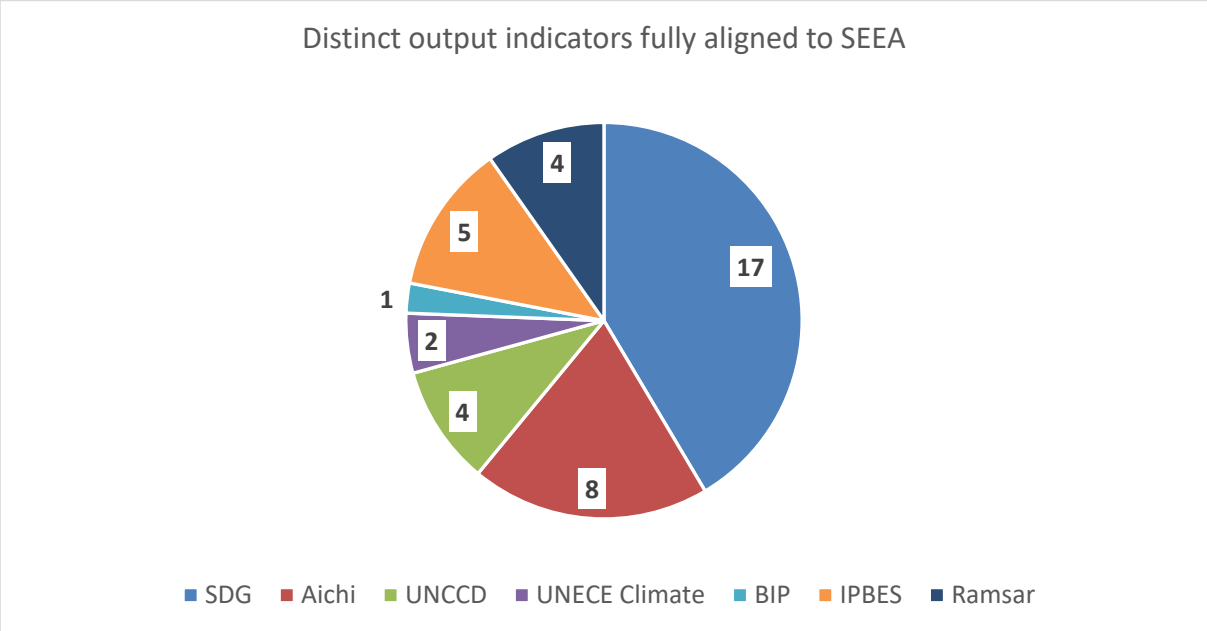


Figure 3: Distribution of distinct output indicators with full possibilities for alignment with the SEEA

Figure 4 summarises the scores for the different accounting modules for the 41 output indicators only (i.e., full possibility for generation via SEEA).[30] This suggests that accounts for land cover, land use or ecosystem extent are particularly relevant for informing different indicator initiatives (scoring 12 out of 41). This is followed by ecosystem condition accounts (scoring 7.5 out of 41) and SEEA water accounts (scoring 7 out of 41). It is notable that ecosystem service accounts only score 5.5 out of 41, these are also generally associated with very conventional provisioning services (biomass, crop, fisheries and wood provision). The exception is for SDG 11.7.1 (the only SDG Indicator where ecosystem service accounts were considered relevant), which relates to the provision of open space for public use in cities. This suggests the full potential of the environment and ecosystem services to contribute to sustainable development is only being considered implicitly (via capacity reflected in condition and extent) in existing global indicators.

[29] As revealed in Table 2, there are also 4 SDG Indicators that could be integrated into the SEEA (i.e., input indicators).
[30] Note: as the SDG Target Indicator 15.9.1, for the Number of countries implementing SEEA (excluding energy accounts), represents the 'Any' entry).

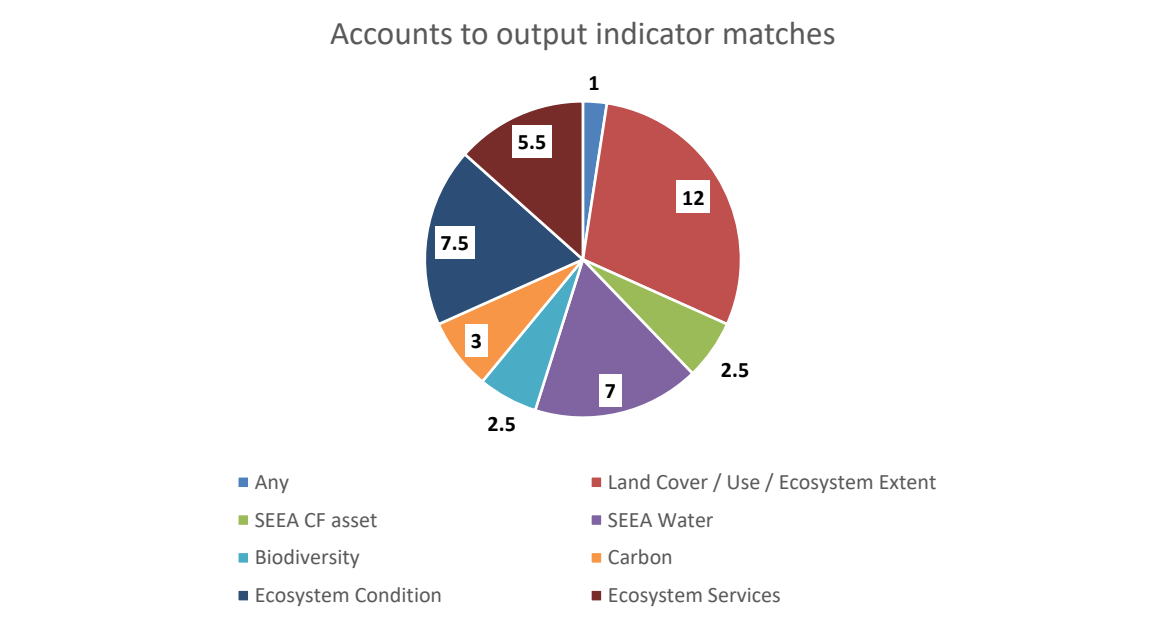


Figure 4: Accounting modules 'scores' for output indicators

3.3 Analysis of SDG Indicators in other global indicator initiatives

Collating information on where indicators feature in multiple reporting commitments in the 'Full Possibilities' tab in Appendix B, allows the identification of the SDG Indicators that are also relevant to other reporting commitments countries face. These are summarised in Table 3, which organises all of the 17 SDG Target Indicators that are considered full possibilities for generation using the SEEA (i.e., the set of output indicators identified in Figure 3) so that those relevant to the highest number of individual global indicators are at the top.

Table 3 can help prioritise methodological development efforts to align indicator data with the SEEA for testing under the NCA and Ecosystem Service Valuation project. This is because there is likely to be a wide demand for those indicators at the top of Table 3 that satisfying multiple reporting requirements. As Table 3 shows, SDG Target 15.3.1 (proportion of land that is degraded over total land area) is also relevant to 5 global initiatives and 10 individual indicators.[31] Consequently, this should be a priority for generation using the SEEA. However, it is acknowledged that there are significant measurement challenges with respect to meaningfully mapping and measuring change in degradation. Similarly, SDG Indicator 6.6.1 is relevant to a number of global initiatives. SDG Indicator 15.1.1 is also relevant to several global indicator initiatives, although its calculation does benefit from data availability via existing global platforms (e.g., global forest watch[32]). SDG Indicator 6.3.1 and 6.4.1 also feature relatively close to the top of Table 3. The third column in Table 3 identifies the relevant SEEA accounting modules for calculating output indicators. Reflecting the results presented in Figure 4, Ecosystem Extent / Land Cover Accounts, Ecosystem Condition Accounts and SEEA Water Accounts feature strongly.

[31] It is noted that there are many definitions of what constitutes degraded land. In the context of SDG 15.3.1 land degradation is defined as the reduction or loss of the biological or economic productivity and complexity of rain fed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from a combination of pressures, including land use and management practices. This definition was adopted by and is used by the 196 countries that are Party to the UNCCD. See: https://unstats.un.org/sdgs/metadata/files/Metadata-15-03-01.pdf

[32] https://www.globalforestwatch.org/

Table 3: SDG Output Indicators that are 'Full Possibilities' for alignment with the SEEA and their use in other global indicator initiatives

SDG Indicator	SDG Indicator	Relevant Accounts	Aichi Indicator	UNCCD Indicator	RAMSAR Indicator	BIP Indicator	IPBES Indicator	UNECE Indicator	Total
15.3.1	Proportion of land that is degraded over total land area	Ecosystem Condition Account & Ecosystem Extent / Land Cover Account	AT 5.3.2	SO 1-1, SO 4-1, SO 1-3, SO 1-2		BIP X.2		CC.3, CC.21, CC.20	10
6.6.1	Change in the extent of water-related ecosystems over time	Ecosystem Extent / Land Cover Account & SEEA Water Accounts	AT 5.5.3, AT 5.5.1		R 8.6	BIP B.1	IPBES H.10		6
15.1.1	Forest area as a proportion of total land area	Ecosystem Extent / Land Cover Account	AT 5.4.2			BIP B.2	IPBES C.6	CC.3	5
15.9.1	Progress towards national targets established in accordance with Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011-2020	All	AT 2.1.1, AT 2.3.1, AT 2.2.1						4
6.3.1	Proportion of wastewater safely treated	SEEA Water Accounts			R 2.6, R 2.11, R 2.8				4
6.4.1	Change in water-use efficiency over time	SEEA Water Accounts	AT 4.2.2, AT 4.2.3					CC.36	4
15.2.1	Progress towards sustainable forest management	Ecosystem Extent / Land Cover Account & Ecosystem Condition Account	AT 5.4.4					CC.38	3

SDG Indicator	SDG Indicator	Relevant Accounts	Aichi Indicator	UNCCD Indicator	RAMSAR Indicator	BIP Indicator	IPBES Indicator	UNECE Indicator	Total
15.4.1	Coverage by protected areas of important sites for mountain biodiversity	Biodiversity Account & Ecosystem Condition Account	AT 14.3.3			BIP X.17			3
11.3.1	Ratio of land consumption rate to population growth rate	Ecosystem Extent / Land Cover Account	AT 4.5.2						2
14.5.1	Coverage of protected areas in relation to marine areas	Ecosystem Condition Account and Biodiversity Account	AT 11.2.2						2
15.4.2	Mountain Green Cover Index	Ecosystem Extent / Land Cover Account & Ecosystem Condition Account	AT 14.3.2						2
6.3.2	Proportion of bodies of water with good ambient water quality	SEEA Water Accounts & Ecosystem Condition Account	AT 8.4.4						2
6.4.2	Level of water stress: freshwater withdrawal as a proportion of available freshwater resources	SEEA Water Accounts							1
8.9.1	Tourism direct GDP as a proportion of total GDP and in growth rate	Ecosystem Extent / Land Cover Account & Ecosystem Services Account							1

SDG Indicator	SDG Indicator	Relevant Accounts	Aichi Indicator	UNCCD Indicator	RAMSAR Indicator	BIP Indicator	IPBES Indicator	UNECE Indicator	Total
11.7.1	Average share of built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities	Ecosystem Extent / Land Cover Account & Ecosystem Services Account							1
14.4.1	Proportion of fish stocks within biologically sustainable levels	SEEA Central Framework Asset Accounts (Fisheries)							1
14.7.1	Sustainable fisheries as a proportion of GDP in small island developing States, least developed countries and all countries	SEEA Central Framework Asset Accounts (Fisheries)							1

3.4 Analysis of Full Possibility Non-SDG Output Indicators

It has been observed that the IAEG-SDG process did not maximise the potential to build on existing global biodiversity indicator frameworks used for biodiversity related conventions and processes. Many operational global indicators already used under the CBD have been identified as highly relevant to the SDG Targets.

There are two major reviews of the SDG indicator framework envisaged before 2030, in 2020 and 2025. These reviews could imply substantive changes to the framework, including the addition, deletion, refinement or adjustment of indicators. The preparation for the 2020 review began in 2018 and presents a clear opportunity to promote better harmonisation of the SDG indicator suite with those used for the CBD, IPBES and other processes. Whilst the Aichi Targets also expire in 2020, it is expected that many of the Aichi Target Indicators will be retained. The potential for Aichi Targets to be retained and integrated into the post 2020 SDG Indicator set is increased where they are also adopted in other environmental reporting commitments or other inter-governmental process (e.g., IPBES).

Accounting for the above, Table 4 presents the 8 distinct Aichi Target Indictors represented in Figure 3 and where they are also adopted in other global indicator initiatives outside of the SDGs (these are all output indicators with full possibilities for alignment with SEEA). Table 4 allows an identification of a set distinct Aichi Target indicators that also feature in other global indicator initiatives.

Table 4: Aichi Target Output Indicators that could be fully aligned to SEEA and their use in other global indicator initiatives

Aichi Target	RAMSAR Indicator	BIP Indicator	IPBES Indicator	UNECE Core Climate Change Indicator
AT 4.2.1 - Human appropriation of net primary productivity		BIP X.8	IPBES H.7	
AT 5.5.2 - Natural habitat extent (land area minus urban and agriculture)				CC.3
AT 5.5.3 - Wetland extent	R 8.6	BIP B.1	IPBES	
AT 6.4.6 - Trends in population of non-target species affected by fisheries				
AT 7.5.1 - Wild Bird Index for farmland birds/Living Planet Index (farmland specialists)		BIP X.5		
AT 12.3.5 - Wild Bird Index		BIP B.8		
AT 14.3.4 - Ocean Health Index		BIP D.2		
AT 15.2.1 - Trends in forest carbon stocks				

Overall Figure 3 identifies a total of 24 non-SDG Indicators, with the 8 Aichi Target indicators described in Table 4. The remaining 16 distinct output indicators from the other global indicator initiates are presented in Table 5.

Table 5: Other global output indicators (excluding SDG and Aichi Target indicators) that could be fully aligned to the SEEA

	Indicator ID	Indicator initiative	Indicator description	Links to other indicators
1	BIP X.1	BIP	Extent of continuous mangrove forest cover	
2	IPBES C.8	IPBES	Total wood removals	
3	IPBES C.11	IPBES	Inland fishery production	
4	IPBES C.15	IPBES	Nitrogen use efficiency	
5	IPBES H.36	IPBES	Land under cereal production	
6	IPBES S.8	IPBES	World grain production per capita/year	
7	SO 1-1	UNCCD	Trends in land cover	15.3.1
8	SO 1-2	UNCCD	Trends in land productivity or functioning of the land	15.3.1
9	SO 1-3	UNCCD	Trends in carbon stocks above and below ground	15.3.1
10	SO 4-1	UNCCD	Trends in carbon stocks above and below ground*	15.3.1
11	R 8.5	Ramsar	trend in wetland condition	
12	R 2.6	Ramsar	No. households linked to sewage system	SDG 6.3.1
13	R 2.8	Ramsar	Percentage of sewage coverage in the country	SDG 6.3.1
14	R 2.11	Ramsar	No. wastewater treatment plants	SDG 6.3.1
15	CC.3	UNECE Climate	losses of land covered by (semi-)natural vegetation	AT 5.5.2
16	CC.11	UNECE Climate	GHG emissions form land use	

* Used to inform on 2 strategic objectives of the UNCCD

Figure 5 repeats the analysis of evaluating the most important accounts for the generation of output indicators, focusing on the 24 distinct non-SDG Output Indicators presented in Table 4 and Table 5. Figure 5 further highlights the important role that land cover or ecosystem extent accounts can play in helping to derive indicators to support reporting on national commitments (scoring 7 out of 24). This is followed by ecosystem condition and ecosystem services accounts, each scoring 4.5 out of 24.

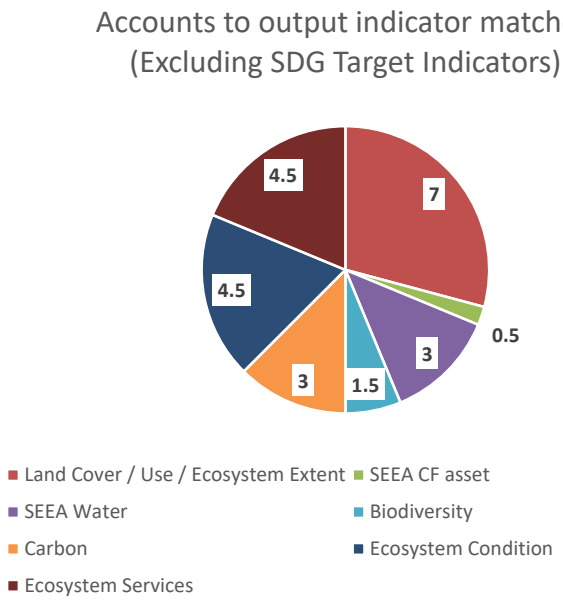


Figure 5: Accounting modules 'scores' for non-SDG Target output indicators

3.5 Analysis of Indicator Methodological Gaps

So far the assessment has focused on where the conceptual possibilities lie for aligning global indicators with the SEEA. With respect to using the SEEA to generate output indicators, this will often comprise establishing accounting approaches to align existing methodologies and data with the compilation of relevant SEEA modules. However, where methodologies for calculating indicators are currently undefined, the SEEA provides a framework to propose new methods and generate new indicators to plug these measurement gaps in existing global indicator initiatives. This section provides a brief analysis of the stated indicator methodological gaps in the SDG and the Aichi Target Indicators. These two initiatives are the focus of the analysis as Table 3 illustrates significant synergies between the SDG and Aichi Target indicators.[33] The methodological gaps in the current SDG Indicators are considered to be those currently categorised as Tier III. The methodological gaps in specific indicators for the Aichi Target are identified in the updated list of indicators for the Strategic Plan for Biodiversity 2011-2020.[34] This strategic plan clearly identifies a set of generic indicators with no matching specific indicators decided upon at present.

3.5.1 Methodology for Indicator Methodological Gap Analysis

To identify methodological gaps in the SDG and Aichi Target indicators and evaluate them from a SEEA perspective, the following stepwise approach was implemented (this is presented in Appendix C, 'Indicator Gaps' Tab, with reference to the columns as indicated below):

1. In Column A, a description for the overarching SDG Target was captured
2. The indicator ID (Column B), Indicator (Column C) for all Tier III (Indicated Column D) SDG Indicators from the 'Full Possibilities' Tab in Appendix B were captured. The information on how to align with the SEEA (integration and generation), whether the SDG Indicator

[33] The exception to this is SDG Target Indicator 6.3.1 – Proportion of wastewater treatment. This only overlaps with the Ramsar indicators R.2.6, R.8 and R2.11. However, it should be noted that there is no agreed methodology or global data in place for the calculation of the Ramsar indicators (in fact they should be considered as indicator questions to relevant national authorities).

[34] https://www.cbd.int/doc/decisions/cop-13/cop-13-dec-28-en.pdf

was an input or output indicator and the possibilities for alignment was also copied into Columns E to H.

3. This created a suitable structure, which was populated with all of the generic indicator methodological gaps the Aichi Targets.[35]
4. The potential to integrate or generate these Aichi Target Indicators with the SEEA, whether the Indicator was an input or output indicator and the possibilities for alignment were captured then in Columns E to H.

3.5.2 Results of Indicator Methodological Gap Analysis

The results of the methodological gap analysis are presented in Table 6. This reveals that out of the 17 SDG Indicators identified in Table 3 (i.e., those considered full possibilities for generation using the SEEA as output indicators) only three indicators have methodological gaps (i.e., are Tier III). For these instances there are no existing, accepted methodologies for calculating the indicators to be drawn on and new SEEA based approaches could be proposed.

Table 6: Analysis of indicator methodological gaps from a SEEA perspective[36]

Indicator ID	Indicator	Operaional Status	Input / Output indicator	Possbilities for Allignment under this Project (Full, Partial, None)
SDG 11.7.1	11.7.1 Average share of built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities	Tier III	Output	Full
SDG 14.7.1	14.7.1 - Sustainable fisheries as a proportion of GDP in small island developing States, least developed countries and all countries	Tier III	Output	Full
SDG 15.9.1	15.9.1 - Progress towards national targets established in accordance with Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011-2020	Tier III	Output	Full
AT 7.4	Trends in proportion of production of aquaculture under sustainable practices	N/A	Output	Full
AT 10.5	Trends in extent and condition of other vulnerable ecosystems impacted by climate change or ocean acidification	N/A	Output	Full
AT 10.7	Trends in pressures on other vulnerable ecosystems impacted by climate change or ocean acidification	N/A	Output	Full
AT 11.3	Trends in areas of particular importance for biodiversity conserved	N/A	Output	Full
AT 14.1	Trends in safeguarded ecosystems that provide essential services	N/A	Output	Full
AT 14.4	Trends in restoration of ecosystems that provide essential services	N/A	Output	Full
AT 15.1	Trends in ecosystem resilience	N/A	Output	Full

Specifically, generating SDG 11.7.1 is likely to require municipal scale accounting applications However, this is likely to require a combination of both land cover and land use accounts

[35] https://www.cbd.int/doc/decisions/cop-13/cop-13-dec-28-en.pdf
[36] See Appendix C for explanation on how each indicator was assessed as Full, Partial or None Possibility for alignment

(including use of cadastral data) to understand the availability of non-green spaces for public use. There are an increasing number of examples that can be drawn in this area to understand the availability of open public space in built up areas, this includes the Urban EEA project for Oslo[37]. In addition, the EU MAES Pilot Study on Urban Ecosystem Condition could yield suitable measurement approaches for urban ecosystem accounting that could support the generation of this indicator via the SEEA.[38] However, there are likely to remain measurement challenges in deriving a national level aggregate for SDG 11.7.1 from the SEEA, as this requires municipal scale accounting to have been undertaken in all cities within a country and high resolution data on urban land use (It is highlighted that since drafting this document UN-Habitats methodology for SDG 11.7.1 has been upgraded to Tier II yet there still remains substantial measurement challenges to overcome for this indicator).

For generating SDG 14.7.1, there remain challenges relating to how to measure the fraction of sustainable fisheries catch that may best be addressed via fishery expert workshops / forums. However, work has been progressed for the EU in developing Fish Biomass Accounts grounded in the SEEA-EEA approach, which could provide a framework to help inform on sustainability of fish harvesting and landings values. For SDG 15.9.1, establishing SEEA accounts (excluding energy) is also identified as an indicator for Aichi Target 2. Realising an institutionalised, regular production process for the SEEA (outside of energy accounting) is considered an appropriate indicator for this SDG Indicator.

For the Aichi Targets, there are a number of indicator gaps that the SEEA-EEA framework is conceptually extremely well-suited to address. In particular, AT 10.5, 14.1, 14.4 and 15.1 provide very relevant entry points for the SEEA-EEA for measuring trends in ecosystem assets and services. These may well reflect key indicators adopted under the post 2020 agenda and are very relevant to mainstreaming the environment into a range of policy objectives, for instance Ecosystem based Adaptation in support of the Sendai goals. Generating such indicators will require developing and implementing appropriate measurement approaches for agreed essential ecosystem service supply and use tables. Nonetheless, this is clearly a process the SEEA can support.

3.6 Analysis of Mainstreaming Opportunities from a SEEA perspective

The SEEA framework is designed to support mainstreaming the environment into economic and development planning. In this regard, there are multiple entry-points for biodiversity and ecosystem services to support sustainable development objectives, such as climate change adaptation, food security and supporting livelihoods. Drawing on such entry-points, the CBD, FAO (Food and Agriculture Organisation of the United Nations), World Bank, UN Environment and UNDP (United Nations Development Programme) have produced a technical note that maps the linkages between the Aichi Targets and the SDGs.[39, 40] This provides an authoritative foundation on where mainstreaming biodiversity into economic and wider development planning will directly support attainment of the SDGs and their targets. Therefore, one is able to work backwards from an SDG Target via these linkages to individual Aichi Targets that reflect the potential for biodiversity to contribute to the attainment of a given SDG Target. If the SEEA can be used to generate an indicator for these individual Aichi Targets, this indicator can also be considered as an indicator that communicates progress on mainstreaming biodiversity into sustainable development planning. By identifying where these linkages can be realised between the SDG and the Aichi Targets more generally (i.e., beyond those instances where an Aichi Target Indicators is

[37] https://www.nina.no/english/Fields-of-research/Projects/Urban-EEA
[38] http://ec.europa.eu/environment/nature/knowledge/ecosystem_assessment/pdf/102.pdf
[39] https://www.cbd.int/development/doc/biodiversity-2030-agenda-technical-note-en.pdf
[40] Extended cross-mapping to the BIP indicators is also possible via the following publication: https://www.bipindicators.net/system/resources/files/000/002/291/original/Cross_mapping_4pp_A3.pdf?1525960022

directly adopted as an SDG Indicator), this analysis allows existing methodologies and data to be readily identified and adopted for biodiversity mainstreaming purposes via the SEEA.

3.6.1 Methodology for identifying SEEA Mainstreaming Indicators

In order to identify where SEEA based indicators could be generated to mainstream biodiversity into achieving different SDG Targets, the following stepwise approach was implemented (presented in Appendix C, 'Mainstreaming Opportunities' Tab, with reference to the columns as indicated below):

1. The SDG Description (Column C), SDG Target number (Column D), the SDG Target description (Column E) where captured in the spreadsheet. The rationale for biodiversity being relevant to that SDG Target provided by the CBD, FAO, World Bank, UN Environment and UNDP technical note[41] was added in Column F and the relevant Aichi Targets in Column I.[42]
2. If any relevant indicators had been captured as full possibilities for alignment with the SEEA, this was captured in the spreadsheet (Column A) with the associated SDG Indicator ID (Column B). Where such an indicator was already available, the respective SDG Target was no longer considered in the analysis (i.e., SDG 6.3, 6.4, 6.6, 11.7)
3. In Column G an assessment was provided on whether the general requirements for generating the indicator could be aligned with the selected SEEA accounting modules (Column G) and a None, Partial or Full conclusion on the possibility for alignment was provided (Column H).

3.6.2 Results of Mainstreaming Indicator analysis

The results of the spreadsheet analysis are summarised in the Figure 6. This identifies that the SEEA could potentially support the production of 17 indicators for mainstreaming biodiversity into the sustainable development goals. The most relevant SDGs comprised SDG 1 – No poverty (2); SDG 2 – Zero hunger (3) and SDG 9 – Industry, innovation and infrastructure (2) and comprised:

- SDG Target 1.4 – Relating to access to basic ecosystem services
- SDG Target 1.5 – Relating to building the resilience of ecosystem services supply on which vulnerable persons depend
- SDG Target 2.1 – Relating to ensuring access to food provisioning services
- SDG Target 2.3 – Relating to the flow of multiple ecosystem services to improve agricultural yields
- SDG Target 2.4 – Relating to maintaining the condition and resilience of agricultural ecosystems.
- SDG Target 9.1 – Relating to green infrastructure
- SDG Target 9.4 - Relating to green infrastructure

The potential for the SEEA for integrating environmental data into poverty alleviation (i.e., with respect to SDG 1 and 2) is currently a proposed application for testing via the Poverty-

[41] https://www.cbd.int/development/doc/biodiversity-2030-agenda-technical-note-en.pdf
[42] SDG 14 and 15 are not included in the spreadsheet as these are environment focused goals and covered in the wider analysis

Environment Accounting Framework.[43] It would be useful to explore such applications further in the context of yielding indicators for poverty alleviation based on improving access to environmental / biodiversity resources. As shown in Figure 6, for SDG 11 – Sustainable cities and communities, three potential mainstreaming indicators were identified but these would require development of municipal scale accounts. A key observation is the potentially ability of the SEEA to support mainstreaming of biodiversity into achieving a wide range of SDG Targets. In total 11 SDG Targets are identified where biodiversity mainstreaming targets could be derived, in addition to SDG 14 and 15.

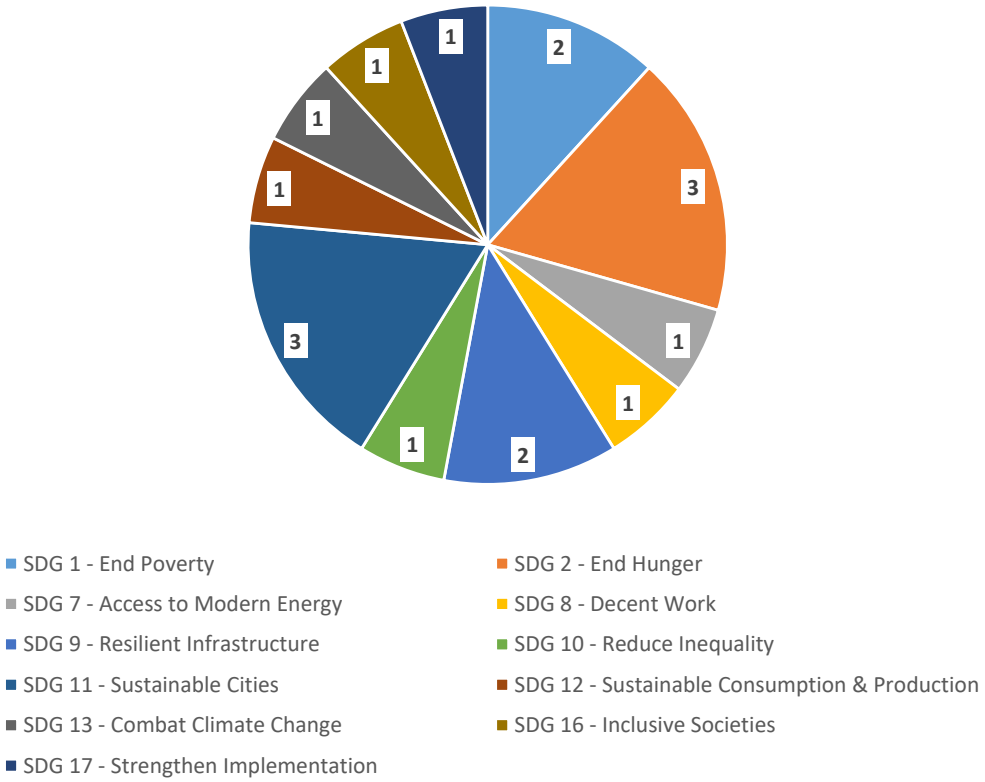


Figure 6: Mainstreaming opportunities for the SEEA

[43] https://unstats.un.org/unsd/envaccounting/londongroup/meeting22/BK_7.pdf

4 Conclusions

The global indicator review is based on a rapid expert assessment process. The broad analysis of 289 individual global indicators across the set of 8 global initiatives reveals the following insights:

- Combined analysis revealed 54 full possibilities for alignment of global indicators with the SEEA. This represents a conceptual alignment based on the structure of the SEEA framework. Of these, 41 were output indicators that could be generated using the SEEA.
- Overall a further 80 partial possibilities for alignment of global indicators with the SEEA were identified. Of these, 2 were SDG Indicators. The potential to achieve a full alignment of these indicators with the SEEA was considered limited, although the SEEA still had a potential role to play in organising some of the information necessary for the calculation of these indicators.
- Land cover / ecosystem extent and ecosystem condition accounts were identified as a priority for calculation to assist national reporting obligations using the SEEA EEA. The SEEA Water Accounts were also identified as a priority for calculation to assist national reporting. The relatively low importance of ecosystem services accounts for calculating indicators is considered to reflect a gap in the ability of existing indicators to mainstream the environment into sustainable development.
- With respect to the SDG Indicators specifically, 21 offer full possibilities for alignment with the SEEA and related to SDG 6, 8, 11, 14 and 15. Of these, 17 were considered to be output indicators. Those SDG Target related output indicators that were relevant to other existing global indicator initiatives comprised:
    - SDG Indicator 15.3.1 – Proportion of degraded land (Relevant to the CBD; UNECE Core climate change-related; UNCCD and Ramsar). The key accounts for calculation of this indicator are the Ecosystem Condition Accounts and Ecosystem Extent / Land Cover Accounts.
    - SDG Indicator 6.6.1 – Change in the extent of water related ecosystems (Relevant to the CBD; Ramsar; BIP and IPBES). The key accounts for calculation of this indicator are the Ecosystem Extent / Land Cover Accounts and SEEA Water Accounts.
    - SDG Indicator 15.1.1 – Proportion of forest area (Relevant to the CBD; UNECE Core climate change-related; BIP and IPBES). The Ecosystem Extent / Land Cover Accounts are the key accounts for calculating this indicator.
    - SDG Indicator 6.3.1 – Proportion of waste water safely treated (Relevant to Ramsar) and 6.4.1 - Change in water-use efficiency over time (Relevant to Aichi Targets and UNECE Core climate change-related). The SEEA Water Accounts are the key accounts for calculating this indicator.
    - SDG Indicator 15.2.1 – Progress towards sustainable forest management (Relevant to CBD and UNECE Core climate change-related) are the Ecosystem Extent / Land Cover Accounts and Ecosystem Condition Accounts
- Of the 24 Non-SDG target output indicators that were full possibilities for generation using the SEEA, 8 of these were Aichi Target (AT) Indicators. Those that could inform other global initiatives outside of the BIP comprised:
    - AT 4.2.1 – Human appropriation of net primary productivity (Relevant to IPBES)

  - AT 5.5.2 – Natural habitat extent (Relevant to UNECE Core climate change-related)
  - AT 5.5.3 – Wetland extent (relevant to IPBES and Ramsar)
- Analysis of the current methodological gaps in calculating SDG indicators identified opportunities for the SEEA to provide new methods for calculating SDG Indicators11.7.1 (Open space for public use in cities) and 14.7.1 (sustainable fisheries). Analysis of the Aichi Target Indicator gaps identified 8 indicator gaps that the SEEA could potentially address. Of these the SEEA-EEA is considered very well suited to generate the following indicators:
  - AT 10.5 - Trends in extent and condition of other vulnerable ecosystems impacted by climate change or ocean acidification
  - AT 14.1 - Trends in safeguarded ecosystems that provide essential services
  - AT 14.4 - Trends in restoration of ecosystems that provide essential services
  - AT 15.1 - Trends in ecosystem resilience
- Analysis of mainstreaming opportunities for biodiversity in attainment of the SDGs, identified 17 SDG Targets that could be mapped to the broad Aichi Targets and that the SEEA could, potentially, generate new biodiversity mainstreaming indicators for. The most relevant comprised:
  - SDG Targets 1.4 and 1.5 – Relating to generating indicators communicating access to basic ecosystem services and building resilience in their supply
  - SDG Targets 2.1, 2.3 and 2.4 – Relating to ensuring access to food provisioning services and the condition of agricultural ecosystems to ensure a flow of multiple services that contribute to food production.
  - SDG Targets 9.1 and 9.4 – Relating to green infrastructure

Overall, the assessment reveal that ecosystem services accounts are of relatively low importance for calculating indicators. This is considered to reflect a gap in the ability of existing indicators to mainstream the environment into sustainable development. This suggests the full potential of harnessing environmental benefits and ecosystem services in pursuit of sustainable development is only being captured implicitly (via capacity reflected in condition and extent) in existing indicators. There is considered to be a key role for the SEEA to play in addressing this situation by providing more explicit biodiversity mainstreaming indicators.

4.1 Proposed Global Indicators for Testing

The analysis identifies 41 possibilities for developing methods to align the generation of existing global indicators as output indicators from the SEEA. Of these, 17 are SDG Indicators that methodological development effort should be targeted towards to fully align their generation to the SEEA. In terms of prioritising this methodological development effort and establishing testing possibilities, in the first instance it is considered rationale to focus on SDG Indicators:

1. that are well matched with the accounts that are envisaged under the NCA and ES Valuation project;

2. Serve multiple reporting purposes.

With respect to point 1, a number of indicators were dependent on ecosystem extent accounts (or land cover / use accounts as potential proxies), in combination with data from other SEEA

modules. Ecosystem extent and land cover accounts will be a starting point for accounting in most pilot countries. As such, priorities for developing methodological approaches to test with countries could include **SDG Indicator 15.3.1** – Proportion of degraded land (calculated via Ecosystem Condition and Ecosystem Extent / Land Cover Accounts); **SDG Indicator 6.6.1** – Change in the extent of water related ecosystems (calculated via Ecosystem Extent / Land Cover Accounts and SEEA Water Accounts); and, **SDG Indicator 15.1.1** – Forest area as a proportion of total land area (calculated via Ecosystem Extent / Land Cover Accounts). With respect to point 2, these SDG indicators will also support wider reporting obligations under the CBD, UNCDD and UNECE Core climate change-related.

SDG Indicators 6.6.1 and 15.3.1 are further identified as a Tier II indicators, providing an opportunity for the SEEA to contribute a statistical process for national scale data collection and estimation. Furthermore, it is anticipated that the accounts required to generate SDG Indicators 15.1.1 and 6.6.1 could also inform on the Aichi Target indicators AT 5.5.2 – Natural habitat extent (also relevant to UNECE Core climate change-related) and AT 5.5.3 – Wetland extent (relevant to IPBES and Ramsar).

It is noted that a key challenge to developing extent accounts for deriving these indicators will be defining extent in an ecologically meaningful manner that remains amenable to measurement on a regular basis. In this context, further work is required to understand the trade-offs between disaggregating identified global data for use by national statistical offices versus the use of nationally (or regionally) established ecosystem typologies and how these can be combined to support regular ecosystem accounting. Organising this type of data will also be relevant to other reporting processes beyond the identified indicator initiatives, for example contributing to the Forest Resources Assessments of the FAO (either directly or via the supply of ground-truthed data to extend remote sensed observations).

SDG indicator methodological gaps were identified in relation to SDG Indicators 11.7.1 (Open space for public use in cities) and 14.7.1 (sustainable fisheries) and there are key opportunities for the SEEA in these areas. However, these are not considered to be well aligned with the types of SEEA accounts to be developed under the NCA and Ecosystem Service Valuation project in the pilot countries

The review of the Aichi Target indicator gaps and environmental mainstreaming opportunities for the SEEA identifies clear synergies. Specifically, it appears conceptually feasible to use the SEEA framework to generate **Aichi Target Indicators: AT 14.1** (Trends in safeguarded ecosystems that provide essential services can be linked to extent, condition and services accounts); **AT 14.4** (Trends in restoration of ecosystems that provide essential services can be linked to condition and services accounts) and **AT 15.1** (Trends in ecosystem resilience can be linked to condition accounts).

Operationalising the production of the above indicators would be highly beneficial for realising the most promising environmental mainstreaming opportunities for reducing poverty (SDG Targets 1.4 and 1.5), ending hunger (SDG Targets 2.1, 2.3 and 2.4) and building resilient (green) infrastructure (SDG Targets 9.1 and 9.4). These indicators should also be considered as priorities for development of methodologies to generate via the SEEA as they are likely to be highly relevant to the post 2020 SDG and CBD agenda. These indicators will also be particularly relevant to a range of wider policy goals, for instance harnessing the full potential of Ecosystem based Adaption to climate change for mitigation of a wider range of disaster risks (i.e., Goals A through E of the Sendai framework for disaster reduction). As such the SEEA offers a pathway for integrating biodiversity and ecosystem services into decision making, and ecosystem service accounts would have key role to pay in this regard.

Appendix A: Inventory of Global Indicator Initiatives (Excel file)

Appendix B: Assessment of Global Indicators from a SEEA perspective (Excel file)

Appendix C: Indicator Gaps and Mainstreaming Opportunities (Excel file)

Appendix D: SEEA, Economic Instruments and the Sustainable Development Goals

To complement the assessment of the linkages between SEEA and the SDG targets, this section aims to provide a short summary of the types of economic instrument that could be used to deliver progress towards the SDGs, the results of which could be tracked through SEEA. Section 0 provides a high level introduction economic instruments, their role in achieving the SDGs and their relationship to the SEEA. This Section also provides a short synopsis of the connections between accounts and economic instruments, in particular how they can be mutually supportive in driving incentives to incorporate the value of nature into decision-making. Section 0 then provides an analysis of the existing literature and guidance on economic instruments that can stimulate progress towards the 17 SDG Output Indicators identified as 'Full Possibilities' for alignment with the SEEA from the Global Indicators Assessment (as detailed in Section 0).

Economic Instruments and the Environment: A short introduction

Filling the SDG financing and implementation gap

There remain large gaps in action and funding required to meet the SDGs. The recently released UN Environment publication "*Measuring Progress: Towards Achieving the Environmental Dimension of the SDGs*" highlights that of 93 environmentally related SDG targets, we only have data to suggest 22 are on track for the target to be met[44]. There are large gaps in the evidence base as well as evidence that upscaling of effort is needed. The issue of financing to support such effort is significant, as exemplified in the analysis from the UN Statistical Division Sustainable Development Goal Report 2018 included in Figure 7 below. Figure 7 highlights that whilst 80% of countries reported insufficient finance to meet national water, sanitation and hygiene needs in 2017, public Official Development Assistance for water has been falling and in 2016 was 25% lower than in 2012. Whilst this is focussed on a specific area, it is characteristic of a generic problem across all the SDGs. This is acknowledged in the Addis Ababa Action Agenda (on Financing for Development), which highlighted the importance of increasing the private sector contribution to meeting the SDGs[45]. In this regard, whilst economic instruments are not necessarily focussed on mobilising private sector finance, they are often seen as ways to deliver the polluter pays / beneficiary pays principles. As such, they are relevant to private (as well as public) sector impacts and dependencies on the natural environment.

[44] https://wedocs.unep.org/bitstream/handle/20.500.11822/27627/MeaProg2019.pdf?sequence=1&isAllowed=y

[45] http://www.un.org/esa/ffd/wp-content/uploads/2015/08/AAAA_Outcome.pdf

Funding commitments to the water sector dropped by more than 25 per cent from 2012 to 2016

Ensuring water and sanitation for all will require financial resources and technical capacity to support and sustain needed investments in capital infrastructure. While total official development assistance (ODA) committed and disbursed across all sectors steadily increased between 2012 and 2016, the share of ODA commitments to waterrelated activities declined. Such activities include drinking water supply, sanitation and hygiene, agricultural water resources, flood protection and hydroelectric power. Between 2012 and 2016, commitments to the water sector decreased from a peak of $12 billion to $9 billion; however disbursements to water-related activities increased from $7.4 billion to $9 billion. As commitments fall, disbursements may also get smaller in the future. Furthermore, any reduction in external aid is likely to hamper progress towards Goal 6: a 2017 survey found that over 80 per cent of countries reported insufficient financing to meet national water, sanitation and hygiene targets.

Offcial development assistance commitments and disbursements to the water sector, 2007–2016 (millions of constant US$ and percentage of total ODA)

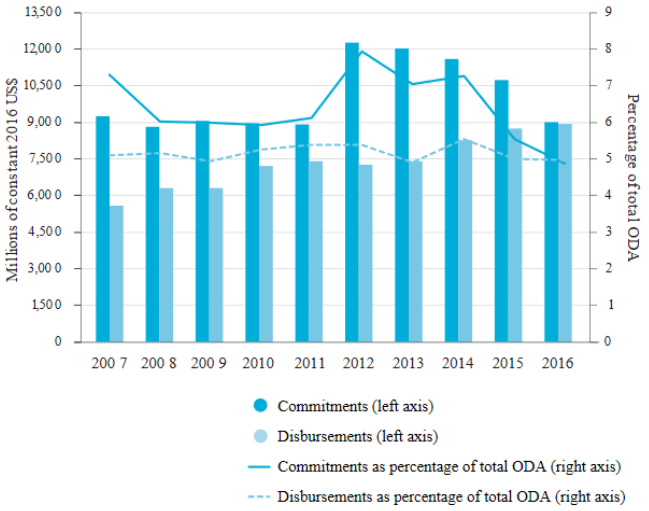


Figure 7: Public sector water funding – assessment by UNSD

Types of instruments and data on their use

The OECD has developed a database of Policy Instruments for the Environment (PINE)[46]; this defines six broad categories of policy instrument, these are:

- Taxes
- Fees or charges
- Tradable permits
- Deposit-refund schemes
- Environmentally motivated subsidies, and
- Voluntary approaches

All of the above can be classed as economic instruments, as they can all be used to improve economic incentives by correcting market failures. Where market failures exist actions with negative impacts on the environment have no associated cost to those doing the damage or, conversely, actions with a positive impact on the environment go unrewarded.

Whilst developed by the OECD the database also covers non-OECD countries, with substantial coverage across South and Central America and some coverage of Africa and Asia. There is, for example, at least some coverage of instruments being used in Brazil, China, India, Mexico and

[46] https://pinedatabase.oecd.org/

South Africa in the database as it stands. The definitions applied in the OECD database are provided below:

Taxes: *Environmentally related taxes are defined as any compulsory, unrequited payment to government levied on tax bases deemed to be of environmental relevance, i.e. taxes that have a tax base with a proven, specific negative impact on the environment. Taxes are unrequited in the sense that benefits provided by government to taxpayers are normally not in proportion to their payments. This means that there needs to be a redistributive element in order for a payment to be considered a tax. Environmentally related taxes increase the costs of a polluting product or activity, which tends to discourage its production or consumption, regardless of what was the intention behind the introduction of the tax. In this database, the term ''levy'' is used to cover taxes, fees and charges.*

The tax base of environmentally related taxes may thus include both (i) the first-best taxes on the negative by-products (e.g. emissions) and (ii) the second-best taxes on inputs or (intermediate) outputs of a polluting activity (e.g. fuel purchases, ownership or use of a motor vehicle).

NB: In line with the SEEA 2012 – Central Framework, taxes on resource rents (or any other taxes on profits) are not included in the definition of environmentally related taxes, because they do not affect relative prices while revenues from auctioning of emission permits for example are included and labelled as ''taxes''.

Fees or charges: *Fees and charges are defined as compulsory requited payments to the government that are levied more–or-less in proportion to the services provided. In this database, the terms "fees" and "charges" are used interchangeably. The main difference between taxes and fees/charges is the type of beneficiary: fees are paid for government services directed at a specific beneficiary, while taxes are used to raise revenue to fund general (or specific) government expenditure.*

Tradable permits: *Tradable permits are market-based instruments that provide allowance or permission to engage in an activity. These permits are often used to allocate pollution rights, and they can be issued under a trading system. There are two main types of trading systems: "cap-and-trade systems" and "baseline-and-credit systems". In a cap-and-trade system, an upper limit on allowances is fixed, and the permits are either auctioned out or distributed for free according specific criteria. Under a baseline-and-credit system, there is no fixed limit on emissions, but polluters that reduce their emissions more than they have to are obliged to can earn 'credits' that they sell to others who need them in order to comply with regulations they are subject to. For the purpose of the database, the terms "permits" and "allowances" are used interchangeably.*

Deposit-refund schemes: *Deposit-refund schemes are market-based instruments consisting of a combination of a product charge (the deposit) and a subsidy for recycling or proper disposal (the refund), generally with the objective to discourage illegal or improper disposal. These can be either voluntary or mandated by government legislation. Deposit-refund systems allow for high collection rates and high quality of collected material, which makes it possible to use recycled instead of new material and reduces the need of extraction of natural resources. Deposit-refund schemes can comprise different sub-schemes, e.g. according to the object they are addressing. This is the case of deposit-refund systems for beverages, which include glass and plastic bottles, as well as aluminium cans.*

Environmentally motivated subsidies: *A subsidy is defined as environmentally motivated if it reduces directly or indirectly the use of something that has a proven, specific negative impact on the environment. The database covers environmentally motivated subsidies consisting of payments from government to producers, or of preferential tax treatments with the objective of influencing the level of production, the price, or the remuneration of the factors of production.*

Voluntary approaches: *Voluntary approaches in environmental policy include all voluntary instruments whereby firms or industries make commitments to improve their environmental performance beyond what the law demands. These could be agreements on environmental performance negotiated between a government authority and one or more private parties, with the aim to improve environmental performance beyond compliance to regulated obligations. Moreover, voluntary approaches also include industries' negotiations on a certain standard of behaviour, which could involve the participation of third parties to monitor compliance, as well as unilateral action by industry.*

Voluntary approaches can include special environmental performance agreements, whereby government bodies and industry organisations agree to act on the basis of specific design criteria, clear environmental objectives and measurable results. Other types of voluntary approaches consist of a set of agreements between the government and certain industries so as to promote environmentally friendly activities, such as agreements on improved industrial energy efficiency and recycling of packaging and containers used in transport. Environmentally related labelling schemes that firms can choose to adhere are also included among voluntary approaches.

Whilst payments for ecosystem services are not currently captured in the PINE database, efforts to integrate them are currently ongoing. It is likely that they will be reported alongside environmentally motivated subsidies, as they seek to reinforce actions which have been proven to have a positive impact on the natural environment. Where they are recorded however is secondary to their inclusion which will be important in the context of measuring and understanding some elements of the value of ecosystem services[47].

Delivering goals at least cost

Economic instruments are often promoted for their efficiency, as they tend to be designed in a way that allows market incentives to deliver the desired outcome at least cost. An example would be carbon-trading schemes, where an emissions cap is set. Those who are able to reduce emissions cheaply cut their emissions and sell permits; those who cannot, purchase them, ultimately raising the cost of carbon intensive products and reducing their competitiveness. Environmental taxes work on a similar principle, with the choice being to reduce impact or pay the tax. The key difference between the two instruments is that with tradable permit schemes the regulator knows the impact they will have – as they set the goal that the market has to meet. With taxation, the regulator sets the cost of damaging the environment, so will know more about the burden they are imposing but not necessarily the impact on the environment, as they will not know whether polluters will prefer to pay the tax or reduce their impacts. Taxes and tradable permits schemes are not the only economic instruments, certification schemes and payments for environmental benefits can also create positive economic returns for environmental improvements.

Their scope to make a difference is potentially large, for example – in the context of the water example above, the 2010 TEEB for Business and Enterprise Report[48] estimated that voluntary payments for water related ecosystem services could reach $10 billion a year by 2050 (See Table 7 below). However, economic instruments can only be effective in certain scenarios, for example

[47] Payments for Ecosystem Services are have a common set of features which define them, which include that they are: (1) voluntary transactions (2) between service users (3) and service providers (4) that are conditional on agreed rules of natural resource management (5) for generating offsite services (Wunder, S., 2015. Revisiting the concept of payments for environmental services. Ecological Economics).

[48] TEEB – The Economics of Ecosystems and Biodiversity Report for Business - Executive Summary 2010 http://img.teebweb.org/wp-content/uploads/Study%20and%20Reports/Reports/Business%20and%20Enterprise/Executive%20Summary/Business%20Executive%20Summary_English.pdf

they must be connected to environmental impacts that are observable, they need to be well regulated and enforced, and transactions costs to be low.

Table 7: TEEB for Business assessment of environmental market opportunities

Market opportunities	Market size (US$ per annum)		
	2008	Estimated 2020	Estimated 2050
Certified agricultural products (e.g., organic, conservation grade)	$40 billion (2.5% of global food and beverage market)	$210 billion	$900 billion
Certified forest products (e.g., FSC, PEFC)	$5 billion of FSC-certified products	$15 billion	$50 billion
Bio-carbon / forest offsets (e.g., CDM, VCS, REDD+)	$21 million (2006)	$10+ billion	$10+ billion
Payments for water-related ecosystem services (government)	$5.2 billion	$6 billion	$20 billion
Payments for watershed management (voluntary)	$5 million Various pilots (Costa Rica, Ecuador)	$2 billion	$10 billion
Other payments for ecosystem services (government-supported)	$3 billion	$7 billion	$15 billion
Mandatory biodiversity offsets (e.g., US mitigation banking)	$3.4 billion	$10 billion	$20 billion
Voluntary biodiversity offsets	$17 million	$100 million	$400 million
Bio-prospecting contracts	$30 million	$100 million	$500 million
Private land trusts, conservation easements (e.g., North America, Australia)	$8 billion in U.S. alone	$20 billion	Difficult to predict

Source: Adapted from Forest Trends and the Ecosystem Marketplace (2008)[51]

Economic instruments and the SEEA

The SEEA Central Framework (SEEA CF) Environmental Activity Accounts allow for the creation of accounts for flows linked to environmentally beneficial and environmentally harmful products or activities, for instance accounts on environmental taxes (which are actually about taxes on environmentally harmful products), subsidies on environmentally beneficial activities as well as potentially environmental damaging subsidies. As such, some economic instruments may be directly recorded directly within the SEEA CF Environmental Activity Accounts.

Such accounts have been used (for example in Sweden[49]) to understand how comprehensively environmental taxes are addressing the issues they are aimed to tackle. Figure 8 below shows this analysis in the context of greenhouse gas emissions and taxes - combining Carbon Emission Account and Environmental Activity account data from the SEEA CF (noting that the analysis was

[49] Palm, V. and Larsson, M., 2007. Economic instruments and the environmental accounts. *Ecological Economics*, *61*(4), pp.684-692: https://www.sciencedirect.com/science/article/pii/S0921800906004605

carried out in 2007 so it is likely that the picture will have changed, the principle in terms of application remains the same).

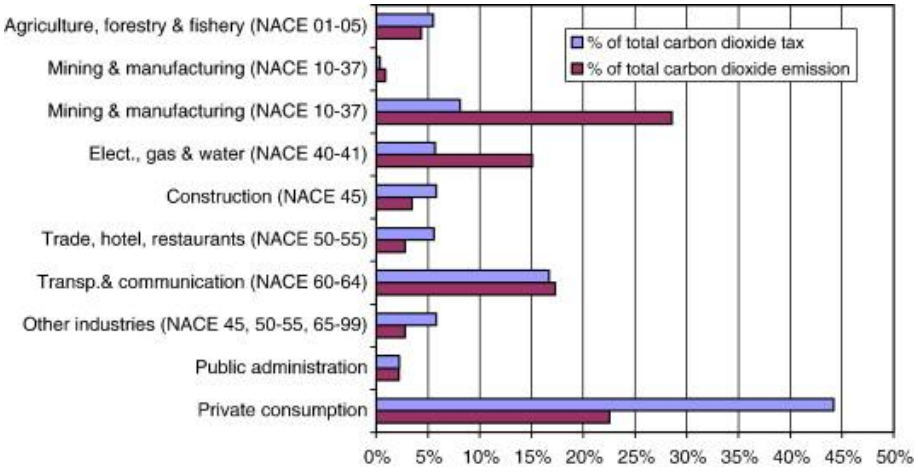


Figure 8: Carbon emissions and taxes by sector in Sweden

In this context accounts can to monitor the impact of economic instruments, both in terms of intending impacts, as well as helping monitor the impact of safeguards, measure co-benefits or identify any unforeseen consequences or through impacts on other SDG indictors linked to the SEEA framework.

From an alternative perspective, economic instruments are also directly interesting for completing / extending SEEA account. This is because they can help previously hidden costs and benefits on the natural environment 'appear' as they tend to require better measurement and monitoring of impacts and can generate an exchange value that can be used in monetary accounts. This is especially true as instruments are more extensively used; a trend which is exemplified in Figure 9, which shows increasing use of biodiversity-relevant taxes around the world.

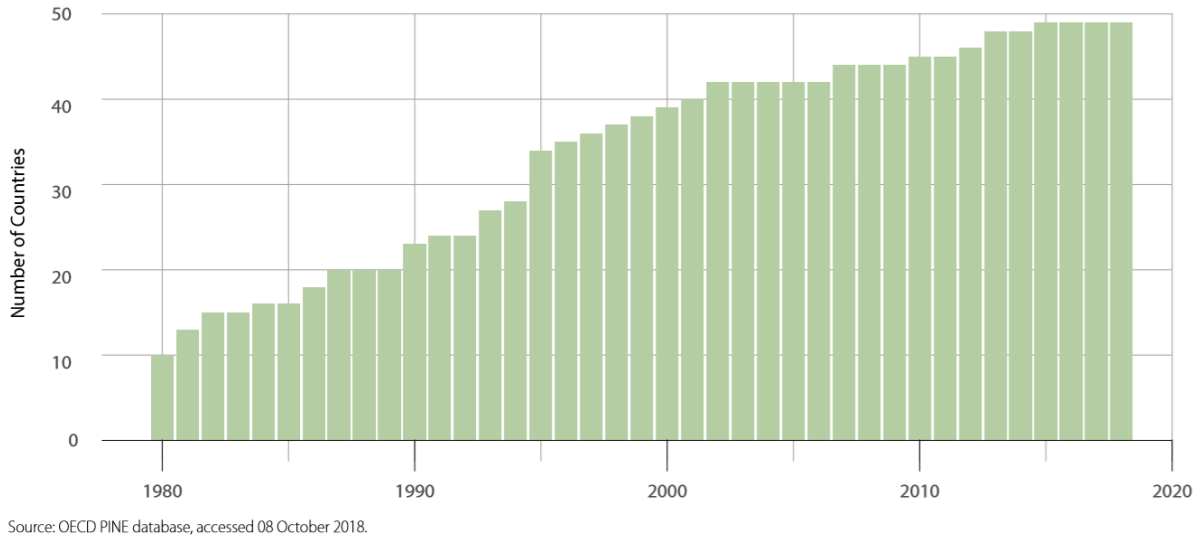


Figure 9: Number of Countries with Biodiversity-relevant taxes[50]

[50] http://www.oecd.org/environment/resources/Tracking-Economic-Instruments-and-Finance-for-Biodiversity.pdf

Perverse subsidies

Although not referenced and recorded in the OECDs PINE database, just as economic instruments are increasingly used to try to improve the natural environment, they are also used to deliver social benefits. Subsidies for example are used to reduce the cost of energy, fertilisers and fishing. However, these can have enormously negative impacts on the environment. For example, globally around US$300 billion annually, or 0.7% of world GDP, was spent on subsidising fossil fuels and therefore contributing directly to climate change. Reforming these perverse or potentially environmentally damaging subsidies (PEDS) is also an important way to address the financing gap for meeting the SDGs, and relevant to accounts as they can be recorded where they affect activity which has negative impacts on the natural environment.

Economic Instruments for the SDGs and their target indicators

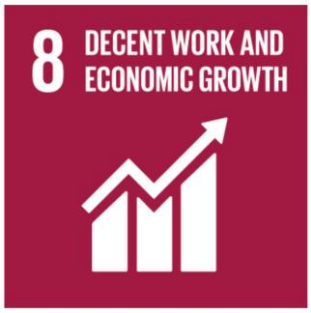
Table 8 provides examples of the types of economic instruments that have been (or could be) used to help meet the SDG targets. Table 8 focuses on the SDGs relevant to the 17 SDG Output Indicators identified as 'Full Possibilities' for alignment with the SEEA from the Global Indicators Assessment only. For each of the specific SDG targets a short summary of the types of instrument reported for associated sectors in the OECD PINE database are described. The potential links across different SDGs are also highlighted.

It should be noted that it will be important to look across a range of indicators to assess the impacts of any instrument selected from **Table 8** to stimulate progress towards specific SDG Targets. This is because economic instruments tend to be designed with a specific narrow focus i.e. a single measurable outcome. This means they are prone to creating unforeseen consequences, for example, incentives to reduce carbon emissions through the use of biofuels (SDG13), through land-use requirements could have negative impacts on food security (SDG2) and biodiversity (SDG15). In the context of the SDGs, and their indivisibility, therefore, they need to be carefully designed and regulated with safeguards incorporated where potential negative side effects seem likely.

Table 8: Economic instruments to stimulating progress to achieving policy targets for 17 priority SDG Target Indicators identified in the Global

Sustainable Development Goal	Potential uses of economic instruments to stimulate progress towards priority SDG targets via policy targets set for SEEA-compliant indicators.
	There are a wide range of economic instruments used in the context of water. These range from relatively straight forward effort around water pricing (to ensure that water is efficiently used – 6.4.1.) to payments which change how land is managed to improve outcomes in terms of water quality or quantity. Such schemes are particularly common in South America where water funds are used to finance the management of upstream areas, typically for the benefits of water users in cities downstream. A selection of water fund examples can be found here: https://www.nature.org/en-us/about-us/where-we-work/latin-america/stories-in-latin-america/water-funds-of-south-america/.

SDG 6.3.1	6.3.1 - Proportion of wastewater safely treated Most instruments around waste water treatment specifically related to charges as a mechanism to ensure that the polluter pays principle is adhered to. However, other instruments were deployed to reduce treatment costs e.g. taxes and levies on products associated with water pollution such as fertilisers. Better treated waste water may deliver co-benefits for the goals on good health (3), responsible consumption and production (12) and life below water (14)
SDG 6.3.2	6.3.2 - Proportion of bodies of water with good ambient water quality As above most instruments focus on water quality tend to take the form of charges/levies either on inputs which impact the quality of water bodies or directly on the return of waste water to bodies (and its condition). Subsidies for behaviours which reduce pollution / tax breaks for improved equipment to better target the use of polluting products are also used. Co-benefits will be similar to those above.
SDG 6.4.1	6.4.1 - Change in water-use efficiency over time Both water pricing and tradable water abstraction permit schemes are widely used to ensure that water is used efficiently and in sustainable volumes. Failing to price water in a way which reflects the costs of delivering it to the final user risks (unsustainable) over use and wastage of a scarce and valuable resource. As such increased water efficiency can lead to co-benefits for goals around responsible consumption and production (12) and climate action (13) as well as life of land (15). However, in countries or regions with high levels of poverty charging – especially households – the full economic cost of water may have negative impacts on the goals around poverty (1) and reduced inequality (10).
SDG 6.4.2	6.4.2 - Level of water stress: freshwater withdrawal as a proportion of available freshwater resources Tradable water abstraction permits are most often used to ensure levels of water abstraction are kept within acceptable limits, abstraction fees are also used, but the underlying regulatory regime which sets the abstraction limits are most relevant in this context. The potential co-benefits are trade-offs are similar to those around target 6.4.1 (above).

SDG 6.6.1	6.6.1 - Change in the extent of water-related ecosystems over time Where water-related ecosystems can improve the quality or availability of water over time. There is a case for the application of the 'beneficiary pays principle' – i.e. those who benefit from an increase in extent of water related ecosystems should fund this increase. This translates to instruments like payments for ecosystem services, or water funds (http://waterfunds.org/esp/), such as those used in Latin America described above. Co-benefits are most likely with goal 15 (life of land) and potentially reduced inequality (10) given the potential to transfer resources from urban to rural areas.
	
SDG 8.9.1	8.9.1 - Tourism direct GDP as a proportion of total GDP and in growth rate
	With urban populations expected to grow very quickly there will be increasing land-use demands associated with this. Economic instruments used in this context will require underpinning spatial specific objectives to deliver effectively.
SDG 11.3.1	11.3.1 Ratio of land consumption rate to population growth rate Transferable Development Rights are an economic instrument, which can be used to help concentrate urban development and steer it away from other highly valued spaces. They are essentially a zoning tool, where some areas are permitted to developed at a higher density, but are required to purchase additional development rights from land where development is not encouraged. This provides compensation for land owner where development is not allowed (and accessible open space preserved), and allows more efficient land use where development is permitted. Development taxes are also used are aimed to encourage more efficient and better located urban development.

	The most likely co-benefits seem likely with targets under goal 15 (Life on Land). There may also be benefits in terms of reduced inequality (10) as those with land which cannot be developed can receive compensation through the tax system or transferable development rights.
SDG 11.7.1	11.7.1 Average share of built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities Development taxes, and specific instruments such as biodiversity offsets can be used to invest in and provide areas of urban green space with values for people and the natural environment. Green space is highly beneficial in urban areas, therefore, there is a risk of inequality with respect to access, either if green space investments are focused in more wealthy areas or areas with green space become more attractive to more wealthy citizens (resulting in gentrification) using economic instruments in the context of this goal has the potential to address this, but they would need to be well regulated. Co-benefits are most likely with respect to goal 10 (reduced inequality) and goal 15 (life on land) where biodiversity offsets are used to deliver biodiversity and green space benefits.
	Subsidy reform is a large and important issue in fisheries, but likewise other instruments e.g. Taxation of carbon and nutrient / plastic use on land, reduction in fishing quota, payments for ecosystem services for example in mangroves to extend nursery grounds for fish, are all likely to be relevant and potentially useful across the suite of indicators below. A useful summary of potential fiscal reforms to support delivery of SDG 14 are provides in the following briefing from IIED: http://pubs.iied.org/pdfs/17411IIED.pdf
SDG 14.1.1	14.1.1 - Index of coastal eutrophication and floating plastic debris density Coastal eutrophication essentially requires reductions in nutrients entering the marine environment whether through improved sewage treatment or reduced run off of nitrates from land. Instruments here are covered in under targets 6.3.1 and 6.3.2. The most common tools used in connection with plastic debris, relate to packaging, in particular the use of deposit-return schemes for plastic bottles. Here the potential co-benefits are to goal 15 (life on land), goal 12 (responsible consumption and production) as well as goal 13 (on climate action).
SDG 14.3.1	14.3.1 Average marine acidity (pH) measured at agreed suite of representative sampling stations

	Atmospheric CO2 is the main driver of increased marine acidity, therefore impacts on this target indicator are likely to be themselves a co-benefit of climate action (goal 13), and the economic instruments used to deliver this. However, measurement of this co-benefit is likely to be valuable in understanding the wider range of benefits derived from tackling CO2 emissions.
SDG 14.4.1	14.4.1 - Proportion of fish stocks within biologically sustainable levels Transferable quota for larger scale fishing and payments for permits / licences for recreational fishers are the most commonly used economic instruments to deliver this target. Whilst in the long term if fish stocks recover there may be co-benefits in terms of goal 8 (decent work and economic growth) in the short term, there may be trade off, if access to fisheries for poorer artisanal fishers are reduced in terms of poverty (goal 1), hunger (goal 2) and reduced inequality (goal 10). This does not mean the instruments should not be used, but that they need to be applied with potential trade-offs in mind so that they can be mitigated.
SDG 14.5.1	14.5.1 - Coverage of protected areas in relation to marine areas Applying the beneficiary pays principle to marine protected areas, would imply understanding the beneficiaries and developing a mechanism to draw payments from them. If for example the protected area is of interest to divers, an access change could be applied, or if the area is of value for maintaining / enhancing fish stocks, revenues from quota sales for example could be used to fund their management. As with goal 14.4.1. There may be trade-offs with goals 1, 2 and 10 where the establishment of marine protected areas reduces access to fisheries for low income fishers.
SDG 14.7.1	14.7.1 - Sustainable fisheries as a proportion of GDP in small island developing States, least developed countries and all countries The instruments available are likely to be similar to those for 14.4.1, however the need to parallel policies to prevent negative trade-offs in the short term while stock recover will be essential, monitoring the impact to ensure undesirable outcomes are not realised will be a key part of this.

	The Biodiversity Finance Initiative – BIOFIN; has produced a workbook for practitioners aiming to deliver on biodiversity targets at a country level. Updated in 2018 it aims to help decision maker think through various different ways of drawing resources into biodiversity. This includes efforts to bring resources into protected areas, e.g. taxes and charges for tourist's / park users. A wider set of instruments are also likely to support sustainable forest management including certification schemes such as FSC.
SDG 15.1.2	15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type Whilst the designation of protected areas is likely to follow scientifically derived criteria, the financing of their management can be supported by economic instruments through the application of the beneficiary pays principle, whether that is the use of water funds, tourist charges or carbon payments. Co-benefits are likely to vary with the protected area but could for example spread across goals 6 (clean water), 11 (sustainable cities), 13 (climate action). If people are excluded from a protected area and no longer able to, for example, collect non-timber forest products in the protected area, there may be trade-offs with goals 1 (poverty) and goal 2 (food security), however recent research suggests such trade-offs are not common.
SDG 15.2.1	15.2.1 - Progress towards sustainable forest management Certification schemes such as FSC are a popular way encourage sustainable forest management, subsidies for sustainable forest management and planting were also commonly available.
SDG 15.3.1	15.3.1 - Proportion of land that is degraded over total land area Subsidies and tax breaks are available in a number of countries to encourage the restoration of degraded land. Offset and other compensation schemes are also referenced.
SDG 15.4.1	15.4.1 - Coverage by protected areas of important sites for mountain biodiversity This will be similar to target 15.1.2.
SDG 15.4.2	15.4.2- Mountain Green Cover Index This indicator is aimed to help monitor the status of mountain ecosystems beyond protected areas, The economic instrument set available to encourage sustainable management of mountain

	ecosystem is likely to be captured in the descriptions covered in under indicators 15,1.2., 15.2.1, and 15.3.1 above.
SDG 15.5.1	15.5.1 - Red List Index Regulations around trade in species, and the sale of permits for collecting / hunting them are reported as economic instruments to encourage the sustainable use of species. Fines are also referenced where laws to protect species are violated. Co-benefits are likely to be around goal 12 (responsible consumption and production).
SDG 15.9.1	15.9.1 - Progress towards national targets established in accordance with Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011-2020 The aim of improved accounting for biodiversity is to develop economic development that is compatible with a thriving natural environment. Therefore, assuming economic planners and decision makers respond to accounts, there should be co-benefits across a wide range of SDGs including in particular goal 8 (decent work and economic growth) and goal 12 (responsible consumption and production).

As shown above, there are a range of economic instruments that have been used across the world to help stimulate progress across the SDGs and which will be measured through influence indicators of their progress above. As identified, these instruments will not often register impacts on a single target indicator alone. There may be co-benefits, which can enhance the case for using such instruments, or potential trade-offs which will need to be mitigated. Economic instruments need to be well regulated to be effective, a key part of this will be ensuring that their impacts are evaluated and fed back into instrument designs as they involve. Spatially relevant accounts can play an important role in this context.