Using the SEEA EA for Calculating Selected SDG Indicators – Project country testing experiences

Report of the NCAVES Project

United Nations

System of Environmental Economic Accounting

Citation and reproduction

This work is available open access by complying with the Creative Commons license created for inter-governmental organizations, available at: http://creativecommons.org/licenses/by/3.0/igo/

Reproduction is permitted provided that an acknowledgment of the source is made.

Citation: UNSD (2021). Using the SEEA EA for Calculating Selected SDG Indicators – Project country testing experiences. 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 and James Vause of the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) under the guidance of Julian Chow of United Nations Statistics Division and William Speller of the United Nations Environment Programme.

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.

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

Executive Summary

This document summarises the experiences of countries of the Natural Capital Accounting and Ecosystem Service Valuation (NCAVES) project in calculating priority SDG Indicators using the System of Environmental Economic Accounting Ecosystem Accounts (SEEA EA) framework. Specifically, it covers the experiences in Brazil, China, India, and South Africa in applying a set of technical notes to calculate 4 SDG Indicators.

The results of the testing are summarised in the figure below. Green indicates it was possible to calculate the indicator using the technical note, amber that a version of the indicator could be calculated using an accounting based approach but challenges remain in aligning it to the globally agreed methodology. Purple indicates it was possible to calculate a version of the indicator using an approach different to that set out in the technical notes. 'N/A' means the indicator could not be calculated due to insufficient data but the importance of the accounts to calculating this indicator was identified by countries.

	South Africa	India	Brazil	China
SDG 15.1.1– Forest area as a proportion of total land area.	Amber	Green	Green	Green
SDG Indicator 15.3.1 - Proportion of land that is degraded over total land area.	N/A	Purple	N/A	N/A
SDG Indicator 6.6.1 – Change in the extent of water-related ecosystems over time.	Amber	Amber	N/A	Amber
SDG Indicator 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	Amber	Amber	N/A	Amber

The most tractable indicator for calculation was found to be SDG 15.1.1. As South Africa have tailored this indicator to make it more ecologically meaningful to their national circumstances, SDG 15.1.1 gets an amber rating in the above figure. However, it was possible to calculate this nationally tailored indicator for South Africa using a SEEA based approach.

It was possible to calculate a version of the SDG 6.6.1 indicator in South Africa, India and China. However, challenges remain with respect to delineating the full extent of water-related ecosystems, particularly where they are small and ephemeral. With respect to tracking trends, challenges are also identified with distinguishing seasonal and other natural fluctuations in extent from more permanent changes in extent.

For SDG 11.7.1, it was possible to calculate a version of the indicator that communicated on the proportion of parklands, green areas or public green space in Urban Areas for South Africa, India and China. However, identifying other public open space areas and confirming accessibility for different social groups remains challenging, both generally and in the context of ecosystem accounting.

None of the NCAVES countries were able to calculate an indicator for SDG 15.3.1 using the technical notes. This was partially due to the limited terrestrial Ecosystem Condition Accounting that has been implemented to date. There were also identified issues in using the global approach for calculating degradation in some countries. For instance, using trends in vegetation indices to infer degradation where encroachment of woody invasive species was occurring in certain ecosystems. However, the potential of the SEEA EA as a framework for organising relevant data and supporting the calculating of this indicator was highlighted. This is identified as a key area for research.

An important insight from the testing is that there is often a need to nationally tailor the global SDG Indicator methods to national circumstances. The flexible nature of the SEEA as an organising framework for environmental information was highlighted as being very useful to aid calculating these nationally tailored SDG Indicators in a rigorous and consistent manner.

Another key area identified for further research is developing robust cross-walks between different ecosystem typologies and thematic definitions (e.g., IUCN Global Ecosystem Typology, national ecosystem typologies, IPCC Land Cover Categories, FAO forest definition). This will greatly enhance the potential of the SEEA EA to deliver a flexible framework for calculating indicators that responds to country's needs. This is because the accounting filter can be used to organise and integrate multiple data for different national and international reporting commitments in a rigorous and consistent way. The importance of establishing the right institutional arrangements and cooperation mechanisms between indicator and data custodians, decision-makers and ecosystem accountants is also highlighted if this potential is to be realised.

1 Introduction

This document comprises a supplement to the document: *Using the SEEA EA for Calculating Selected SDG Indicators*, which presents a series of *Technical Notes* to support the calculation of 4 priority SDG Indicators using the System of Environmental Economic Accounting Ecosystem Accounts (SEEA EA) framework (see UNSD, 2020). The technical notes are in alignment with the methods described for calculating these global SDG indicators, as described in their associated metadata sheets.[2] These four SDG Indicators were selected as priorities for testing calculation via the SEEA because they speak to multiple reporting commitments. These priority SDG Indicators comprise:

- SDG Indicator 15.1.1 – Forest area as a proportion of total land area.
- SDG Indicator 15.3.1 - Proportion of land that is degraded over total land area.
- SDG Indicator 6.6.1 – Change in the extent of water-related ecosystems over time.
- SDG Indicator 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.

This supplementary document summarises the experiences of the project countries of the Natural Capital Accounting and Ecosystem Service Valuation (NCAVES) project in evaluating and implementing these technical notes. Specifically, it covers the experiences in Brazil, China, India, and South Africa in applying the technical notes to calculate the above indicators. These technical notes are intended to provide a broad, conceptual framing for calculating the indicators using accounting approaches to organise data. They are not intended to provide detailed instructions on associated measurement approaches. It was not possible for Mexico, the final NCAVES project country, to test the technical notes.

The technical notes should be read in conjunction with this supplementary document. In order assist project countries in a consistent approach to testing indicator calculation via the technical notes, they were provided with a proposed testing approach (provided in Appendix A). Following the testing, each country produced a short report detailing outcomes and findings. These are presented in Appendices B to E and summarised in Chapters 2 to 5 herein.

The objective of this document is to capture the lessons learned across the NCAVES countries on implementing the technical notes and using the SEEA EA to calculate the above SDG Indicators. These real world implementation insights will inform possibilities for updating the approaches in technical notes so they can best support other countries and organizations interested in using them. They will also provide more general insight into the opportunities and benefits of using the SEEA EA for calculating indicators and SDG Indicators specifically, as well as identifying key areas for further research and experimentation. A synthesis of these findings is provided in Chapter 6.

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

2 South Africa

2.1 Introduction

A report on "Testing and refining global and national SEEA-EEA related indicators" for South Africa is presented as Appendix B herein. The aim of that report was to assess the usefulness of the SEEA EA in informing the four SDG Indicators for which the technical notes had been compiled. To this end, the study aimed to identify how South Africa's current compilations of SEEA EA accounts align with the indicators in terms of data requirements and calculation, as well as conveying their intended purpose and meaning. Based on the findings of the report, a series of recommendations were provided on how South Africa may best adjust global SDG Indicators to suit their national circumstances and the possibilities for their calculation via the SEEA.

Statistics South Africa (Stats SA) coordinates the reporting of SDG Indicators for South Africa, working in partnership with a range of institutions. To guide reporting on progress towards the SDGs, Stats SA have produced the following reports:

- Sustainable Development Goals: Indicator Baseline Report 2017 (Stats SA 2017), which covers 98 SDG Indicators (out of the 156 for which there were agreed standards and methods); and,
- Sustainable Development Goals: Country Report 2019, which was the "first full-scale report" on progress towards the SDGs. This report presents the expanded list of 156 SDG Indicators for which there are agreed standards and methods (this is out of the full set of 230 SDG indicators).[3]

With respect to the four SDG Indicators for which the technical notes have been compiled, SDG 15.1.1 features in both the Indicator Baseline Report (2017) and the Country Report (2019). SDG 15.3.1 and 6.6.1 are included in the Country Report (2019) only. SDG 11.7.1 does not feature in either, although recommendations are still provided in the South Africa report in Appendix B on how the SEEA EA could support the calculation of a domesticated version of this SDG Indicator. For consistency, such domesticated indicators are termed "nationally tailored" indicators in this document hereafter. Where a "nationally tailored" SDG indicator implies an indicator for any given SDG Target that is adjusted from the globally agreed method for calculating the SDG indicator or and does not have a direct equivalent in the globally agreed SDG indicator framework.[4]

2.2 Summary of testing technical notes in South Africa

Following the in-country testing, the South Africa team provided recommendations on calculating each of the SDG Indicators and the support the SEEA could provide. These are summarised in the following sections.

2.2.1 SDG Indicator 15.1.1 – Forest area as a proportion of total land area.

The South African testing report notes the adoption of the FAO definition for forests in calculating this indicator at the global scale. It highlights that South Africa has "nationally tailored" (or domesticated) the indicator to report on the remaining extent of its natural woody vegetation biomes. This avoids the inclusion of increases in tree cover due to bush encroachment (i.e., increases in the density of woody vegetation in grassland areas), the spread of invasive alien

[3] http://www.statssa.gov.za/MDG/SDGs_Country_Report_2019_South_Africa.pdf
[4] As described here: https://unstats.un.org/sdgs/metadata/

trees and expansion of exotic timber plantations, all of which have negative impacts on ecosystems. The expansion of invasive alien trees is a major challenge in South Africa, with substantial negative impacts on water security and biodiversity.

In the country's SDG reporting, Indicator 15.1.1 is "nationally tailored" to communicate the extent of the biomes: Natural Forest; Savanna; and, Albany Thicket, as defined in the National Vegetation Map (rather than the area with more than 10% tree cover, following the FAO definition). Forests as a total proportion of total land area depend on a range of factors in the South African context, where natural indigenous forests have always been a small, naturally fragmented biome that makes up a very small proportion of the country. The remaining extent of these biomes is calculated in relation to their historical extent (prior to major human modification of the landscape, circa. 1750). In the 2019 SDG Country Report, the extent of Natural Forest was 0.4% of the total land area historically (c.1750), dropping to 0.3% in 1990 and 2014. Savanna declined from 32% of land area historically (c.1750) to 27% in 1990 and to 26% in 2014. Albany Thicket remained at 2% in all years.

A key recommendation from the report is that the global indicator is changed from being forestry- to ecosystem-focused. This would be achieved by using a definition of forest based on the forest biomes in the IUCN's Global Ecosystem Typology (which is also the reference classification for the SEEA EA), rather than the FAO definition of forests. An overall conclusion is that the SEEA EA provides a very suitable framework for organising data to calculate this South African "nationally tailored" version of SDG 15.1.1.

2.2.2 SDG Indicator 15.3.1 - Proportion of land that is degraded over total land area.

According to South Africa's seventh report to the United Nations Convention to Combat Desertification (UNCCD) Performance Review and Assessment of Implementation System (presented in 2014), 10.71% of South Africa's land area is classified as degraded. This is the figure reported in the South African 2019 Country Report on the SDGs.

In South Africa, land cover changes are considered indicative of degradation if they reflect a change from natural or semi-natural land cover classes to intensive land uses, such as cropland, mines or urban settlements. As with the global indicator, land is also considered degraded on the basis of land productivity trends (but with no clear directional relationship as discussed below) or trends in soil organic carbon.

With respect to measuring land productivity dynamics using vegetation indices as an indicator, the South African testing report highlights that this is not appropriate for all ecosystem types. For instance, bush encroachment or spread of invasive alien woody plant species would be linked to increasing vegetation index measures, yet also indicative of degradation. Conversely, restoration to remove invasive alien woody plants would be linked to decreasing vegetation index measures, yet indicate reversal of degradation. This observation and need for adaptation for such circumstances is also highlighted in the technical note for SDG 15.3.1. As such, it is noted that vegetation indices cannot be reliably used to indicate degradation in South Africa's terrestrial ecosystems.

The report also highlights the potential role of Ecosystem Service Accounts for measuring carbon sequestration and storage services to inform land degradation. Indicators from such accounts are considered to be better aligned to the envisaged evolvement of the sub-indicator for carbon stocks, rather than relying on Soil Organic Carbon (SOC) as a proxy. This type of ecosystem services orientated approach would also align better with the ambition of SDG 15.3.1 to measure changes in total terrestrial carbon stocks. Specifically, including above and below ground biomass and dead organic matter, in addition to changes in SOC.

The South Africa report highlighted that substantial discussion and work needs to be undertaken to develop a reliable and consistent methodology to assess national terrestrial ecosystem condition. Nonetheless, the development of SEEA EA Accounts is considered essential for informing this indicator, and indeed for improving upon its three sub-indicators. While some work is needed to adapt the current Land and Terrestrial Ecosystem Accounts (LTEA) to provide information for the first (land cover change) sub-indicator, this appears to be very feasible in the short term. With suitable data, Ecosystem Condition and Ecosystem Services Accounts are highlighted as an important way of integrating a more reliable assessment of the second the third sub-indicators, rather than simply relying on changes in vegetation indices and SOC (or inferred changes in SOC from land cover change).

The report provides a useful caveat with respect to reference levels. The Global SDG Indicator 15.3.1 is structured on a 2000 and to 2015 baseline, reflecting the ambition to achieve land degradation neutrality between that baseline and 2030. However, it is also important to have a national reference condition, so that there is awareness of the overall level of land degradation that can be provided to national policy makers and land managers. In the case of South Africa, a national reference condition for 'no degradation' can be based on the situation prior to major human modification of the landscape (circa. 1750).

2.2.3 SDG Indicator 6.6.1 – Change in the extent of water-related ecosystems over time.

The report for South Africa highlights that there are 5 sub-indicators for SDG 6.6.1, arranged over two levels.[5] For level 1, the report identifies that the sub-indicator on the spatial extent of water-related ecosystems could be calculated by SEEA EA Ecosystem Extent Accounts for freshwater ecosystems (hereafter referred to as SDG 6.6.1). The potential for the SEEA EA Ecosystem Condition Accounts for freshwater ecosystems to calculate the water quality indicator for lakes and artificial water bodies is also highlighted.

There are five data sources that are considered for calculating SDG 6.6.1 for South Africa, as presented in Table 1. The current approach adopted in the SDG Country Report for 2019 is based on data provided by SANBI and the Department for Water and Sanitation (the HYDSTRA Database). The HYDSTRA data in Table 1 are the aggregated extent of dams, estuaries, wetlands and lakes (rivers are excluded but identified as important for future inclusion). The South African Inventory of Inland Aquatic Ecosystems (SAIIAE, van Deventer *et al.* 2018) has been compiled in order to more fully assess the total extent and condition of waterbodies in South Africa. The SAIIAE includes comprehensive data on the extent and condition of water related ecosystems in South Africa.

Table 1 also presents 2 global databases that can be used to calculate the extent of water related ecosystems. Specifically, the Global Surface Water Explorer tool produced by the Joint Research Centre of the European Commission (Pekel et al., 2016) and the Global Lakes and Wetlands product curated by the World Wide Fund for Nature (Lehner and Doll, 2004).

In Table 1, the extent of water related ecosystems calculated from the above data sources is compared to the extent of waterbodies reported in national Land and Terrestrial Ecosystem Accounts (LTEA, Stats SA 2020), where waterbodies comprise the combined extent of "wetlands", "water seasonal" and "water permanent" land cover classes. A key observation from Table 1 is

[5] These comprise: Level 1, Sub-Indicator 1, Spatial extent of water-related ecosystems; and, Sub-Indicator 2, Water quality of lakes and artificial water bodies. Level 2, Sub-Indicator 3, Quantity of water (discharge) in rivers and estuaries; Sub-Indicator 4, Water quality imported from SDG Indicator 6.3.2, Sub-Indicator 5, Quantity of groundwater within aquifers.

the large differences in the extent of water-related ecosystems derived from these different data sources. In particular, the JRC Surface Water Explorer provides an extent an order of magnitude lower that the LTEA and a change that is also an order of magnitude lower and in the opposite direction. This may reflect that the JRC Surface Water Explorer tool does not capture the full extent of some vegetated wetlands that are seasonally or periodically, rather than permanently, inundated.

The SAIIAE combines remote sensing with other methods and data, including modelling of wetland probability and on-the-ground mapping of wetlands, to produce the most comprehensive dataset on water-related ecosystems for South Africa. It includes the full extent of wetlands, including those that are seasonally or periodically dry, as well as many small waterbodies that are not picked up in other datasets. The SAIIAE, thus, reports the largest area of water-related ecosystems of the available global and national datasets and is the closest to being a comprehensive, accurate value of their extent.

Table 1: Different computations of extent of water-related ecosystems, highlighting the vast differences in values and the complexity of determining an accurate value (Adapted from Table 3, see Appendix B for reference details)

		SAIIE (van Deventer *et al.* 2018)	HYDSTRA / SDG Country report. (Stats SA 2019)	JRC Surface Water Explorer (Pekel *et al.*, 2016)	GLW (Lehner and Döll 2004)	LTEA 2014 (Stats SA, 2020)
Ca. 1990	Extent of water-related ecosystems (ha) (approximate)	N/A	N/A	526 096	N/A	2 096 528
	Extent of water-related ecosystems (% of total land area) (approximate)	N/A	N/A	0.4	N/A	1.7
Ca. 2014	Extent of water-related ecosystems (ha) (approximate)	4 123 798	3 902 926	571 551	1 536 066	1 420 676
	Extent of water-related ecosystems (% of total land area) (approximate)	3.4	3.2	0.5	1.3	1.2
Net Change	Change in the extent of water related ecosystems as a percentage of the opening extent	N/A	N/A	+8.6%	N/A	-32.2%

None of the South African datasets have the temporal resolution required for accurate reporting on trends in the extent of water-related ecosystems, at this stage. It is more difficult to judge the accuracy of such a change for waterbodies than for other land cover classes because of the seasonal and inter-annual variability of these ecosystems. For example, a decrease in the extent of water bodies over a particular period can reflect simply that the opening year was a wetter year, with more rainfall, than the closing year. This was the case with the extent of waterbodies in the Land and Terrestrial Ecosystem Accounts, which decreased by 32.2% between 1990 and 2014, from 1.7% of the mainland area to 1.2%. This decrease reflects mainly that 1990 was a wetter year than 2014, and cannot be used to draw conclusions about actual change in the extent of water-related ecosystems. This highlights the need for assessments of the extent of waterbodies to be derived from a combination of satellite data, modelling of wetland probability and on-the-ground mapping of wetlands at regular intervals.

The key conclusions from South Africa on using the SEEA EA to calculate SDG 6.6.1 are:

- A key weakness of this indicator if applied too simply is its inability to distinguish what has been permanently lost versus temporarily reduced through natural fluctuations. For example, due to seasonal or longer term variation in rainfall or major drought.
- For SDG Indicator 6.6.1, the global datasets as they stand are inadequate. This is because they substantially under-represent the extent of water-related ecosystems in South Africa.
- The indicator should preferably report on the extent of wetlands and other water-related ecosystems based on an estimation of their natural full extent, taking into accounts both seasonality and longer period natural variation. A reduction in the extent of wetlands and other water-related ecosystems should only be reported when there has been actual loss of area (for example, as a result of conversion of wetlands to intensive land uses, such as cultivation or mining). It should not be reported when the reduction in extent is the result of seasonal or longer term natural fluctuations. It will also be useful to track the longer term (inter-annual) variation of wet and dry cycles and extended droughts in the accounts, as this is important for more accurate description of the delivery of ecosystem services.
- The SAIIAE (its highest quality data on aquatic ecosystems) should be incorporated into the SEEA ecosystem accounts in response to the above. Accounts for freshwater ecosystems, still to be developed, will provide the most rigorous and consistent information for this indicator.

2.2.4 SDG Indicator 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

The SDG 11.7.1 indicator for urban public open space has not been reported in either the Baseline (Stats SA 2017) or Country Report (Stats SA 2019). However, South Africa has developed a set of Land Accounts for Metropolitan Municipalities (known as Metros). These describe (a) the proportion of green open space area and (b) the degree of greenness within the urban land cover classes. These Land Accounts for Metros provide a more detailed disaggregation of the urban land cover class identified in the national Land and Terrestrial Ecosystem Accounts (LTEA).

A key challenge identified for calculating SDG 11.7.1 using the Land Accounts for Metros, is the need to define an urban boundary in a way that is consistent with the approach outlined by UN Habitat for calculating the global SDG 11.7.1 indicator. Currently, the Ecosystem Accounting Area for these accounts is based on the administrative boundaries for metropolitan municipalities. Further, the Land Accounts for Metros only cover eight metropolitan areas in South Africa (which include the largest urban agglomerations). To meet the full needs of SDG Indicator 11.7.1, additional accounts would need to be compiled for all other urban areas (including smaller cities and towns) or some way to generalise results, as a representative sample, would need to be developed.

Another key challenge is to identify all the types of public open space required for inclusion in SDG Indicator 11.7.1. The global indicator refers to open space, rather than green space. This includes built open space such as plazas, streets and walking boulevards, as well as public open green spaces such as parks. In the Land Accounts for Metros, paved open spaces and roads are classified as built areas and not distinguished as publicly accessible areas.

The spatial resolution of the Land Accounts for Metros (which use a 1 ha grid) was identified as a potential constraint to calculating the indicator accurately. Far more detailed and accurate data are available for several of the larger municipalities, some with a very fine resolution of about 2.5 metres. These data have been developed based on a combination of satellite data, planning information and on-the-ground verification, in order to support monitoring and management efforts. These will greatly improve the possibilities for identifying the many smaller and important open areas that are publicly accessible. This includes hard covered areas such as plazas, which are hard to identify using remote sensing approaches.

A more general observation with respect to the SDG Indicator 11.7.1, is the global agreed indicator includes the area allocated to streets in the calculation of 'publicly accessible open space'. Whilst such areas are clearly functionally important, they are often of low aesthetic and amenity value. They may also not provide 'safe' areas for the public to use. As such, the South Africa team suggest that it may not be appropriate to include these areas in the calculation of SDG 11.7.1 for South Africa.

The South African report suggests that the Land Accounts for Metros can be used to derive an indicator that communicates on the general 'sense' or ambition of SDG 11.7.1. Particularly, communicating an indication of the extent of large (>1ha) parklands in a sample of urban areas. This does not necessarily fulfil the full ambition of the indicator, as it does not distinguish all open spaces required by the indicator or align with the same exact delineation of urban area. It is also highlighted that further work is required to consistently and accurately define green open space in the Land Accounts for Metros.

2.3 Key findings from the South African Testing Experience

Overall, the South African testing report indicates that there is strong potential for the SEEA EA to support the calculation of the SDG Indicators tested in South Africa. The report highlights that there is often a need to "nationally tailor" (termed domesticate in South Africa) these global indicators for the South African. The flexible nature of the SEEA EA as a framework for organising environmental data can assist in calculating these SDG Indicators in a rigorous and consistent way.

For calculating both SDG 15.1.1 and 6.6.1, the need to integrate wider information than just remotely sensed land cover data to achieve a better thematic representation of forest and water-related ecosystems is highlighted. For SDG 15.1.1 this is based on calculating the extent of natural forest and woodland biomes as defined in the National Vegetation Map, which align well with the forest and woodland biomes defined in the IUCN's Global Ecosystem Typology. The remaining extent of these biomes is calculated in relation to their historical extent (prior to major human modification of the landscape, circa 1750).

For SDG 6.6.1, South Africa has developed high resolution data on the extent of water-related ecosystems that combine data from remote sensing with on-the-ground information. Ecosystem Extent Accounts for freshwater ecosystems provide an opportunity to integrate this information into the SEEA EA framework. It may be necessary to use an analytical grid unit that is higher resolution than the current 1ha grid employed. With this in place, the indicator can be regularly and robustly calculated via the SEEA EA.

For SDG 11.71. South Africa have developed Land Accounts for Metropolitan Municipalities that provide a sense of this indicator, specifically the extent of parklands as a proportion of urban extent. Whilst not exactly aligned to the global method, this is a useful indicator for urban planners. However, identifying open accessible public places (especially < 1 ha in area), such as plazas and other non-green areas, remains challenging. A more general observation is made with respect to how the indicator should be structured to ensure that only public open spaces that have amenity value and are safe are included.

Whilst further work is required for establishing the methods and data basis for calculating SDG 15.3.1 in a manner that is appropriate for South Africa, the SEEA EA is identified as a crucial framework for integrating the necessary data to support this calculation. Specifically, with respect to bringing together a coherent assessment of land cover change, ecosystem condition indicators for degradation and ecosystem services related to carbon sequestration and storage.

3 India

3.1 Introduction

The "Report on SEA & SDGs" for India and is presented as Appendix C herein. The report provides an overview of the SDGs, their relationship with the SEEA and outcomes from testing SDG Indicator calculation using the SEEA EA.

3.2 Summary of testing technical notes in India

The following sections summarises the insights gained in India from testing the calculation of SDG 153.1.1; SDG 15.3.1; SDG 6.6.1; and, SDG 11.7.1 via the technical notes. In addition, the report in Appendix C also describes testing the calculation of SDG 11.3.1: Ratio of land consumption rate to population growth rate using the SEEA. This is not reported on herein.

3.2.1 SDG Indicator 15.1.1 – Forest area as a proportion of total land area.

A key first step highlighted for testing the calculation of SDG 15.1.1 in India is defining the ecosystem types that are considered 'Forest'. In India, 'Forest Cover' refers to "All lands, more than one hectare in area, with a tree canopy density of more than 10% irrespective of ownership and legal status. Such lands may not necessarily be recorded forest area. It also includes orchards, bamboo and palm". This would appear to align reasonably well with the FAO definition for forests. However, it is noted that the FAO definition (as adopted in SDG 15.1.1) covers all land spanning more than 0.5 hectares. As such, the India definition would systematically exclude all lands spanning >0.5ha and <1ha.

The report presents an Ecosystem Extent Account, which includes the three forest classes reported India State of Forest Report (ISFR).[6] Comprising: Very Dense Forest; Moderately Dense Forest; and, Open Forest. The ISFR is published every two years, allowing SDG 15.1.1 to be calculated on a regular basis. The Ecosystem Extent Account is presented as Table 2 and shows SDG 15.1.1 increased from 21.05% in 2008/09 to 21.67% in 2017/18. In addition to these national results, the indicator is also calculated at subnational, State scale in Appendix C.

Table 2: Ecosystem Extent Account for Calculating SDG 15.1.1 (2008/09 to 2017/18, in km²)

	Very Dense Forest (Canopy cover ≥ 70%)	Moderately Dense Forest (Canopy cover ≥ 40% and <40%)	Open Forest (Canopy cover ≥ 10% and <70%)	Total	Scrub (Canopy cover < 10%)	Non-Forest	Total Geographic Area	SDG 15.1.1
Opening Stock (2008-09)	83,471	3,20,736	2,87,820	6,92,027	42,176	25,53,060	32,87,263	*21.05*
Net Change	15,807	-12,264	16,679	20,222	4,121	-24,137	206	
Closing stock (2017-18)	99,278	3,08,472	3,04,499	7,12,249	46,297	25,28,923	32,87,469	*21.67*

[6] https://fsi.nic.in/forest-report-2019?pgID=forest-report-2019

As Table 2 reveals, the approach to mapping forest cover in India relies on mapping areas to different canopy densities that satisfy the FAO definition of canopy cover > 10%. Whilst further work is required to align the extent of three different canopy densities with the national land cover classification system, concordance tables can be compiled

3.2.2 SDG Indicator 15.3.1 - Proportion of land that is degraded over total land area.

The report highlights that there is a national approach to measuring land degradation, using data from the National Remote Sensing Centre (NRSC) and methods developed by the Indian Space Research Organisation (ISRO).[7] It is this national methodology that is the basis for reporting on SDG 15.3.1 by India. The report compares the results from the national approach to a global approach, using Trends.Earth to calculate SDG 15.3.1. The results from calculating SDG 15.3.1 for India using Trends.Earth are presented in Table 3. Table 3 shows that Trends.Earth identifies that 8.12% of total land area in India has degraded over the span of 15 years from 2000 to 2015. The national estimate for total degraded area for India is far higher at 27.77%, as reported in the SDG Progress Report (by NRSC).

Table 3: Summary of SDG 15.3.1 Indicator calculated using Trends.Earth

	Area (sq km)	Percent of total land area
Total land area:	32,15,129.6	100.00%
Land area improved:	17,89,096.3	55.65%
Land area stable:	10,77,146.2	33.50%
Land area degraded:	2,61,197.6	8.12%
Land area with no data:	87,689.5	2.73%

It is highlighted that there are key measurement differences between the NRSC and Trends.Earth approaches. However, both rely on stratifying the national extent by land cover or land use type, then identifying areas of degradation based on different indicators of condition. It is also important to stress that the estimate obtained using the Trends.Earth tool represents the change in degraded land over the 2000 to 2015 reference period. Whereas, the estimate given by the NRSC which measures the absolute degraded land area. Therefore, it is considerably higher. This value of the absolute extent of degraded land (which can be broken down into various classes) may be of more interested to policy makers interested in addressing long-standing land degradation concerns.

The report highlights the role of the Ecosystem Extent Accounts in calculating the SDG 15.3.1 sub-indicator on land degradation from land cover change. The role of Ecosystem Condition Accounts in tracking trends in the two other sub-indicators for land degradation (land productivity and carbon stocks) is also identified. Review of the documentation on the Indian national approach also considers some land cover flows indicative of degradation. For instance, expansion of areas of barren land and rocky areas. It also considers a number of physical, chemical and functional state indicators within different land cover / use types that could be aligned to Ecosystem Condition Accounts. As with the global approach, these are not expressed as quantitative values, rather they are categorised into low and high severity classes indicative of degradation.

[7] https://www.sac.gov.in/SACSITE/Desertification_Atlas_2016_SAC_ISRO.pdf

Overall, there appears to be potential to align the SEEA EA with the national approach for measuring land degradation, as well as the existing global one. However, as the appropriate Ecosystem Condition Accounts were not developed as part of the project in India further testing and experimentation is required to evaluate this fully.

3.2.3 SDG Indicator 6.6.1 – Change in the extent of water-related ecosystems over time.

In India, the national version of the SDG 6.6.1 indicator is quite different to the globally defined indicator. The nationally tailored SDG 6.6.1 indicator for India is: "Percentage of blocks/mandals/taluka over-exploited".[8] Nonetheless, the report in Appendix C sets out a test to calculate the global version of SDG 6.6.1 via the technical note in the Indian context.

In the SDG 6.6.1 technical note, the approach to calculating SDG 6.6.1 is grounded in compiling Ecosystem Extent Accounts and identifying the water related ecosystems in those accounts. In India, the land-use and land-cover (LULC) statistics are maintained by National Remote Sensing Centre (NRSC). The report presents an extract from the type of Ecosystem Extent Account that could be compiled using these data to calculate SDG 6.6.1. This is presented as Table 4.

As Table 4 shows, the Wetlands / Water Bodies land-use / land cover type is disaggregated to Inland Wetlands, Coastal Wetlands, Water Courses and Water Bodies. Between 2011/12 and 2015/16, the extant of Wetlands / Water bodies decreases from 138,294 km^2 to 137,774 km^2. This is a relative net change of -0.38% (equivalent to the value for SDG 6.6.1 over the accounting period).

The report also presents these statistics by state. An interesting piece of additional analysis is the state-wise details of Ramsar sites. This presents the total wetland areas and the wetland areas classified as Ramsar sites alongside each other. This allows for the percentage of wetlands considered Ramsar sites to be derived for each state.

The testing results support the use of the Ecosystem Extent Accounting structure to calculate SDG 6.6.1, further confirmation that the land use / land cover type for wetlands and water bodies aligns adequately with the extent of all water-related ecosystems in India should be sought from national wetland experts before being used in decision-making.

Table 4: Extract from possible Ecosystem Extent Account for Calculating SDG 6.6.1 (2011/12 to 2015/16)

L1	L2	Opening Stock (2011-12)	Addition to Stock	Reduction in Stock	Closing Stock (2015-16)
Wetlands/ Water bodies	Inland Wetland	8,175	458	1,027	7,606
	Coastal Wetland	10,719	189	121	10,787
	River/Stream/ Canals	61,032	2,130	2,333	60,829
	Water bodies	58,367	1,478	1,293	58,552
	Total	138,294	4,254	4,775	137,774

[8] Blocks, Mandals or taluka are understood to comprise sub-state administrative areas or boundaries

3.2.4 SDG Indicator 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

The report in Appendix C presents the outcomes from testing the calculation of a version of SDG 11.7.1 for the city of Vijayawada in Andhra Pradesh. The indicator is predicated on identifying the extent of green areas in urban extent of the city. The focus on Urban Green Spaces (UGS) reflects their importance in providing important biophysical and socio-economic ecosystem services to urban residents through flood mitigation, temperature regulation, promoting public health and outdoor activity, and relieving stress.[9]

The overall urban extent is identified from the land-use land cover statistics / maps compiled by the NRSC (the ESA CCI Land Cover Maps are also tested). These would be the data used to compile Land Use / Land Cover Accounts (or proxy Ecosystem Extent Accounts) at the national scale for India.

UGS within the urban area is calculated using the extent of green areas identified using maps of Normalized Difference Vegetation Index (NDVI) derived from Bhuvan, at the National Remote Sensing Centre (The Indian Geo-Platform of the Indian Space Research Organisation). This allows the green portion of the city to be identified. The approach is to take the average of 26 bi-weekly NDVI observations as a measure of the extent of green urban space.

The testing process for Vijayawada derives an indicator similar to the extent of blue / green spaces proposed in the technical note and achieves the ambition of providing a more detailed ecosystem extent accounting for urban areas. This is considered to be useful to urban planning interested in monitoring and increasing the provision of areas of high amenity value for city residents. In due course, the indicator would benefit from further work to confirm the degree of public accessibility to these areas.

3.3 Key findings from the Indian Testing Experience

The Indian testing report highlights that the systems approach of the SEEA EA enables countries to develop sets of statistics and indicators on ecosystems and how they relate to the economy and can be used to directly measure several SDG indicators and provide supplemental information for numerous others. It increases efficiency and provides policy makers with relevant information to measure and monitor progress towards achieving SDGs. It also supports the disaggregation of SDG indicators to inform national policy (spatially, by sector, etc.)

The testing process itself is broadly supportive of the ability of the SEEA to calculate SDG Indicators using the technical notes. For SDG 15.1.1 and 6.6.1, it has been possible to calculate national and state scale indicators using data that would feature in an Ecosystem Extent Account. For SDG 15.1.1, the current approach to measuring forest extent based on canopy cover would require additional work to align with the NRSC information on land cover and land use or an alternative ecosystem typology (e.g., the IUCN GET). However, the potential to develop concordance tables is identified. For SDG 6.6.1, it has been possible to calculate a version of the indicator using the NSRC Land use / Land Cover data in an Ecosystem Extent Accounting format.

[9]https://www.researchgate.net/profile/Raaj_Ramsankaran2/publication/328969328_Linking_remotely_sensed_Urban_Green_Space_UGS_distribution_patterns_and_Socio-Economic_Status_SES-_A_multi-scale_probabilistic_analysis_based_in_Mumbai_India/links/5e29a817a6fdcc70a1452e6b/Linking-remotely-sensed-Urban-Green-Space-UGS-distribution-patterns-and-Socio-Economic-Status-SES-A-multi-scale-probabilistic-analysis-based-in-Mumbai-India.pdf

A version of the SDG 11.7.1 Indicator, has been calculated for the city of Vijayawada in Andhra Pradesh. This was based on using NDVI data to disaggregate the extent of urban areas into Urban Green Spaces and the remaining urban area. While further work is required to confirm the accessibility of these areas to the public, this is still considered a useful indicator for urban planning along the lines envisaged under SDG Target 11.7. This version of SDG 11.7.1 for Vijayawada is similar to the indicator for the aggregated extent of blue / green space in cities proposed in the SDG 11.7.1 technical note.

Whilst further testing is required with respect to calculating SDG 15.3.1 via the SEEA in India, the potential to achieve this is identified. This could be for both the globally agreed approach for calculating the indicator or drawing in India's own approach for mapping degraded areas and integrating this information into the SEEA EA framework.

4 Brazil

4.1 Introduction

The "Short Report Describing Results of Deriving Indicators" for Brazil is provided as Appendix D. The objective of the report is to describe the status of the four SDG Indicators for which the technical notes were compiled, based on the experience of Brazil.

With respect to monitoring progress towards the SDGs, the Brazilian Institute of Geography and Statistics (IBGE) launched a platform in 2018, through which the indicators for monitoring the SDG targets are released.[10] The platform contains the country's first set of indicators for monitoring progress towards the SDGs and describes their status. The platform was created as a result of collaboration between IBGE and other institutions via National Commission for the Sustainable Development Goals, created through Decree No. 8,892, October 27, 2016.[11]

The National Commission for the Sustainable Development Goals has produced an action plan to adapt the global goals of the 2030 Agenda for Sustainable Development to the Brazilian reality, considering national strategies, plans and programs and the country's challenges to guarantee sustainable development in the next decade. Efforts to support the spatializing of the SDGs (that is, to estimate the indicators for monitoring the SDG targets by region) were also are identified, where appropriate, via this plan. However, as described in the testing report for Brazil, the decree that instituted the National Commission for the Sustainable Development Goals was repealed after about 3 years of its creation. As such, the work agenda in Brazil with respect to the SDG Indicators continues to be guided by the global SDGs, Targets and Indicators.[12]

4.2 Summary of testing technical notes in Brazil

The following sections provide an overview of the approach to calculating SDG 15.1.1; SDG 15.3.1; SDG 6.6.1; and, SDG 11.7.1 in Brazil and the potential for the technical notes to support this. It is highlighted that the main accounting outputs from the NCAVES project in Brazil are accounts of Natural Ecosystem Extent and Species Threat Status. There are some challenges in testing the calculation of SDGs given the thematic focus of these accounts.

4.2.1 SDG Indicator 15.1.1 – Forest area as a proportion of total land area.

The calculation of this indicator is the responsibility of the Brazilian Forest Service (SFB) and is captured in the platform created by IBGE for the SDG indicators. The aggregated nature of the Ecosystem Extent Accounts produced for Brazil does not allow for natural forest or plantation areas to be directly determined. However, these Ecosystem Extent Accounts are, in turn, underpinned by the IBGE maps produced via the Monitoring of Land Cover and Use study. These include a land cover / land use class of "Forest vegetation".

In order to test the Technical Note for SDG 15.1.1, the extent of "Forest vegetation" that would be tracked via an Ecosystem Extent (or Land) Account was calculated using the Monitoring of Land Cover and Use study data. The results are presented and contrasted with the official indicator produced by SFB in Figure 1, which follows a different methodology. The difference between the test result and the official indicator is only 1.02%. This difference is small and indicates the SEEA based approach can generate an indicator very similar to the official SDG 15.1.1 indicator produced by SFB.

[10] https://odsbrasil.gov.br/
[11] http://www.planalto.gov.br/ccivil_03/_ato2015-2018/2016/decreto/D8892.htm
[12] http://www.planalto.gov.br/ccivil_03/_Ato2019-2022/2019/Decreto/D10179.htm#art1

A key finding from the test was that if in the next Brazil Ecosystem Extent Accounts present the results for the classification "Forest ecosystems", the derivation of indicator 15.1.1 will be possible. Some key insights were identified for using the accounts to calculate SDG 15.1.1:

- The methodological approach is simpler than the existing method of calculating SDG 15.1.1;
- The Ecosystem Extent Accounts would need to be produced every 2 years to match the current periodicity for calculating SDG 15.1.1; and,
- The Ecosystem Extent Accounts would allow SDG 15.1.1 to be calculated by biome.

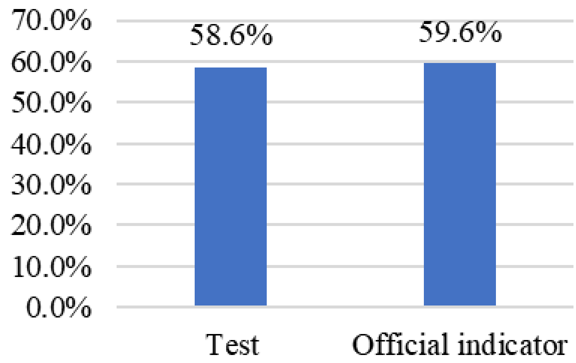

Figure 1: Indicator 15.1.1 - Forest area as a proportion of total land area (Brazil, 2010)

4.2.2 SDG Indicator 15.3.1 - Proportion of land that is degraded over total land area.

The “Short Report Describing Results of Deriving Indicators” highlights that the IBGE platform currently identifies this indicator as “Under analysis/construction”.[13] The report provides a brief overview of the efforts underway in Brazil to calculate this indicator. The use of Trends.Earth and default global data has been tested and was considered to overestimate the extent of degraded land in Brazil, mainly in the Northeast of Brazil, in the Caatinga biome. The global land cover data was replaced with the IBGE Monitoring of Land Cover and Use study data to evaluate if this improved results. However, this was also considered to overestimate the extent of land degradation in Brazil.

A final stage of calibrating the calculation of SDG 15.3.1 to national circumstances is being carried out. This is based on using MODIS images for calculating NDVI with some corrections for the Caatinga and Cerrado biomes. The carbon sub-indicator is also being further evaluated using national data collected via the Brazilian Agricultural Research Corporation (Embrapa). It is highlighted this initial work was progressed via a collaboration between IBGE and the MMA Secretariat for Extractivism, Rural Development and Combat Desertification.[14] However, this secretariat has now been dissolved, making the development of a national SDG 15.3.1 indicator challenging.

It is highlighted that the data basis for the current Ecosystem Extent Accounts can be used to inform the sub-indicator on land degradation due to land cover flows in Brazil. The potential for

[13] https://odsbrasil.gov.br/objetivo/objetivo?n=15

[14] Extractivism is understood as the process of extracting natural resources from the earth for sale on the world market

Ecosystem Condition Accounts to support calculation of the other two sub-indicators for SDG 15.31 is acknowledged.

4.2.3 SDG Indicator 6.6.1 – Change in the extent of water-related ecosystems over time.

The National Water and Sanitation Agency (ANA) is the national focal point for this indicator, calculating and reporting to the UN custodian agency on SDG 6.6.1. The national SDG 6.6.1 indicator track changes in the following aquatic ecosystems: Wetlands; Peatlands; Mangroves; Rivers, Floodplains and Estuaries, Lakes and Artificial Reservoirs; and, Aquifers. The changes considered include sub-components for: spatial extent; water quantity and water quality.

The current approach by ANA to calculating this indicator is based on using only national data derived from the following sources: Annual average flow balance (from the National Hydro Meteorological Network, RHN); National Hydro Meteorological Network (RHN) data (annual average flow balance); MapBiomass project (which provides annual data for 83 Brazilian Level 3 river basins); and, ANA calculation of SDG Indicator 6.3.2. Going forward, these data may also be supplemented with data from the global platform from the SDG 6.6.1 web platform developed by UNEP, Google and the European Commission's Joint Research Centre.[15]

In terms of testing the calculation of SDG 6.6.1 using information in the Ecosystem Extent Account, it is highlighted that there are some significant challenges for achieving this in the Brazilian context. First, the Ecosystem Extent Accounts produced via the NCAVES project are not disaggregated beyond natural versus 'anthropogenised' ecosystems. Second, ANA and IBGE do not work with aquatic ecosystem classifications. Thus, for it to be possible to develop Ecosystem Extent Accounts for that realm, initial work to identify these classifications in Brazil would have to be carried out. To be more specific, in the "land cover/land use accounts" that can be derived from the using the Monitoring of Land Cover and Use study, the extent of water bodies is kept fixed. This likely reflects a focus on surface water ecosystems, such as rivers and lakes. This implies challenges in accurately identifying and delineating other water-related ecosystem types, such as wetlands, peatlands and flood plains using these data. These issues currently prevent the derivation of indicator 6.6.1 from SEEA accounts.

4.2.4 SDG Indicator 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

To date, Brazil has not released information for the two monitoring indicators for target 11.7. According to the SDG platform through which the indicators are released in the country, indicator 11.7.1 is classified as "without data". However, the IBGE team have identified that the estimation of indicator 11.7.1 is one of the institution's priorities within its SDG 11 activities.

IBGE have indicated that whilst it is possible to identify public spaces of greater proportion through remote sensing, the quality of public spaces 'open' to all and their typologies depends on administrative records (such as municipal cadastres) and/or field work. Additionally, identifying the public spaces of a city and identifying the sex, age and other characteristics of the people who have access to these spaces, brings a series of challenges that will also require examination of administrative records that qualify the space and the people using it. Since the IBGE is concerned with working nationwide, producing this information for about 5,570 municipalities is challenging.

In order to progress calculating this indicator in Brazil, three lines of work are being evaluated: Conducting case studies in large cities; Developing a data cube to extract features of interest

[15] https://www.sdg661.app/about

such as streets, green spaces and blue spaces from urban areas; and, using a mobile application launched via the National Agenda for Urban Environmental Quality. The application provides users with information on the characteristics of green areas registered by different municipalities.

With respect to testing the calculation of SDG 11.7.1 using the technical note, it is highlighted that there are currently no Ecosystem Extent Accounts that have been generated in Brazil that provide further disaggregation in urban areas. It may be possible to generate such accounts in the future based on the progression of the work streams described above, although no national programmes of work are currently envisaged in these regards.

It is important to highlight that in the current Monitoring of Land Cover and Use study classes; urban areas are part of the class “artificial areas”. This class collectively refers to “Areas where non-agricultural anthropic surfaces predominate". They are those structured by buildings and road system, which include metropolises, cities, towns, indigenous villages and quilombola communities, areas occupied by industrial and commercial complexes and buildings that may, in some cases, be located in peri-urban areas. Also belonging to this class are the areas where mining or extraction of mineral substances occurs, through mining. As such, delineating urban areas using these data this land cover / land use class would require further disaggregation and other data may need to be relied upon (e.g., municipal administrative boundaries).

4.3 Key findings from the Brazilian Testing Experience

A key constraint to implementing the technical notes using the NCAVES outputs in Brazil is that the Ecosystem Extent Accounts have been compiled at a high level of aggregation (i.e., natural versus anthropogenised ecosystems). Nonetheless, the tests confirm that calculation of SDG 15.1.1 can be achieved using the Monitoring of Land Cover and Use data that underpins the Ecosystem Extent Accounts and this delivers similar to the current method for calculating the indicator. Some key advantages are also identified, in terms of simplicity and also being able to readily spatial the indicator (e.g., by Biome) using the SEEA EA based approach.

For SDG 6.6.1, the prospects for calculation via Ecosystem Extent Accounts using the current data basis in Brazil are limited. This is due to constraints in adequately identifying and mapping the extent of water-related ecosystems. It appears the current approach to mapping wetlands and other aquatic ecosystems using the national land cover classification cannot be relied upon for calculating these indicators and other data sources are employed.

For calculating SDG 15.3.1 and 11.7.1 in Brazil, these indicators are identified to be “Under analysis/construction” or “without data”, respectively. A potential role for using the Monitoring of Land Cover and Use data and the more detailed Land Cover / Land Use Accounts these for calculating the sub-indicator for SDG 15.3.1 related to land degradation due to land cover change support is identified. Further work is ongoing within the country to evaluate how best to calculate the other two sub-indicators for SDG Indicator 15.3.1.

Further work is also ongoing with respect to establishing the data basis for calculating SDG 11.7.1 for Brazil. One option being considered is to start with a selection of case studies in large cities, which would provide a sample for calculating a version of the indicator. By integrating different remote sensing and on-the-ground data, a more detailed disaggregation of urban areas could be achieved that could inform the type of Urban Ecosystem Extent Accounts envisaged in the technical note. Delineating urban areas consistently also appears to be challenging, as urban areas are not a distinct land cover / use type in the Monitoring of Land Cover and Use Data.

5 China

5.1 Introduction

The "SEEA-linked Indicator Test Report" presents the findings of testing the technical notes for calculating the 4 SDG Indicators using the pilot Ecosystem Accounts produced for the Guangxi Zhuang Autonomous Region Bureau of Statistics. This report is presented as Appendix E herein. It described the Ecosystem Extent Accounts produced for the region, which are arranged over two to three levels of aggregation. The higher level of aggregation describes the extent of farmland; forest; grassland; freshwater (wetland) ecosystem, marine ecosystem and urban ecosystems. The report also identifies that the NCAVES project supported the delivery of a set of Ecosystem Services Accounts for Guangxi. Indeed, this is understood to be the main focus of the pilot. The set of pilot accounts for the Guangxi Zhuang Autonomous Region cover the period 2016 to 2017.

5.2 Summary of testing technical notes in China

5.2.1 SDG Indicator 15.1.1 – Forest area as a proportion of total land area.

Forest ecosystem extent is defined with reference to the National Standard Technical Regulations for Continuous Forest Inventory of the People's Republic of China and Technical Regulations for Continuous Forest Inventory (2014). The ecosystem type of forest is then further disaggregated to Arbour Forest; Bamboo Forest; Scrublands; and, Other Forests. A further level of disaggregation yields a total of 11 different forest ecosystems, the extent of which is presented in the Ecosystem Extent Accounts for the Guangxi Zhuang Autonomous Region in Appendix E.

The testing report for Guangxi also provides a crosswalk, linking the 11 forest ecosystem types to their respective IUCN Ecosystem Functional Groups and Biomes within the IUCN Global Ecosystem Typology. Collectively, the 11 forest ecosystem types for the Guangxi pilot crosswalk to the following IUCN Ecosystem Types:

- T1. Tropical-subtropical forests biome
- T3.1 Seasonally dry tropical shrublands
- T3.4 Young rocky pavements, lava flows and screes

Following the crosswalk, an Ecosystem Extent Account is compiled for these IUCN Biome / Ecosystem Types to allow SDG 15.1.1 to be calculated. This is presented as Table 5.

Table 5: Forest ecosystem-extent accounts according to the IUCN system (2016 to 2017, in ha)

	Tropical-subtropical forests biome	T3.1 Seasonally dry tropical shrublands	T3.4 Young rocky pavements, lava flows and screes	SDG 15.1.1 (%age of total land area)
Opening stock	10,427,377	736,797	1,557,924	60.79%
Additions to stocks	716,133	92,147	63,482	
Reductions to stock	704,023	47,004	89,813	
Closing stock	10,439,487	781,940	1,531,593	60.91%

The report highlights that while the crosswalk is broadly aligned, a rigid correspondence cannot be established. Furthermore, the IUCN Ecosystem Type 'T7.3 plantations' is included in the farmland ecosystem type and mangroves are included in the marine ecosystem type, rather than the forest ecosystem type, in the highest level of aggregation for the Ecosystem Extent Accounts compiled for Guangxi. As such, the value for SDG 15.1.1 in Table 5 should be adjusted to reflect these additional areas that meet the FAO definition of forests. This can be achieved using information recorded elsewhere in the Ecosystem Extent Accounts at lower levels aggregation for Guangxi and by using bridging tables (as shown for SDG 6.6.1).

5.2.2 SDG Indicator 15.3.1 - Proportion of land that is degraded over total land area.

The report highlights that land degradation is reflected in land conversion and changes in the ecosystem quality indicators for net primary productivity and carbon storage. With respect to the SDG 15.3.1 sub indicator on land cover change, the report highlights research by the Research Center for Eco-Environmental Sciences within the Chinese Academy of Sciences that has characterised historic land cover flows in the Xijiang River Basin Area. These flows would be derived from the type of land cover change matrix that is routinely calculated as part of the process of compiling and Ecosystem Extent Account and identifying the gross additions and reductions within the table. Subject to specifying the flows indicative of degradation, there is potential to calculate the land cover change sub-indicator for SDG 15.13.1 using this matrix is highlighted.

Calculating the SDG 15.3.1 sub-indicator for land cover change was not tested as part of the indicator testing in China. This reflects that a key challenge remains in aligning with the baseline for reporting for the SDG 15.3.1 indicator, which is 2000 to 2015. Given the Guangxi pilot on ecosystem accounts only cover a short time period, from 2016 and 2017, the magnitude of the land cover flows indicative of degradation are likely to be low.

The global SDG 15.3.1 Indicator approach also includes the two sub-indicators on land productivity and carbon stocks. Their measurement via the global approach is based on measuring trends in vegetation indices and carbon stocks. However, the testing from China suggests that it could also be possible to calculate these indicators using information from ecosystem services accounts. For instance, changes in land productivity could be reflected in changes in ecosystem product (or aggregate service flows).[16] As part of this, information on changes in carbon stocks could be derived from information in the Ecosystem Services Accounts for carbon sequestration services and capacity. A similar observation was made by the South Africa report with respect to measuring change in the carbon stock sub-indicator for SDG 15.3.1.

The report highlights that the Ecosystem Services Accounts compiled for Guangxi estimate ecosystem service flows using look up tables for different ecosystem types. Given the accounts have been compiled for 2016 and 2017 only, there is not a sufficient temporal difference to ascertain meaningful changes that can be aligned to the baseline reporting envisaged for SDG 15.3.1 at this stage (i.e., 2000 to 2015) for carbon related regulating ecosystem services.

5.2.3 SDG Indicator 6.6.1 – Change in the extent of water-related ecosystems over time.

The testing of calculating SDG 6.6.1 was grounded in the extent of ecosystems within the broad freshwater (wetland) ecosystem type recorded in the Ecosystem Extent Accounts for the Guangxi Pilot. This is further disaggregated into 6 sub-types, comprising: River surface; Lake surface; Reservoir surface, Pond surface, Ditches; and, Inland shoals. Ecosystem Extent Accounts showing the extent of these ecosystems types are provided in Appendix E.

[16] As highlighted in the *Assessing the linkages between national indicator initiatives, SEEA Modules and the SDG Targets* report, GEP aggregates across a set of provisioning, regulating and cultural ecosystem services that Ecosystem Accounting can inform on.

Appendix E highlights that Rice Paddies are considered a 'water-related ecosystem type' following the Ramsar definition (as set out in the technical notes). As would be expected this ecosystem type is part of the broader 'Farmland' ecosystem type for which Ecosystem Extent Accounts have been compiled in Guangxi. In order to align the SDG calculated directly from the extent of the Freshwater (wetland) ecosystem type with global definition for this indicator, a bridging table is provided. This is presented in Table 6. The bridging table highlights the utility of having a well-structured, hierarchical and nested national ecosystem typology that provides a flexible approach to calculating SDG 6.6.1 and other indicators, crosswalk to other classifications such as the IUCN GET and maintain the structure most relevant to national or sub-national analyses.

It is noted that the SDG 6.6.1 indicator calculated from the Freshwater (wetland) ecosystem extent in the Guangxi Pilot is aligned mostly to surface water ecosystems. The bridging table illustrates the capability to link to other wetland types. This could, potentially, be expanded to include other vegetated wetland areas.

Table 6: Bridging table linking Freshwater (wetland) ecosystem extent to paddy extent and SDG 6.6.1 (2016 to 2017, in ha)

	2016	2017	SDG 6.6.1
Freshwater (wetland) Ecosystems	456,477	462,087	-1.23 %
Plus Extent of wetland in F3.3 Rice Paddies	2,178,845	2,179,694	
Extent of water related ecosystems including rice paddies	2,635,322	2,641,781	-0.25 %

5.2.4 SDG Indicator 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

The urban ecosystem type in the pilot Ecosystem Extent Accounts for Guangxi includes the sub-type 'Urban Public Green Space (GX205)'. Similar to the disaggregation of parklands in the South African Metro Accounts, this allows the proportion of Urban Public Green Space within the total urban ecosystem extent in Guangxi to determined. The Urban Ecosystem Account is provided in Table 7, this identifies that around 9% of the total urban ecosystem extent comprises urban public green space.

Similar to the blue / green space indicator proposed in the technical note as a supplement to the global SDG 11.7.1, indicator, the proportion of 'Urban Public Green Space' provides an indicator that is aligned to the general ambition of SDG Target 11.7. However, it is highlighted that some areas that would contribute to the global version of SDG 11.7.1. are clearly excluded. These include public blue spaces, plazas and other hard covered public areas and areas allocated to streets. Nonetheless, this is clearly an indicator that will be of interest to urban planners interested in monitoring and improving the amenity value of urban areas. Again, developing this indicator to communicate on universal access to these public spaces remains challenging.

Table 7: Guangxi Urban Ecosystem Extent Account (2016 to 2017, in ha)

	Urban public green space GX205 (GX Es)	Total urban extent (GX)	SDG 11.7.1 (% Urban Area)
Opening stock (2016)	24,733	271,911	8.6%
Additions to stocks	314	12,696	
Reductions to stock	681	1,054	
Closing stock (2017)	24,366	283,554	9.1%

5.3 Key findings from the Chinese Testing Experience

The testing of the technical notes in China using the Guangxi Pilot Ecosystem Accounts confirmed the possibilities to calculate SDG 15.1.1 and SDG 6.6.1 using Ecosystem Extent Accounts. The tests for calculating forest and water-related ecosystem extent also demonstrated the advantage of having a hierarchical structure for disaggregating broader ecosystem types. This provided the flexibility in the Ecosystem Extent Accounts to calculate SDG and other indicators, crosswalk to the IUCN GET and maintain the structure most relevant to national or sub-national analyses. The utility of using bridging tables to calculate indicators where ecosystem typologies do not nest conveniently is also demonstrated (as proposed in the technical notes).

Whilst the potential of Ecosystem Extent Accounts to inform the land cover change sub-indicator for SDG 15.3.1 was highlighted, this was not tested using the Guangxi Pilot Ecosystem Accounts as they only cover the period 2016 to 2017 (i.e., not the 2000 to 2015 baseline established under SDG 15.3.1). However, an historical analysis for the Xijiang River Basin Area was provided that illustrated the possibility. Further work is also needed to compile the necessary Ecosystem Condition Accounts to inform on the other two sub-indicators for land productivity and carbon stocks. An alternative approach that could draw on Ecosystem Services Accounts is identified. Essentially, changes in land productivity could be derived from changes in overall ecosystem services delivery and changes in carbon stocks / storage based on information on carbon sequestration services and capacity. It is highlighted that other factors will likely need to be controlled (e.g., increased use of fertiliser) to get an adequate indicator for the impact of land degradation on land productivity change using this type of approach. However, this is also likely an issue for the currently agreed global approach to calculating SDG 15.3.1.

Similar to the testing in South Africa, a tractable way of calculating an indicator relevant to SDG 11.7.1 was found to be using the extent or urban ecosystems identified within a given Ecosystem Accounting Area and determining the proportion of these that were public green space. Whilst this does not identify all public open spaces (e.g., blue spaces, plazas and streets), it is clearly a useful indicator for urban planners interested in managing the overall amenity values of cities.

6 Synthesis of country testing

Testing the technical notes across the four NCAVES countries indicates that there is strong potential for the SEEA to support the calculation of SDG Indicators. The results of the testing are summarised in Figure 2. Green means that the SDG Indicator could be calculated using the technical note approach. Amber means a version of the SDG Indicator could be calculated using an accounting based approach but challenges remain in aligning it to the global SDG Indicator methodology. Purple means a version of the SDG Indicator could be calculated using an approach different to that set out in the technical notes. 'N/A' means the SDG Indicator could not be calculated due to insufficient data but an important role for accounts in supporting calculation was identified.

	South Africa	India	Brazil	China
SDG 15.1.1– Forest area as a proportion of total land area.	Amber	Green	Green	Green
SDG Indicator 15.3.1 - Proportion of land that is degraded over total land area.	N/A	Purple	N/A	N/A
SDG Indicator 6.6.1 – Change in the extent of water-related ecosystems over time.	Amber	Amber	N/A	Amber
SDG Indicator 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	Amber	Amber	N/A	Amber

Figure 2: Summary results of testing the technical notes

The most tractable indicator for calculation was found to be SDG 15.1.1. Generally, following the SDG 15.1.1 technical notes approach, it was possible to calculate this indicator in all four countries using Ecosystem Extent Accounts. As South Africa have tailored this indicator to make it more ecologically meaningful to their national circumstances, SDG 15.1.1 gets an amber rating in the figure above. This is because the nationally tailored version of the indicator calculated is not full aligned to the global SDG 15.1.1 Indicator.

For SDG 6.6.1, it was possible to calculate a version of this indicator in South Africa, India and the Guangxi Region in China. However, challenges remain with respect to establishing suitable data for delineating the full extent of water-related ecosystems, particularly where they are small and ephemeral. The need to integrate wider information than just remotely sensed land cover data to achieve a better thematic representation of forest and water-related ecosystems was also highlighted.

With respect to SDG 11.7.1, it was possible to generate a version of the indicator that communicated the proportion of parklands, green areas or public green space in Urban Areas for South Africa, Vijayawada City in India and the Guangxi Region in China. These approaches followed the general approach of compiling more detailed Ecosystem Extent Accounts for urban areas, as proposed in the SDG 11.7.1 technical note. Challenges remain to identifying other (non-green) open space areas and confirming universal public accessibility for different social groups.

None of the NCAVES countries were able to calculate an indicator for SDG 15.3.1 using the associated technical note. However, all four of the NCAVES countries acknowledged the potential to generate the land cover change sub-indicator for SDG 15.3.1 via the SEEA Ecosystem Extent (or Land) Accounts. However, generating the sub-indicators on land productivity and carbon stocks remained challenging. An important insight from the reports is that there is often a need to nationally tailor the global SDG Indicator methods to national circumstances. This was noted with respect to the use of vegetation indices for the land productivity sub indicator for SDG 15.3.1, as increases in vegetation can be associated with degradation (e.g., proliferation of invasive, woody species). The flexible nature of the SEEA as an organising framework was highlighted as being very useful to aid calculating these nationally tailored SDG Indicators in a rigorous and consistent manner.

A theme that was consistent across South Africa, India and Brazil was the need to establish the right institutional arrangements and cooperation mechanisms to support the calculation of SDG Indicators. These will equally apply to compiling SEEA based accounts that can support calculation of these indicators and be aligned to them. For example, in India and Brazil, the Forest Services agencies are the key institutions with the mandate for producing data for calculating SDG 15.1.1. The South African National Biodiversity Institute (SANBI) maintain the most suitable data for calculating SDG 15.1.1 and SDG 6.6.1 and in Brazil it is the National Water and Sanitation Agency (ANA) for SDG 6.6.1.

6.1 Key lessons learnt from in-country testing

In addition to the general insights described above, specific insights from the testing in the NCAVES countries were gained for the individual SDG Indicators and Technical Notes. These are summarised in Table 8.

Table 8: Key lessons from in-country testing

SDG Indicator 15.1.1 – Forest area as a proportion of total land area.	• In South Africa this indicator is nationally tailored to be more ecosystem focused and excludes areas of exotic forest plantations and areas of invasive alien woody plants. A key recommendation from the report, is that the indicator is changed from being forestry- to ecosystem-focused, which could be achieved by aligning the definition of forest with the IUCN's Global Ecosystem Typology. The SEEA EA is well placed to support the calculating of such this indicator • In India and the China testing, the national definitions and approaches for measuring forest extent do not align perfectly with the FAO definition. The flexibility of the SEEA EA as a conceptual framework allows indicators to be calculated that can align to these different definitions. For example, in the Guangxi Region pilot accounts, mangroves and plantations are excluded from the broad forest ecosystem type. However, the extent of mangroves and plantations could be included in a bridging table to get to the FAO defined version of 15.1.1, if this was of interest. • For South Africa and India, it is necessary to integrate data on natural biomes and canopy density (respectively) with information on land cover to calculate the national version of SDG 15.1.1. • The Brazil report identified the need to ensure that if Ecosystem Extent Accounts are to support SDG 15.1.1 reporting, they would need to be produced every two years to match the reporting

	cycles in the country (this would also appear to be the case for India) • South Africa identifies that the flexible nature of the spatial infrastructure supporting Ecosystem Extent Accounts allows alignment and reporting of SDG 15.1.1 by forest and woodland biomes, which align with biomes in the IUCN's Global Ecosystem Typology. A similar recommendation also came from the testing in Brazil. The Guangxi Region accounts provided an example of this approach, for the IUCN Biome of T1.Tropical-subtropical forests biome
SDG Indicator 15.3.1 - Proportion of land that is degraded over total land area.	• For SDG 15.3.1, there was broad agreement from the South Africa, India, Brazil and Guangxi Region testing that the land cover change sub-indicator can be calculated using the SEEA Ecosystem Extent / Land Cover accounts. • For land productivity, vegetation indices cannot be reliably used to indicate degradation in South Africa's terrestrial ecosystems, specifically in those ecosystems where bush encroachment or spread of invasive woody plant species is indicative of loss of condition. These issues are highlighted in the Good Practice Guidance for SDG 15.3.1 and the technical note and are likely to apply in other countries.
SDG Indicator 6.6.1 – Change in the extent of water-related ecosystems over time.	• South Africa identifies global data is inadequate to calculate this indicator and high spatial and thematic resolution data is required. Delineating the full extent of water-related ecosystems requires combining remote sensing with other methods and data, such as modelling of wetland probability and on-the-ground mapping of wetlands, to ensure that wetlands that are seasonally or periodically dry are included and the many small waterbodies that are not picked up in other datasets. Spatial resolution should ideally be less < 1 ha to identify the smaller wetlands and water bodies. Thematic resolution should be improved in order to better consider seasonality and natural variation over protracted dry periods. Incorporating these data in Ecosystem Extent Accounts for freshwater ecosystems would allow for robust and consistent calculation of this indicator. Whilst not explicitly stated, this insight is very likely to be true for other countries also. • In India an interesting extension of the accounts was the presentation of the extent of wetland areas classified as Ramsar sites alongside the extent of water related ecosystems. This allowed the proportion of wetlands that were considered to be of international importance to be conveyed to decision-makers. • For Brazil a key barrier for calculating this indicator is that the ANA and IBGE do not work with aquatic ecosystem classifications. • The Guangxi Region pilot accounts provide a useful example of how the bringing tables presented in the technical notes can

	support the calculation of SDG Indicators. The example demonstrates adding rice paddies as water-related ecosystems to the extent of aggregated Freshwater (wetland) ecosystems. This could, potentially, be expanded to include other vegetated wetland areas.
SDG Indicator 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.	• Delineating urban areas using the urban ecosystem extent class in national or subnational Ecosystem Extent or Land Accounts appears to be a pragmatic way of supporting calculating a version of SDG 11.7.1 using the SEEA, as shown in South Africa, India and Guangxi Region pilot accounts (i.e., defining urban areas, the dominator for the indicator). • A tractable approach to calculating the area of publicly accessible open space for SDG 11.7.1 is using remote sensed observations or other delineations of green spaces or parklands in urban areas (as demonstrated in the South Africa, India and Guangxi Region tests). Whilst not completely aligned to the global methodology for SDG 11.7.1, this indicator is similar to the supplementary indicator proposed in the technical note and useful to urban planners interested in improving the amenity value of cities. • Challenges are identified by all four countries with respect to identifying public open spaces other than green areas, such as plazas, blue open spaces, street space. Also establishing public accessibility and universal access requires additional work. There should also be some consideration of how safe areas are, noted by South Africa with respect to street space. • The need for high resolution data that incorporate land-use data (e.g., cadastre's or on-the-ground verifications) are highlighted as necessary to support the calculation of SDG 11.7.1. • Producing this indicator for about 5,570 municipalities in Brazil is extremely challenging. Similarly, South Africa only produce this data for major metropolitan areas rather than all urban areas and the India and Brazil tests were based on one city and one sub-national region respectively. It may be possible to generate this indicator from samples of cities to give a sense of progress towards the SDG Target.

6.2 Key Options to explore for future revisions of Technical Notes

A number of important insights are captured in Table 8. Some of these relate directly to how to structure accounts and calculate indicators from them. Others are more relevant to the measurement approaches and data employed to track the phenomena of interest (e.g., changes in forest extent). Based on the findings of the project country testing, the following possible updates are identified for the technical notes:

- **For SDG 15.1.1 (Forest area as a proportion of total land area):** This indicator should be calculated for different forest and woodland biomes. Ideally, the set of relevant biomes in the IUCN's Global Ecosystem Typology. This would help to achieve a more ecosystem focused indicator and allow international comparison. Disaggregating trends in the extent of natural forest biomes from plantation forests (or forested areas associated with the spread of invasive species) would provide more ecological insight, in line with the broad intention of SDG 15.

Related to the above, the way countries define forests often differs from the FAO definition. This should also be more explicitly acknowledged and the appropriate structures for reconciling this difference identified (i.e., through bridging tables).

- **For SDG 15.3.1 (Proportion of land that is degraded over total land area):** The SEEA EA is identified as a crucial framework for integrating the necessary data to support this calculation. However, all countries identified that further research is required before the technical note for this indicator can be updated (discussed below).

- **For SDG 6.6.1 (Change in the extent of water-related ecosystems over time):** The need to integrate remote sensed and other data to deliver high spatial and thematic resolution data on the extent of water related ecosystems should be stressed. This will involve collaboration with the appropriate environmental assessment ministries.

- **For 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):** The approach to delineating the urban Ecosystem Accounting Area could be updated to reflect the approaches in South Africa, India and the Guangxi Region. In short, using information on urban extent from national or sub-national Ecosystem Extent or Land Accounts. A version of the indicator could then be generated based on the proportion of green space in these urban extents. This indicator could be improved by identifying publicly accessible spaces specifically (i.e., as per the Urban Green Spaces in the Guangxi Region). This indicator could also be calculated using a representative sample of urban areas to limit resources required.

6.3 Possibilities for additional research and experimentation

The experiences of testing and evaluating the technical notes in the project countries has identified several areas for further research into how the SEEA EA could support the calculation of SDG Indicators and make them more useful to decision-makers. These are summarised below:

- **For SDG 15.1.1:** Whilst not identified as a core recommendation, the testing report for South Africa suggested that this indicator could be modified to take into account the functional extent through inclusion of information on condition (ecological integrity), as well as extent (e.g., via some area weighting process).

- **For SDG 15.3.1:** There is a general need for more research into how best to calculate this indicator for different countries. One of the insights form the country testing is the need to use different indicators of degradation than vegetation indices, which are inappropriate in certain circumstances (e.g., where woody invasive species are spreading). Ecosystem Condition and Ecosystem Services Accounts are highlighted as an important way of integrating a more reliable assessment of degradation than one based simply on change in vegetation indices and Soil Organic Carbon. The testing reports from South Africa and the Guangxi Region highlight the role of Ecosystem Service Accounts for measuring carbon sequestration and storage services to inform on the sub-indicator for carbon stocks. The testing report for the Guangxi Region pilot accounts also highlights the potential for Ecosystem Services Accounts to inform on the sub-indicator for land productivity.

India has developed a national approach to assess the overall level of land degradation in the country, which considers a number of physical, chemical and functional state indicators within different land cover / use types. This could, potentially, be aligned to Ecosystem Extent and Condition Accounts. As identified by South Africa, it would also be useful for decision-makers to understand absolute degraded area, as well as degradation relevant to the 2000 – 2015 baseline for SDG 15.3.1.

- For SDG 6.6.1: Water-related ecosystems (including wetlands) are often highlighted as one of the most important ecosystems globally for biodiversity and ecosystem services supply. However, there have been very few good quality wetland extent estimates at national and continental scales and even fewer providing time series estimates of changes in extent. A key weakness of this indicator (if applied too simply) is its inability to distinguish what has been permanently lost versus temporarily reduced through natural fluctuations. For example, due to seasonal or longer term variation in rainfall or major drought. An important ongoing area of research is how to produce comprehensive maps of water-related ecosystems that can provide reliable time-series observation of change in extent. As these maps become available for different countries and globally, their use in supporting water-related ecosystem extent accounts should be a priority for experimentation and testing.
- For SDG 11.7.1: In Brazil, three approaches to calculate national versions of these indicators are being evaluated: Conducting case studies in large cities; Developing a data cube to extract features of interest such as streets, green spaces and blue spaces from urban areas; and, information on the location and characteristics of green areas registered by different municipalities. It would be interesting to explore the potential for the SEEA EA to organize these data and support calculation of SDG 11.7.1 once these approaches have been trailed.

The tests for calculating forest and water-related ecosystem extent in the Guangxi Region demonstrated the advantage of having a hierarchical structure for disaggregating ecosystem types. This provided flexibility in the Ecosystem Extent Accounts to use them to calculate SDG and other indicators, crosswalk to the IUCN GET and maintain the structure most relevant to national or sub-national analyses. An important area for research is developing cross-walks between the IUCN GET, national ecosystem typologies and typologies used for different reporting commitments (e.g., FAO definition of forest and UNCCD adoption of IPCC Land Cover classes).

As the SEEA EA is a relatively new and novel statistical framework, experimentation and lesson learning on how best to implement it and compile accounts will be very helpful to practitioners. This experimentation is envisaged as 'learning by doing' and the NCAVES project will have some key lessons to learned that can be shared with ecosystem accounting community. Key to this will be understanding the processes and steps to establish the right institutional arrangements and cooperation mechanisms to support the compilation of SEEA EA Accounts and calculation of SDG and other national development indicators. It will imperative that such efforts engage policy makers and decision-makers at an early stage.

A final observation is that the more investment that is made in the thematic, spatial and temporal resolution of the SEEA EA accounts the more useful they will be for decision making. As the framework is flexible, aggregates and indicators can be derived that respond to various thematic policy demands. With regular updates, these can be matched to different national policy cycles and planning strategies for various sectors. This will help ensure that the SEEA EA not only delivers consistent and robust environmental-economic indicators but also the indicators that are best suited to national circumstances for informing sustainable development that proceeds in balance with nature.

Appendix A: Approach for testing the technical notes

The objective of the indicator work stream for the Natural Capital Accounting and Valuation of Ecosystem Services (NCAVES) project is to develop a systematic and consistent approach on the use of SEEA accounts to derive sustainable development indicators for national and global reporting purpose. By demonstrating the usefulness of the SEEA accounts to derive policy relevant indicators, this work stream contributes to the mainstreaming of the use of ecosystem accounts in national and local level policy-planning and implementation.

As part of the NCAVES project activities, countries are encouraged to undertake pilot testing of a selected set of SDG indicators using the SEEA EA. To date, the following two working documents have been draft to provide guidance in this area.

- *An assessment report "Assessing the linkages between global indicator initiatives, SEEA Modules and the SDG Targets"* [17] that review the linkage of SEEA with various global indicator initiatives assessment
- A guidance document *"Using the SEEA EEA for Calculating Selected SDG Indicators"* that provides an overview of the steps required to implement a national programme of work for indicators, and Technical Notes on compiling SEEA EA accounts for specific SDG indicators

The assessment report identified that ecosystem extent is a key determinant in a number of the SDG indicators. This is because it is relatively easy to measure and provides a good indicator for wider sustainable development concerns. For example, extent of freshwater ecosystems is a good proxy for water provisioning services. Forest extent is a good proxy for conservation of forest biodiversity and the delivery of forest ecosystem services.

From this assessment, four SDG indicators have been identified as priorities for testing their calculation using the SEEA. All of these indicators draw completely (or substantially) on information in the SEEA EA ecosystem extent accounts. They comprise:

- **SDG Indicator 15.1.1** – Forest area as a proportion of total land area.
- **SDG Indicator 6.6.1** – Change in the extent of water-related ecosystems over time.
- **SDG Indicator 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.
- **SDG Indicator 15.3.1** - Proportion of land that is degraded over total land area.

Technical Notes in the guidance document provide an overview of how to compile a set of SEEA EA accounts to support the calculation of these four SDG indicators (provided alongside this testing note). The Technical Notes are intended to provide suitable accounting structures to organize information, and a broad overview of associated measurement approaches and data sources to compile relevant accounts and calculate the indicators.

This short note is intended to support the NCAVES pilot countries in testing these Technical Notes to the degree possible, given the different accounts each country is producing. The objective of the testing process is to better understand the feasibility of implementing the Technical Notes and identify the key issues associated with such implementation. Ultimately, the aim is to capture lessons learned and best practices for compilation. This will allow the Technical Notes to be improved and support other countries interested in implementing them to calculated the SDG Indicators, including providing case study examples.

17 https://seea.un.org/sites/seea.un.org/files/seea_global_indicator_review_methodological_note_post_workshop_0.pdf

General testing approach

The general testing approach is grounded in the compilation of ecosystem extent accounts, supplemented by additional data where necessary. The Technical Notes use the IUCN Global Ecosystem Typology to provide concrete ecosystem extent account examples and how they can be used to support the SDG indicators calculation. However, it is anticipated that countries will choose appropriate national ecosystem typologies for testing based on their national circumstances. As such, there is no need to align these national ecosystem typologies to the IUCN Global Ecosystem Typology when implementing the testing approach.

The testing approach is set out in three parts, reflecting the increasing complexity and specificity of calculating each of the four SDG Indicators. SDG indicator 15.3.1 is most complex, given that it requires calculations of three sub-indicators and their integration in a spatially consistent fashion. Please provide testing results and summarise your feedback from testing the Technical Notes in a short report, covering all indicators tested by the 30th September 2020.

Testing SDG indicators 15.1.1 and 6.6.1.

It is anticipated that all countries will be able to test the calculation of these two indicators.

1) **Identify current indicator reporting processes.** Please contact the national focal point for both SDG Indicators and find out how the indicator is currently reported on. Specifically:
    a. Which institution reports on the indicator?
    b. How is it calculated (i.e., is the national version different from the global)?
    c. What national data is used?
    d. What global data is used?
    e. What data processing is employed? (e.g., global platforms such as the freshwater ecosystems explorer, national data infrastructures, spreadsheet analysis, GIS tools, etc.)
2) **Identify forest and water related ecosystem types.** Based on the national classification for ecosystems that is being used for SEEA ecosystem accounting, please indicate which types were identified for reporting on forest and water-related ecosystems.
3) **Quantify the extent** based on your most recent ecosystem extent account. If this is not possible, explain why not.
4) **Calculate the SDG 15.1.1 and 6.6.1 indicators** using the information in the ecosystem extent accounts and the equations set out in the Technical Notes. Please pay attention to how 'Total land area' for SDG 15.1.1 is calculated. Please identify any barriers or issues encountered when calculating these indicators.
5) **Aligning the SEEA and SDG indicators,** please review the definition of forest and water-related ecosystems set out at the beginning of the Technical Notes. Please identify any national ecosystem types where alignment with this definition is unclear. Please review the bridging tables proposed in the technical note to help achieve an alignment between the SEEA ecosystem extent account information and these definitions. If possible please create a bridging table for each indicator, if not please identify the main barriers to doing so.
6) **Identify any other issues you encountered**
7) **Identify and key lessons learned and specific recommendations on how the Technical Notes could be improved in light of this.**
8) **Provide a summary** of testing results with feedback on the above in the short report covering all indicators tested.

Testing SDG indicator 11.7.1.

Countries interested in implementing urban ecosystem extent accounts are encouraged to test the calculation of this indicator.

1) **Identify current indicator reporting processes.** Please contact the national focal point for the SDG Indicator and find out how the indicator is currently reported on. Specifically:
    a. Which institution reports on the indicator?
    b. How is it calculated (i.e., is the national version different from the global)?
    c. What national data is used?
    d. What global data is used?
    e. What data processing is employed? (e.g., global platforms, national data infrastructures, spreadsheet analysis, GIS tools, etc.)
2) **Defining an urban ecosystem accounting area.** Please summarize the process and data employed in defining the boundary for the urban ecosystem accounting area and how you are organizing spatial data in this area.
3) **The typology for urban ecosystem assets.** Please summarize the ecosystem typology you have applied for compiling urban ecosystem extent accounts and how it aligns to that set out in the technical note. Please also summarize the reasons for your choice of typology.
4) **Calculate the SDG 11.7.1 indicator** using the information in the urban ecosystem extent accounts and the two equations set out in the technical note. Please identify any barriers or issues encountered when calculating this indicator, and provide feedback on the two calculation methods.
5) **Aligning the SEEA and SDG indicators,** please review the bridging table proposed in the technical note to help achieve an alignment between the SEEA urban ecosystem extent account information and the definition of open space under SDG 11.7.1. Do you think such a table is required for your situation? Please summarize why or why not such a table is required, for instance have you included fringe areas in your accounting area or open spaces >200 ha?
6) **Identify any other issues you encountered**
7) **Identify and key lessons learned and specific recommendations on how the Technical Notes could be improved in light of this.**
8) **Provide a summary** of testing results with feedback on the above in the short report covering all indicators tested exercise.

Testing SDG indicator 15.3.1.

Countries interested in accounting for land degradation are encouraged to test the calculation of this indicator.

1) **Identify current indicator reporting processes.** Please contact the national focal point for the SDG Indicator and find out how the indicator is currently reported on. Specifically:
    a. Which institution reports on the indicator?
    b. How is it calculated (i.e., is the national version different from the global)?
    c. What national data is used?
    d. What global data is used?
    e. What data processing is employed? (e.g., global platforms such as trends.earth, national data infrastructures, spreadsheet analysis, GIS tools, etc.)
2) **Measuring the land cover change sub-indicator.** Please confirm the ecosystem changes you have identified as indicative of degradation or improvement from a land degradation perspective and the reasons for your choice. Are there any significant issues calculating this indicator using the ecosystem change matrix that can be produced when compiling the ecosystem extent accounts?
3) **Measuring the ecosystem condition sub-indicators.** Please summarize the process and data employed in measuring the land productivity and carbon stock sub-indicators. Have you used these data to inform ecosystem condition accounts? What are the key barriers to regular measurement of these condition indicators? How do you propose to integrate this information with information on land cover change?

4) **Compiling the land degradation summary table.** Is it possible to compile the land degradation summary table using the information on the three land degradation sub-indicators you have organized?
5) **Calculate the SDG 15.3.1 indicator** set out in the technical note using the information in the land degradation summary table or organized via your accounts or supporting data infrastructure. Please identify any barriers or issues encountered when calculating this indicator. Is land degradation summary table helpful for calculation or presentation? Did you calculate the indicator without compiling this land degradation summary table?
6) **Summarise data used:** National data used is ideal, please describe any national data sources and where global data has been used to plug gaps.
7) **Identify any other issues you encountered**
8) **Identify and key lessons learned and specific recommendations on how the Technical Notes could be improved in light of this.**
9) **Provide a summary** of testing results with feedback on the above in the short report covering all indicators tested.

Appendix B: South Africa Indicators Testing Report

Appendix C: India Indicators Testing Report

Appendix D: Brazil Indicators Testing Report

Appendix E: China Indicators Testing Report