The SEEA Ecosystem Accounts for India

POLICY BRIEF

Government of India
Ministry of Statistics & Programme Implementation
सत्यमेव जयते

NSO INDIA
Data for Development

1. WHAT ARE ECOSYSTEM ACCOUNTS?

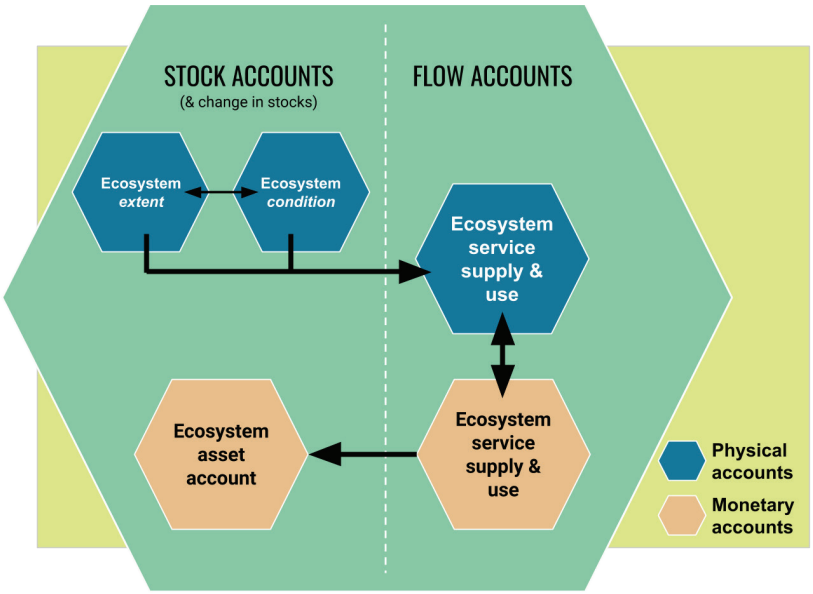
The System of Environmental Economic Accounting - Ecosystem Accounting (SEEA EA) complements the original SEEA Central Framework, adopted by the UN Statistical Commission as the first international standard for environmental economic accounting in 2012.[1] The Central Framework accounts for specific environmental assets, such as water or energy resources, and describes how they are used in economic activity. The SEEA EA takes a landscape or spatial perspective and accounts for the environment in terms of ecosystems characterized by their extent and condition, which supply ecosystem services.

Why use ecosystem accounting?

Ecosystem accounting (EA) helps facilitate more integrated policy- and decision-making by offering a means of monitoring an economy's impacts and dependencies on the environment through a range of indicators and statistics.

Supported by the NCAVES project (Box 1), India has applied the SEEA EA framework to better account for ecosystem contributions to the country's well-being and to inform integrated decision-making for sustainable development.

Figure 1: *The SEEA EA framework showing the relationship between extent and condition accounts and supply and use accounts*



Box 1. About the NCAVES project

In 2017, the United Nations Statistics Division, the United Nations Environment Programme, the Secretariat of the Convention on Biological Diversity (CBD), and the European Union launched the Natural Capital Accounting and Valuation of Ecosystem Services (NCAVES) project.[2]

NCAVES has supported the Government of India to improve its capacity to implement environmental economic accounting, in particular, ecosystem accounting using the SEEA. NCAVES aims to:

- Improve measurement of ecosystem services;
- Mainstream biodiversity and ecosystems into policy planning and implementation; and
- Contribute to the development of internationally agreed methodologies.

In India, NCAVES has been implemented by the National Statistical Office of the Ministry of Statistics and Programme Implementation (MoSPI). MoSPI has worked closely with the Ministry of Environment, Forest and Climate Change, National Remote Sensing Centre and the other concerned Ministries / Departments and organisations of the Government.

2. PUTTING SEEA EA INTO OPERATION

The ability of a landscape to provide a flow of ecosystem services is dependent on both the extent and integrity of its *ecosystem* assets. These two aspects are captured in physical units in the SEEA EA *extent* and *condition* accounts (Figure 1).

For example, if a forest is large and highly integrous, the flow of ecosystem services is likely to be high and it will also have the capacity to generate future ecosystem services sustainably.

Across the landscape different ecosystem asset types provide different ecosystem services. These are recorded in *supply and use accounts*. These accounts can be recorded in either physical units or monetary units, depending on data needs and availability. Monetary estimates of the value of ecosystem services are derived by applying non-market valuation techniques.

Through the support of the NCAVES project, MoSPI has used the SEEA EA framework to compile a range of ecosystem accounts. In addition, the project team constructed a thematic account that assessed the state of the country's biodiversity.

2.1. Extent account

Ecosystem extent accounts record the total area of each ecosystem within an ecosystem accounting area and how that changes over time. Land cover / Land use (how the land is used from a socio-economic perspective) can be used as proxy for ecosystem type and is measured using spatial analysis and organised by standardised classifications schemes.

MoSPI compiled ecosystem extent change matrices for India (Table 1). Key findings include:

- Agricultural land occupies more than 55 % of total land use;
- Forests are second most important land use in India, occupying about 22% of the country's geographic area. A more in-depth look into forests is given in Section 3;
- There has been a decrease in area of snow and glacier. While these differences may reflect short term fluctuations, the overall trend is evidence of the impacts of climate change; and
- A significant proportion of India is classified as barren. This percentage has, however, been decreasing over time.

2.2. Condition account

Ecosystem condition accounts record the physical state of ecosystem assets in terms of selected characteristics at specific points in time. Over time, they record changes to their condition.

A range of biophysical indicators are used to determine ecosystem condition, dependent on the ecosystem asset under consideration. For example, the condition account of India's croplands is determined by measures of:

- Intensity and irrigation;
- Land holding fragmentation (see Box 2); and
- Crop diversification.

2.3. Supply and use accounts

The extent and condition accounts are brought together to calculate the flow of ecosystem services through the *supply and use account*. For each recorded supply of ecosystem service there must be a corresponding use, therefore only ecosystem services that have use value are included and measured. For this reason, only exchange values are compatible with SEEA EA – values that are either measured in markets, or in shadow, or proxy markets.

Box 2. Who owns India's agricultural production?

In establishing the condition account for India's croplands, MoSPI considered the level of fragmentation of India's croplands. India is experiencing increasing fragmentation of land holdings. Medium holdings are being converted into small and marginal holdings and the average size continues to fall, which will have an impact on future food production and security.

Fragmentation can be measured using the Gini Coefficient of Inequality, based on a Lorenz curve – a cumulative frequency curve that compares the present distribution with a uniform distribution that represents complete equality.

Figure 2 gives the Lorenz curve, where the perfect equality is represented by the diagonal line, whilst the Gini Coefficient is calculated by the equation A/(A+B).

Figure 2: Lorenz Curve

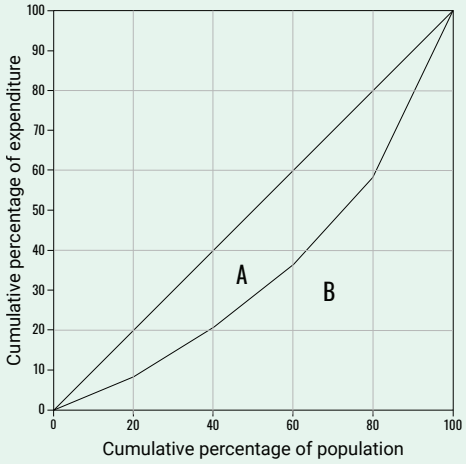


Table 1: *Extent account for India's land use and land cover between 2011-12 and 2015-16*

Land use / land cover classes		2015-16 (in sq. Km.)							Grand total (2011-12)	
		Agriculture	Barren / un-culturable	Built-up	Forest	Grass / grazing	Snow and glacier	Wetlands / water bodies	Area	% of geo-graphic area
2011-12	Agriculture	1,809,033	5,103	2,648	2,299	94	8	2,547	**1,821,732**	**55.41**
	Barren / unculturable	4,237	348,460	589	2,285	61	68,471	614	**424,717**	**12.92**
	Built-up	238	442	118,239	48	2	0	29	**118,998**	**3.62**
	Forest	5,085	6,838	205	712,342	207	637	230	**725,543**	**22.07**
	Grass / grazing	147	408	118	368	22,502	1,333	521	**25,397**	**0.77**
	Snow and glacier	0	1,643	0	131	7	30,799	1	**32,581**	**0.99**
	Wetlands / water bodies	2,536	966	49	155	679	77	133,833	**138,294**	**4.21**
Grand total (2015-16)	**Area**	**1,821,276**	**363,860**	**121,848**	**717,629**	**23,551**	**101,325**	**137,774**	**3,287,263**	**99.99**
	% of geo-graphic area	**55.40**	**11.07**	**3.71**	**21.83**	**0.72**	**3.08**	**4.19**	**99.99**	

Depending on the ecosystem service, the user may receive that service *within* the supplying ecosystem asset (e.g. fish from a lake) or *elsewhere* (e.g., air filtration services from a neighbouring forest). The contribution of ecosystems in the provisioning of some of the products are discussed below

2.3.1. Food from cropland

India's agriculture sector is pivotal to the sustainable growth and development of the country. Agriculture is the primary contributor to livelihoods for 58% of rural households and 40% of all households. As a range of intermediate ecosystem services underpin this sector, the contribution of ecosystem services to cropping is calculated by estimating the total contribution of ecological functions, such as, infiltration of water, the water holding capacity of the soil, the absorption of plant nutrients by soil particles, and the resupply of these particles to plants to the production of crops. Therefore, the value of human inputs, such as machinery, labour, and fertilizers are excluded.

The economic value of the ecosystem service contribution to cropping is reported in table 2. In the nine years assessed, between 2005-06 and 2014-15, this contribution has increased by 153%, or approximately 17% on average per year.

2.3.2. Timber from forests

Timber from India's landscape is one of the most sought-after natural products. The measure of ecosystem service contribution to timber provisioning is defined as the total recorded contribution of the forest, excluding inputs from human capital. A 10% upwards adjustment was further made to account for unrecorded timber harvesting.

The economic value of the ecosystem service contribution to timber production is reported in Table 2. It has fluctuated considerably over the years but has increased by 22% between 2011-12 and 2017-18.

2.3.3. Non-timber forest products

Non-timber forest products (NTFPs) are important to the livelihoods of millions of people in India, particularly those on the forest fringes. NTFPs include fodder, honey, gum arabic, rattan and bamboo shoots, cork, nuts, mushrooms, oleoresins, essential oils, and plant or animal parts for pharmaceutical products, but excludes extractive uses of timber and firewood. NTFP data is based on the royalties received from those authorised to extract products from the forests. The economic value of the ecosystem service contribution to NTFPs is reported in Table 2.

Table 2: *Monetary supply table for assessed ecosystem services by ecosystem type (INR 000' crores per year)*

Ecosystem service type	Ecosystem service	Year of assessment	Ecosystem type			
			Croplands	Forests	Other	Total
Provisioning	Crop provisioning	2014-15	147.59			**147.59**
	Timber provisioning	2017-18		16.30		**16.30**
	NTFP provisioning	2017-18		10.96		**10.96**
Regulating	Carbon retention	2017-18		438.49		**438.49**
Cultural	Nature-based tourism	2014-15	-	-	-	**18.82**

2.3.4. Carbon retention

India's forests play an important role in climate change mitigation through their capacity to both store and sequester carbon in its existing forests and in areas of reforestation. Carbon retention is the most valuable ecosystem service provided by India's forests (of the services assessed). Its economic value is more than twice that of the gross value added of the Indian forestry sector (Table 2).

Carbon retention ecosystem service values are assessed in greater detail in Section 3.

2.3.5. Nature-based tourism

India's landscape provides numerous opportunities for nature-based (and religious) tourism. An assessment of the current flow of ecosystem services to nature-based tourism used estimates based on direct expenditure of visitors and an 'attribution factor' (expenditure that can be directly attributed to the natural areas). This value is relatively conservative, as it does not include economic multipliers.

In the six years between 2008-09 and 2014-15, the economic value of ecosystem service contributions to nature-based tourism has increased by 155%, or around 26% each year (Table 2).

2.3.6. Soil erosion prevention

Soil erosion drives the abandonment of cropland and reduces the productivity of remaining land. In turn, this contributes to the conversion of primary forests and pastureland to new cropland areas and to increases in demand for costly artificial fertilizer inputs, which increases economic costs. Soil erosion is affected by soil structure, vegetation cover, rainfall, and topography.

Where cropland is sustainably managed, soil erosion is reduced. Soil erosion prevention is defined as the difference between current estimates of soil loss and soil loss that would occur in case of barren soil.

This ecosystem service was only measured in physical units. There has been a small decrease in the amount of erosion prevented on India's croplands between 2011-12 and 2015-16.

2.4. Integrated Contribution To Livelihoods Of India's Ecosystem Services

Table 2 provides a summary of monetary supply and use accounts for ecosystem services assessed for India. In the future, it will be possible to add more ecosystem types and ecosystem services and to construct a time series.

2.5. Biodiversity thematic account

India is one of the recognised mega-diverse countries of the world. Biodiversity holds both ecological and economic significance.

Therefore, regular monitoring of biodiversity is essential in providing a basis for evaluating the integrity of ecosystems, their responses to disturbances, and the success of actions taken to conserve or recover biodiversity.

The biodiversity of any given region is not evenly distributed and varies between and within regions. The various factors that influence biodiversity of a region include temperature, altitude, precipitation, soils, and, in particular, pressures from human activities.

The NCAVES project brought together various aspects of India's biodiversity, including a set of statistics on flora and fauna and its biodiversity hotspots, species accounts (including a map of species richness), an overview of biodiversity-related expenditures, and a discussion of the role of the SEEA in the CBD post-2020 monitoring framework.

3. AN IN-DEPTH LOOK AT INDIA'S FORESTS

Through the NCAVES project, India's forests were assessed in terms of the ecosystem service contributions to timber production and NTFP provisioning and to carbon retention. The ecosystem service contribution of India's forests to nature-based tourism was only implicitly included, as this value was estimated across all India's landscapes.

3.1.Forest extent account

Forest extent accounts were determined for the period 2017-18 to provide a breakdown for the three main forest types: very dense forest (14% of total forest), moderately dense forest (43%), and open forest (43%). Very dense forests have grown over time. The percentage of dense forest is an indicator used in India to distribute tax revenues to Indian States. The States of Odisha, Arunachal Pradesh , Madhya Pradesh, Chattisgarh, and Maharastra are the major beneficiaries – being the top five States in India with the highest percentage share of dense forests in the country.

3.2. Forest condition account

The forest ecosystem condition account provided insight about the characteristics and quality of India's forest ecosystem assets and how they have changed over time. Measurement of ecosystem condition is of significant interest when it comes to supporting environmental policy and decision-making, which is focused on protecting, maintaining and restoring ecosystem condition. It uses a combination of relevant variables and indicators, dependent on characteristics of the ecosystem asset. Measures for India's forests are shown in Figure 3. For each of these metrics, state-wise changes were determined and reported in the full report.[2]

Figure 3: *Aspects of forest condition account for India*

Condition accounts
Volume of growing stock
Carbon stock, by type of carbon pool – above ground biomass, below ground biomass, soil organic carbon, dead wood and litter
Carbon stock per hectare, by type of carbon pool
Number and area of wetlands within Recorded Forest Area
Biodiversity assessment
Total number of species of herbs, shrubs and trees
Shannon-Wiener Index of herbs, shrubs and trees
Effective number of species of herbs, shrubs and trees
Average patch size, number of patches in different patch size classes, proportion of small patches (of less than 1km^2)

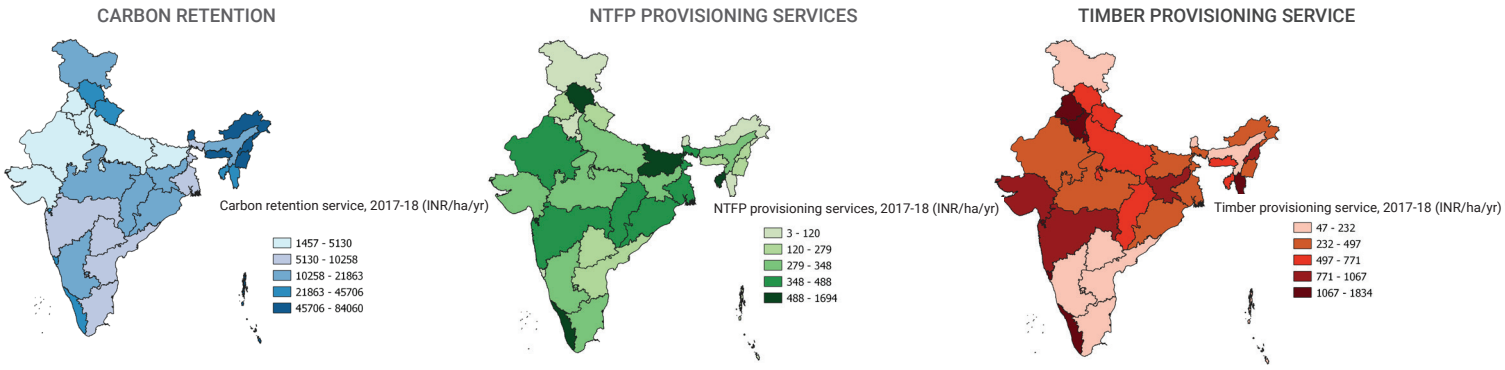
3.3. Forest ecosystem services

Ecosystem service contributions to timber provisioning was measured by assessing the quantity of timber removed from private or government forests and non-traditional forest areas. In addition to assessing authorised removals, estimates were made to account for non-recorded removals. To determine the value of timber provisioning attributable to ecosystem services, estimates of the value of output of the sector were first calculated and then the value-added of various human inputs was deducted. The residual value remaining is assumed to be the value attributable to ecosystem services.

State-wise estimates of the value of output of NTFPs are available in India's National Accounts Statistics. Values are built on the basis of royalty received (in monetary terms) from people authorised to extract NTFPs from forests. The value of fodder from forests, estimated using the 'per animal consumption' norms from the National Accounts Statistics, is also a component of the estimate of NTFPs.

Forest carbon stocks are assumed to be in five pools: above-ground biomass and below ground biomass (the living portion), dead wood and litter (dead organic matter), and soil organic matter. Stock estimates were made for each of the forest types. This estimate was then multiplied by the social cost of carbon (in INR) and multiplied by an assumed rate of return (3% in this case) to provide an annual flow of value of carbon retention in monetary terms.

Figure 4: *Spatial distribution of ecosystem service values for India's forests. India's ecosystem accounting for forests has assessed timber and NTFP provisioning services and carbon retention. For each of these ecosystem services, economic valuations have been applied to provide per hectare per year monetary values. Figure 4 shows how these forest ecosystem services are distributed across the whole country.*



Source: MoSPI

4. MAPPING SEEA EA TO SUSTAINABLE DEVELOPMENT OBJECTIVES

The 2030 Agenda for Sustainable Development, adopted by all UN Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet.[3] Its agenda includes 17 Sustainable Development Goals (SDGs), underpinned by 168 specific targets.

The SEEA EA accounts have proven useful measures of India's progress towards achieving some key targets. For example, some targets, such as 15.1.1 (measure of forest cover) can be fully measured by the SEEA EA forest extent account. Other SDG targets can be partially measured by the SEEA EA.

MoSPI has mapped the SEEA framework to India's SDG National Indicator Framework, making India's SDG reporting consistent, comprehensive and coherent. Out of 43 SDG indicators that were found to align with the SEEA, 39 could be fully measured (see full report for details).

MoSPI tested four SDG indicators using the SEEA standard:

- **15.1.1 - forest area:** drawing from the SEEA-EA forest extent account, MoSPI reported that India has increased its overall area of forest cover from 21.05% in 2008-09 to 21.67% in 2017-18.
- **6.1.1 - change in the extent of water-related ecosystems over time:** this indicator draws on extent accounts for freshwater ecosystems and reports a -0.38% fall in extent between 2011-12 to 2015-16.
- **15.3.1 - proportion of land degraded over time:** this indicator uses land cover observations to measure changes in land degradation for different land cover classes. 8.12% of the land area of India has become degraded between 2001 and 2015.
- **11.3.1 - ratio of land consumption rate to population growth rate:** this indicator compares the growth in population with the growth in the footprint of urban areas. A longer-term dataset from extent accounts is required to find meaningful measures for this indicator.

5. RECOMMENDATIONS AND NEXT STEPS

By using the SEEA EA standard India has an opportunity to enhance policy-making and improve decision-making. The SEEA EA can show how human activities influence how ecosystem services are provided by landscapes over time in a way that is compatible with traditional national accounts and that is comparable across countries.

The application of these accounts can help focus resources on hotspots that are degrading. For instance, water quality accounts can help in identifying regions that require resources for artificial ground water recharging in the immediate future.

Due to its integrated approach, the SEEA EA can monitor progress towards critical global initiatives. For example, the NCAVES project has demonstrated that the SEEA is an ideal framework for directly mapping with India's SDG National Indicator Framework, which measures and monitors the progress made towards achieving the SDGs.

In addition, the Biodiversity Thematic Account can help India promote and coordinate the development and delivery of biodiversity indicators for use by the Convention on Biodiversity.

MoSPI will continue to strive for expanding the coverage of the information, so as to guide the country and the decision-makers towards a "better environment, better tomorrow".

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REFERENCES

1 UN Statistics Division. *System of Environmental Economic Accounting 2012 - Experimental Ecosystem Accounting.* (2012).

2 MoSPI. *Ecosystem Accounts for India: Report of the NCAVES project.* (2021).

3 UN. Sustainable Development Goals. (2015).

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For more information please visit:
https://www.mospi.gov.in/natural-capital-accounting-and-valuation-of-ecosystem-services-ncaves-

or **https://seea.un.org/home/Natural-Capital-Accounting-Project**

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