Introduction

Chapter 1

Introduction

The World is not to be put in order.
The World is in order. It is for us to put ourselves in unison with this order.
-Henry Miller

Background

1.1 The use of natural resources and materials has always been the backbone of global economies and in turn of human development and well-being. In the fast pace of rapid economic and population growth, there has been increasing demand for the natural resources over the last few decades for achieving the accelerated economic growth. Due to this reason, natural resources have been extensively used which is adversely affecting the environment and biodiversity. The general narrative of growth and development of a country has been linked with the magnitude of both current flow of income and future flows of income. This approach can be deceptive given the fact that if natural resources are depleted for economic development, the income derived will not be sustainable. Managing natural resources sustainably allows countries to establish the foundation for long-term development and human well-being.

1.2 India exhibits immense diversity, not only in terms of its climate, physio-geography and ecological regime but also its people and culture. The country has an abundance of natural resources and biodiversity wealth that is closely interlinked with the lives and livelihoods of the people, especially in the rural and remote areas. Realizing this, the environmental issues are embedded in India's Constitutional guidelines adopted in 1950. The Article 48A[1] of the Directive Principles of State Policy, given in the Constitution of India, contain provisions that reflect the State's commitment to protect the environment and which enjoins upon the citizens of India the responsibility to protect and improve the environment and to safeguard the forests and the wildlife.

1.3 Today the cross-linkages between the resource use, climate change, land degradation and biodiversity loss has been scientifically well established. Concerns

[1] https://www.india.gov.in/my-government/constitution-india/amendments/constitution-india-forty-second-amendment-act-1976

about rapidly depleting vital resources and adverse impacts on natural environment have lately gained prominence, resulting in an increased focus on judicious use of the resources through a combination of conservation and efficiency measures and advocating transition towards circular economy.

1.4 The Union Budget 2023-24[2] included 'Green Growth' as one of the Government's major visions for the '*Amrit Kaal*'. Many programmes for green fuel, green energy, green farming, green mobility, green buildings, green equipment and policies for efficient use of energy across various economic sectors are being implemented. Also, Hon'ble Prime Minister has provided a vision for 'LiFE' or Lifestyle for Environment, to spur a movement of environmentally conscious lifestyle. India is moving forward firmly for the '*Panchamrit*' and net-zero carbon emission by 2070 to usher in green industrial and economic transition. In addition, the recently launched "National Green Hydrogen Mission"[3] with an outlay of Rs. 19,700 crores, will facilitate transition of the economy to low carbon intensity, reduce dependence on fossil fuel imports, and make the country assume technology and market leadership in this sunrise sector. These green growth efforts help in reducing carbon intensity of the economy and provides for large- scale green job opportunities.

1.5 In addition, under India's G20 Presidency, in the G20 Environment and Climate Sustainability Working Group (ECSWG[4],[5]) held on 29th March, 2023 all the G20 countries deliberated on Arresting Land Degradation, Accelerating Ecosystem, Restoration and Enriching Biodiversity, Promoting a Sustainable and Climate Resilient Blue Economy and Encouraging Resource Efficiency and Circular Economy and expressed their commitment towards combating the environment and climate crisis, but with a renewed sense of urgency. During the G20 Summit, Hon'ble Prime Minister announced the launch of Global Biofuel Alliance. This will enable global biofuels trade, developing concrete policies on lesson-sharing and promoting provision of technical support for national biofuels programmes worldwide.

1.6 For a developing country like India with GDP of ₹235 lakh crore approximately for the year 2021-22 at current prices, it is important to balance

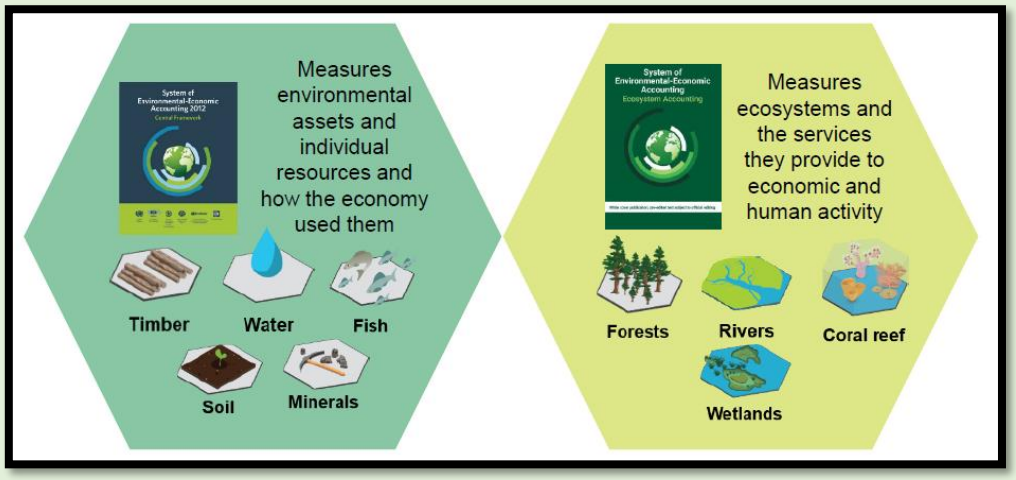
[2] https://www.indiabudget.gov.in/doc/budget_speech.pdf
[3] https://www.pib.gov.in/PressReleasePage.aspx?PRID=1907698
[4] https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1911971
[5] https://pib.gov.in/PressReleasePage.aspx?PRID=1898304

economic growth with environmentally sustainable practises, to temper growth with environmental equity, sustainability and social justice. It has become crucial to understand that when economic profits come at the expense of the people and the available natural resources in the country, we are left with an incomplete picture of the true cost of economic growth. It is therefore the need of the hour to think of alternative means to measure economic prosperity and progress and go 'Beyond GDP'.

The System of Environmental Economic Accounting (SEEA[6])

1.7 The System of Environmental-Economic Accounting (SEEA) is an agreed international statistical standard for describing the interaction between the economy and the environment, and the stocks and changes in stocks of environmental assets. The SEEA uses a structure and classifications consistent with the System of National Accounts (SNA) to facilitate the development of indicators and analysis on the economy-environment nexus. SEEA also represents melding of many disciplines (e.g economics, statistics, energy, hydrology, forestry, fisheries and environmental science etc.), each with its own concepts and structures. Thus, while the underlying structure is the same as that used in the national accounts, the SEEA aims to integrate perspectives from other disciplines and where relevant, provide an improved body of information for environmental economic accounts. There are two sides of SEEA - SEEA-Central Framework (SEEA-CF) and the SEEA-Ecosystem Accounting (SEEA-EA) as illustrated in the **Figure 1.1** below.

Figure 1.1: SEEA-CF and SEEA-EA



Source: UN-SIAP

[6] https://seea.un.org/

1.8 The SEEA-Central Framework (SEEA-CF), adopted as the International standard in 2012, organizes and integrates the information on the various stocks and flows of the economy and the environment in a series of tables and accounts. The Central Framework covers measurements in three main areas:

(i) **Environment Flows**: The flows of natural inputs, products and residuals between the environment and the economy, and within the economy, both in physical and monetary terms.

(ii) **Stocks of Environmental Assets**: The stocks of individual assets, such as water or energy assets, and how they change over an accounting period due to economic activity and natural processes, both in physical and monetary terms.

(iii) **Economic Activity related to the Environment**: Monetary flows associated with economic activities related to the environment, including spending on environmental protection and resource management, and the production of 'environmental goods and services'

1.9 In the SEEA-CF, the focus is on the individual components of the environment that provide material and space to all economic activities. It, however, does not consider the non-material benefits from the indirect use of environmental assets (e.g. Benefits from ecosystem services such as water purification, storage of carbon and flood mitigation).

1.10 SEEA-Ecosystem Accounting, a complementary framework of SEEA-CF constitutes an integrated and comprehensive statistical framework for organising data about habitats and landscapes, measuring the ecosystem services, tracking changes in the ecosystem assets, and linking this information to economic and other human activity. SEEA-EA describes the measurement of ecosystems in physical terms and the valuation of ecosystems in so far as it is consistent with the market valuation principles. SEEA-EA, adopted by the UNSC in its 54th Session in 2021, also encompasses the environmental assets but focuses on the interactions between individual environmental assets within ecosystems and on the broad set of material and non-material benefits that accrue to the economy and other human activity from flows of ecosystem services. The SEEA-EA is built on 5 core accounts:

(i) **Extent Accounts**: record the total area of each ecosystems, classified by type within a specified area (Ecosystem Accounting Area). Ecosystem Extent accounts are measured over time in Ecosystem Accounting Area (e.g. nations, province, river basins, protected area, etc.) by ecosystem

type, thus illustrating the changes in extent from one ecosystem type to another over the accounting period.

(ii) **Condition Accounts**: record the condition of the ecosystem assets in terms of selected characteristics at specific points in time. Over time, they record the changes to the ecosystems' condition and provide valuable information on the health of the ecosystem.

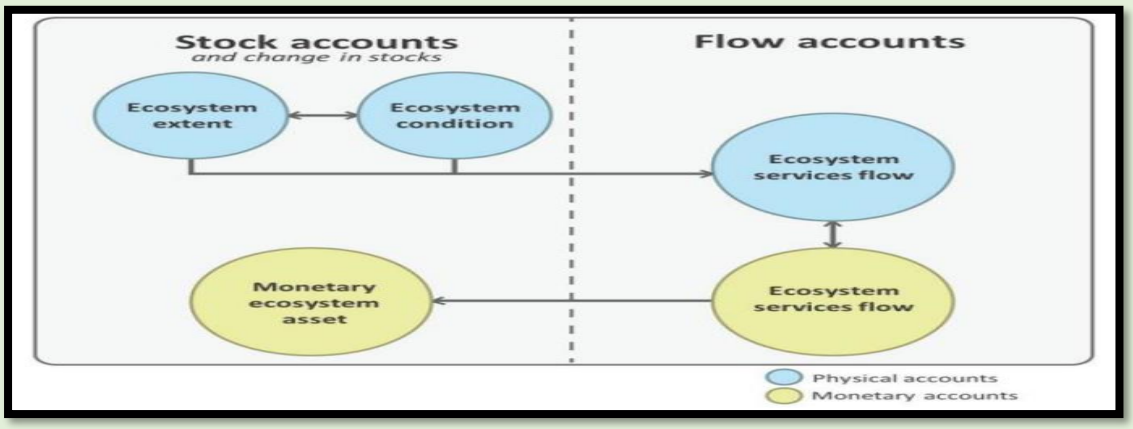
(iii) **Flows of Ecosystem Service (Physical and Monetary)**: record the supply of ecosystem services by ecosystem assets and the use of those services by economic units, including households.

(iv) **Monetary Ecosystem asset account**: describes the information on stocks and changes in stocks (additions and reductions) of assets and records this information in monetary terms for ecosystem assets based on the monetary valuation of ecosystem services and applying the net present value approach to obtain opening and closing values in monetary terms for ecosystem assets at the beginning and end of each accounting period. This includes accounting for Ecosystem degradation and enhancement.

(v) **Thematic accounts**: organizes the data on themes of specific policy relevance. For examples - biodiversity, climate change, oceans and urban areas. Other important thematic accounts would include accounting for protected areas, wetlands and forests etc.

1.11 While the extent and the condition accounts describing the spread and the health of the ecosystems are the stock variables, the ecosystem service flows which help to understand the benefits derived from the ecosystems in the economy are the flow variable. A diagrammatic representation **(Figure 1.2)** for the same is presented below for better understanding.

Figure 1.2: Set of Ecosystem Accounts



Source: UN-*SIAP*

1.12 The supply of ecosystem services and the use of these services by economic units, including households, is one of the central features of ecosystem accounting. Ecosystem services are only recorded in case there are actual beneficiaries for the services, i.e. when there is a demand. This is similar to the system of national accounts, which is based on transactions or actual exchanges in the economy.

1.13 It is a well-conceived fact that the 'Nature' provides several valuable services to the mankind, but despite having immense value in the lives of human beings they are often beyond the scope of valuation. The prime motivation for ecosystem accounting is that the analysis of 'ecosystems' and the 'economy' separately does not reinforce the vital nature of the relationship between mankind and the environment. The standard approaches to the measurement of the economy focus largely on economic and other human activities that is reflected in the transactions of the markets. Ecosystem accounting aims to shed light on the non-market activities that relates to ecosystems and integrate this information with relevant market related data. It is understood that individual and social decisions concerning the use of the environment may be better informed by developing information sets based on recognition of the relationship between ecosystems and economic and other human activities. The contribution of the environmental goods and services duly measured enables robust and sustainable decisions and policies.

1.14 The valuation of ecosystem services and ecosystem assets is a complex process, but it is essential to frame, prioritise and justify the sustainable development policies oriented towards the protection or restoration of ecosystem. Ecosystem services accounts are a very useful tool that provides pertinent information on the role of ecosystems in delivering services which in turn benefits the society. Ecosystem services contribute to two types of benefits- System of National Accounts (SNA) benefit, or non-SNA benefits.

i. The products produced by economic units (e.g., food, water, clothing, shelter, recreation) are referred to as SNA benefits, since the measurement boundary is within the production boundary used to measure Gross Domestic Product (GDP) in the System of National Accounts (SNA).

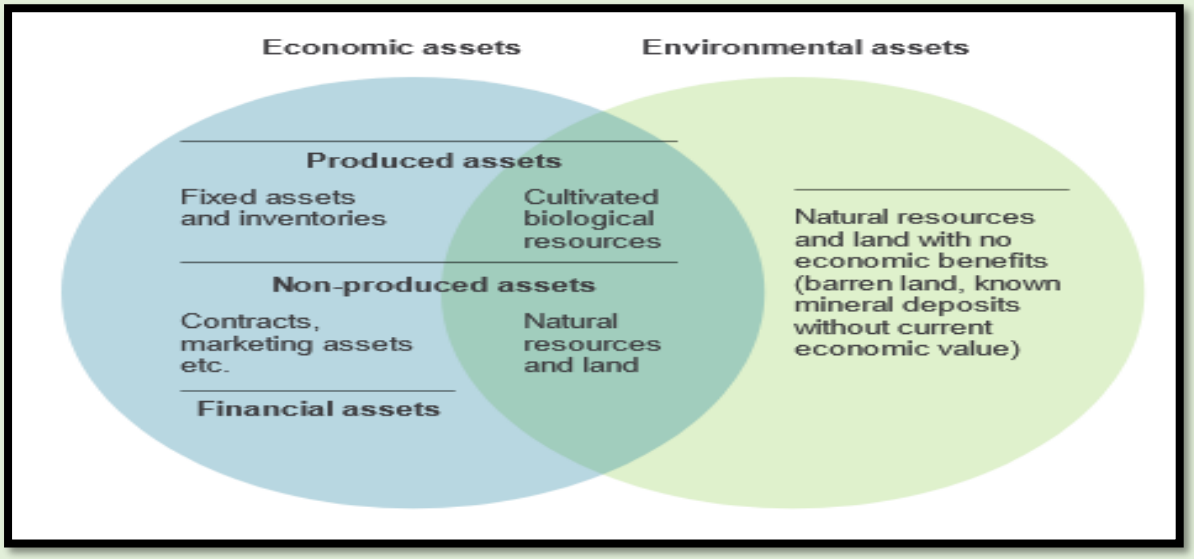
ii. The benefits that accrue to individuals that are not produced by economic units (e.g., clean air) are referred to as non-SNA benefits, reflecting the fact that the receipt of these benefits by individuals is not the result of an economic production process defined within the SNA.

1.15 Some ecosystem services are already included in GDP (as they contribute to products, for example timber which fall in the production boundary), but others (e.g. carbon retention) fall outside the SNA production boundary.

Linkages of SEEA with the SNA

1.16 The System of National Accounts (SNA) is the internationally agreed standard set of recommendations on the compilation methodology of the measures of various economic activities. SEEA was initially developed as a satellite account of SNA and therefore the underlying concepts, definitions are the same for both SEEA and SNA. SEEA is similar to SNA in the sense that SEEA organises and integrates the information on various stocks and flows of the economy and the environment in a series of tables and accounts. SEEA has the capacity to coherently present information in both physical and monetary terms. SEEA enables to include all the goods and services which may or may- not have a market value and this makes SEEA have a broader scope of coverage as compared to the SNA which is restricted to the SNA production boundary. The following **Figure 1.3** shows the distinction between the economic and the environmental assets:

Figure 1.3: Economic and Environmental Assets



Source: UN-SIAP

Environment Accounts in India

1.17 The National Statistical Office (NSO) under the Ministry of Statistics and Programme Implementation (MoSPI) is mandated with the "Development of

Environment Statistics and Development of methodology, concepts and preparation of National Resource Accounts for India". In accordance with this mandate, the Ministry constituted an Expert Group in 2011 under the chairmanship of Prof. Sir Partha DasGupta, Frank Ramsey Professor Emeritus of Economics, University of Cambridge, U.K for advising on an implementation plan for compiling "Green National Accounts in India". The Expert Group submitted its report in 2013 and recommended compilation of the accounts following the SEEA Framework in a phased manner, i.e. starting with the asset accounts followed by the physical and the monetary flows.

1.18 India also participated in the 'Natural Capital Accounting and Valuation of Ecosystem services (NCAVES)' launched by the United Nations Statistics Division (UNSD), the United Nations Environment Programme (UNEP) and the Secretariat of the Convention of Biological Diversity (CBD) in 2017. This European Union (EU) funded project, through its partnership instrument, aimed to assist the five participating countries namely Brazil, China, India, Mexico and South Africa, to advance the knowledge agenda on environmental-economic accounting in particular ecosystem accounting. NSO, MoSPI implemented the NCAVES project in close collaboration with Ministry of Environment, Forest and Climate Change (MoEF&CC), the National Remote Sensing Centre (NRSC), the Soil and Land Use Survey of India (SLUSI) and Indian Institute of Science (IISc)- Centre for Ecological Sciences. Under the NCAVES Project, NSO, India took up several activities towards compilation of the Environment Accounts.

1.19 In adherence with the recommendations of the Sir Partha DasGupta Committee Report, the first layers of the Environment Accounts (i.e., asset accounts) were released in the year 2018, in the publication, EnviStats India 2018 – Supplement on Environment Accounts[7], detailing the physical asset accounts of land cover, minerals, water and forests, at the state and national levels.

1.20 Since then, the Ministry has continuously strived to enhance the scope and coverage of environmental accounts, including those of extent and condition accounts. Further, in order to translate the physical values using an economic yardstick, the Ministry evaluated some ecosystem services-such as Crop Provisioning Services, Timber and Non-timber Forest Products Provisioning

[7] https://mospi.gov.in/download-reports

Services, Fish Provisioning Services, Carbon Retention Services provided by Forests and Nature-Based Tourism services in monetary terms. These accounts, along with the extent and the condition accounts, present a systematic glimpse of the State of Environment in India in respect of various environmental assets and ecosystems. Several accounts that have been released in the form of the annual publication "EnviStats India: Vol. II- Environment Accounts" are presented in the **Table 1.1** below:

Table 1.1: List of Accounts Published

Type of account	Topics covered (Year of publication given in parentheses)
Ecosystem extent	• Change matrix of Land Use – Land Cover (LULC) from 2005-06 to 2011-12 and 2011-12 to 2015-16 (2018, 2020) • Asset Account for Land Use-Land Cover (LULC), 2005-06, 2011-12 and 2015-16 (2018, 2020) • Accounts related to the Land Degradation, 2005-06 and 2015-16 (2020) • Wetland Extent Account- 2006-07, 2016-17 (2020, 2022)
Ecosystem condition	• Soil nutrient indices -2015-17, 2017- 19 and 2019-20 (2019, 2021) • Water quality accounts -2015-16 to 2018-19 (2019, 2021) • Forest condition account -2015-16 and 2017-18 (2020) • Cropland condition account -2005-06, 2010-11 and 2015-16 (2020) • Wetland Condition account -2019-20 (2020)
Ecosystem services	• Crop provisioning services (monetary) from 2005-06 to 2017-18 (2019, 2021) • Timber provisioning services (monetary) -2011-12 to 2019-20 (2020, 2022) • Non-Timber Forest Products (NTFP) provisioning services (monetary) -2011-12 to 2019-20 (2020, 2022) • Fish Provisioning Services (monetary) -2015-16 to 2021-22 (2022) • Carbon retention services provided by forests (physical

Type of account	Topics covered (Year of publication given in parentheses)
	and monetary) -2015-16, 2017-18 and 2019-20 (2020, 2022) • Nature-based tourism (monetary) -2008-09 and 2014-15 (2019) • Soil erosion prevention services provided by croplands (physical) for 2005-06, 2011-12 and 2015-16 (2020)
Thematic Accounts	• Biodiversity - The extent of protected areas -2020 (2020) • State-wise floral and faunal species accounts -2020 (2020) • Species Richness of IUCN Red List species - versions 2020-2, 2020-3, 2021-1, 2021-2, 2021-3 and 2022-1 (2020, 2021, 2022)
Individual environmental asset accounts (SEEA CF)	• Forests – Growing Stocks of Timber and Carbon -2006-07, 2010-11, 2015-16 and 2017-18 (2018, 2020) • Water (2018) • Minerals -2005, 2010 and 2015 (2018) • Energy -2015-16 to 2020-21(2022) • Solid Waste Accounts -2020-21 (2022)

1.21 In order to conclude the project activities in India and to highlight the users to which the natural capital accounts can be put, especially in the areas of decision making and policy analysis, NSO, India conducted the NCAVES India Forum in January, 2021, where line Ministries, State Governments, Multilateral Organizations and Research Institutions had participated. During the Forum, MoSPI had announced to release the 'Strategy for Environmental Economic Accounting in India' in order to provide a road-map for development for Environmental Accounting in India. In line with the announcement made and also to further expand the coverage of the Environmental Accounts in India, NSO, MoSPI released the 'Strategy for Environmental Economic Accounts in India: 2022-2026'[8] where some of the potential areas for work as given below has been identified:

(a) Energy Accounts
(b) Material Flow Accounts
(c) Ocean Accounts

[8]https://mospi.gov.in/sites/default/files/publication_reports/Environment%20Accounting%20Strategy%202022-261638528460762_0.pdf

(d) Thematic accounts for Biodiversity and Urban Area Accounts

1.22 The current publication which is sixth in series covers Material Flow Accounts, Soil Erosion Prevention Services provided by the Forests, Fish Provisioning Services and Solid Waste Accounts. A brief description about the remaining chapters are provided in the subsequent paragraphs.

Chapter 2. Material Flow Accounts

1.23 It is an undeniable fact that that the world has a finite volume of natural resources and a limited ability to produce new resources. Extraction and processing of materials, fuels and food causes significant greenhouse gas emissions, biodiversity loss and water stress. It is therefore important to rethink how we exploit/utilize the available resources, how the cities and infrastructure are built, how the food is grown and how the residuals are managed.

1.24 Material Flow Accounts provide a statistical framework measuring natural resource extraction, trade in natural resources, waste disposal and emissions. Domestic material consumption and material footprint, including by extraction type (biomass, fossil fuels, metal ores and non-metallic minerals) are seen as a proxy for overall environmental pressure within a national economy and the impact of a domestic economy on the environment.

1.25 In order to sustainably manage these resources, it is important that the natural resources are optimally utilized i.e. by minimizing the use of the natural resources and maximining the economic growth and social benefit. Developing policies which promotes circular economy and decoupling economic growth can only be done through efficient tracking mechanism revealing how materials are being used and by identifying opportunities for improving efficiency, reducing material use and waste, promoting recycling and changing processes.

1.26 India adopted a circular economy path to bring in substantial annual benefits, along with significant reduction in congestion and pollution, which would consequently have a snowball effect on the economy. The aim is to maximize the national resource efficiency, minimise the consumption of finite resources as well as provide impetus to the emergence of new business models and entrepreneurial ventures. All these will enable providing a spur to the transition towards self-reliance of the country. Also, the Government has been actively formulating policies

and promoting projects to drive the country towards a circular economy. It has already notified various rules, such as the Plastic Waste Management Rules, e-Waste Management Rules, Construction and Demolition Waste Management Rules, Metals Recycling Policy, etc., in this regard.

1.27 The chapter 2 of the publication talks about the Core Accounts of the Material Flow Accounts which includes Domestic Extraction, Exports and the Imports. The residual part (only the solid waste accounts) has been covered in the Chapter 3 of the publication. The primary data source for the Core MFA accounts is the M/o Agriculture, Indian Bureau of Mines and Directorate General of Commercial Intelligence and Statistics (DGCIS).

Chapter 3: Solid Waste Accounts

1.28 As a subset of the Material Flow Accounts, NSO India had attempted compilation of the Solid Waste Accounts for the Union territory of Delhi in the EnviStats India Vol.II: Environment Accounts 2022[9]. In the current publication, the accounts have been developed for 7 more states viz. Jammu and Kashmir, Maharashtra, Mizoram, Rajasthan, Tamil Nadu, Chandigarh and Gujarat. The Solid Waste Accounts provides organized information on the generation of solid waste and the management of flows of solid waste to recycling facilities, to controlled landfills or 'to the environment'. The main idea behind the compilation of the solid wastes is to get a glimpse of the collection and management mechanism of the solid waste in the area. The exercise can be further expanded for other states based on the data availability.

1.29 The Chapter 3 of the publication provides estimates for the Solid Waste Accounts- Physical Supply and Use Table (PSUT) using the SEEA framework. Five different types of wastes have been considered in the publication- Municipal Solid Waste, Bio-medical Waste, Hazardous Waste, Plastics and E-waste. These accounts would provide a basis for identifying the amount of wastes that enter the environment and given the harmful effects of the residuals on the earth, these accounts pave the way towards the adoption of a circular economy model wherein the wastes are reduced to a minimum.

[9] https://mospi.gov.in/download-reports

Chapter 4: Fish Provisioning Services

1.30 SEEA-EA defines ecosystem services as the contribution of the ecosystems to benefits used in the economic and other human activity which is categorized into 3 categories: Provisioning Services, Regulating & Maintenance Service and Cultural Services.

1.31 Using the information provided by the States on the Rent/Lease of the rivers/ponds where the fishes thrive, an estimate of the Fish Provisioning Services had been computed in the EnviStats India Vol.II Environment Accounts 2022[10] for the States of Andhra Pradesh, Rajasthan and Haryana. Fish Provisioning Services have been compiled for some more states such as Bihar for the years 2017-18 to 2021-22, Kerala for the block years 2020-21 to 2025-26 and Tamil Nadu for the years 2016-17 to 2020-21 and are presented in the Chapter 4 of this publication.

Chapter 5: Soil Erosion Prevention Services by the Forests

1.32 One of the regulatory services provided by the Forests Ecosystem Services is the Soil Erosion Prevention Services. An attempt has been made in the current publication to compute the soil erosion prevention services provided by the Forests using data from the National Remote Sensing Centre (NRSC), Soil and Land Use Survey of India (SLUSI) and Global Rainfall Data with the technical support of the SLUSI.

1.33 NSO, India had earlier compiled experimental estimates of soil erosion prevention services due to Croplands using the global and National datasets for the years 2005-06, 2011-12 and 2015-16 for the States of India. The findings of the analysis were published in EnviStats India Vol. II 2020[11]. In the current publication, a comparative study on soil erosion prevention services by forest for two districts- Gondia, Maharashtra and Balrampur, Chhattisgarh has been made on an experimental basis considering two different scenarios- Bare land and Forests.

Conclusion

1.34 The subject matter of 'Environment' is not only vast and diverse, but is intermingled with multiple other disciplines. It is a huge challenge to understand the inter-relationships and also to put a 'numeric value' to its services. Nevertheless,

[10] https://mospi.gov.in/download-reports
[11] https://mospi.gov.in/download-reports

NSO, India has been gradually expanding the scope and coverage of environmental accounts in terms of time, domains and geographic coverage since the time of its inception. However, it is pertinent that understanding the intricacies of the data sources and methods used to compile accounts will evolve over time as a result of engagement with the data sources agencies and the users, especially the policy makers. Lastly, as with all statistical products, with the availability of updated data, the accounts presented so far do have a scope of further revision and refinement to depict better connection between environment and economic and human activities.

1.35 EnviStats India: Environment Accounts is an attempt to acknowledge the value of 'nature' in the lives of mankind both in physical and in monetary terms. This will help to provide the right push towards having a sustainable future emanating from a healthier environment in sync with 'Better Environment, Better Tomorrow'.

*****