INTRODUCTION

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Background

Natural capital refers to all types of environmental assets existing in the environment. The concept of natural capital incorporates a broad perspective on the set of services provided by ecosystems assets. Natural capital is essential for economic growth, employment, and, ultimately, prosperity. The benefits derived from environment range from the use of environmental assets as raw materials for production and the dependence on environmental conditions for production to the benefits derived from being able to enjoy nature, we constantly derive benefits from the environment. The interplay of the environment and the economy is crucial to be understood by the policy makers while framing the policy for growing economy using the natural resource on sustainable basis.

National Accounts and Environment

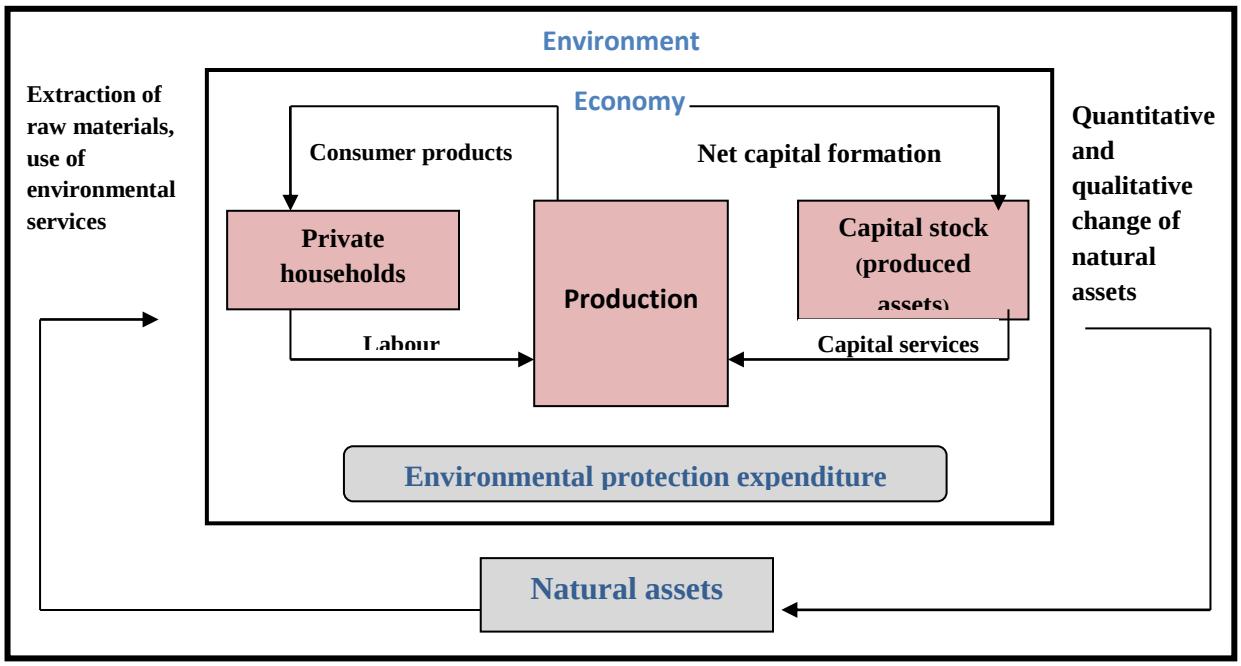
2. The System of National Accounts (SNA) is an accounting framework for measuring the economic activities of production, consumption and accumulation of wealth in an economy during a period of time. The SNA provides a comprehensive conceptual and accounting framework for analyzing and evaluating the performance of an economy. It also provides a structure for addressing emerging concerns related to the determinants of economic growth and their links to different sectors of the economy. However, the fact that the standard accounting procedures followed for tracking a growth in the economy (read GDP and SNA) fail to account for environmental degradation and resource depletion is now well acknowledged. This issue is more pronounced especially in developing countries, which depend heavily on natural resources. If a country cuts down its forests, depletes its soil fertility, and pollutes its water supplies, this surely makes the country poorer in real sense. But national income accounts merely record the market value of the timber, agricultural produce, and industrial output as positive contributions to GDP. This may lead policy makers to view the country's development in an unrealistically rosy light—at least until the effects of the environmental damage become apparent, which in some cases may take decades.

3. In this context, different measures have been formulated which involve environmental modelling which aim to develop economic, social, and governance systems capable of ending poverty and achieving sustainable levels of production and consumption while securing the life-support systems provided by nature underpinning

current and future human well-being. Essential to meeting this objective is the incorporation of status of natural capital and the ecosystem services it provides into decision-making.

4. Environmental-Economic Accounting (EEA) describes the interrelationship between the economy and the environment (**Figure 1**). For its economic activities, an economy not only uses labour and produced assets but also natural assets. Natural assets include raw materials such as sources of energy, ores, other minerals and water as well as land that serves as a location for production, consumption and various leisure activities. These parts of natural assets are used directly. Other components of natural assets are ecosystems and other natural systems such as the atmosphere. They support economic activities by absorbing and eliminating residues and pollutants arising from production and consumption, such as atmospheric emissions, waste and effluent.

Figure 1: Interrelationship between economy and environment



5. The use of natural assets–similar to the produced capital stock–generally involves depletion, which means that the burden or impact on the environment causes changes in its state and/or natural assets. On the one hand, these changes are of a quantitative nature (e.g. a decreasing amount of non-renewable raw materials); on the other, they have many qualitative aspects (deteriorating air quality due to emissions of pollutants, diminished biodiversity etc.). Attempts then need to be made to prevent these negative changes with targeted, appropriate environmental protection measures,

such as by avoiding environmental burden or remedying damage that has already been done (e.g. cleaning up polluted sites). The interdependencies between the economy and the environment therefore are not restricted to showing the burdens on the environment - in fact, the pattern also includes changes to the state of the environment brought about by pollution and the steps taken to avoid it or repair the damage.

6. The EEA aims to describe all three forms of interdependence between economy and environment – environmental burden, the environmental state and environmental measures. The description of these interdependencies takes as its starting point the fact, mentioned above, that a national economy not only uses labour and capital but also nature. Therefore, the basic idea is to take the commonly accepted definition of a national economy and expand it by a factor "nature".

7. In 2012, the United Nations Statistical Commission adopted the System of Environmental Economic Accounting (SEEA) - Central Framework as an international statistical standard, which prescribes a satellite System of Integrated Environmental and Economic Accounting framework to supplement SNA system of accounts. The objective of this framework is to extend the presentation of the economic process by a depiction of the interrelationship between the economic system and the environment. SEEA envisages compilation of the following broad accounts namely -

i. Asset accounts for individual environment asset in physical and monetary terms showing stock of environmental asset at the beginning and end of each accounting years and changes in the stock;
ii. Supply and use tables in physical and monetary terms showing flow of natural resource inputs, products and residuals;
iii. A sequence of economic accounts that highlights depletion adjusted economic aggregates; and
iv. Functional accounts which records transactions and other information about economic activities undertaken for environmental purposes.

By describing the two dimensions of sustainable development – economy and environment – and their interrelationship, these accounts provide an important and useful data base for stakeholder discussions concerning sustainability.

Environmental Accounting in India

8. India has a long history of research on environmental aspects including ecosystem services, ranging from theoretical concepts to its practical applications and internalization of study outcomes into policies. These studies had been carried out in

the areas of forest, wetland, coastal, marine & mangrove and others. Some of the major milestones in the research in this area are highlighted in **Figure 2**.

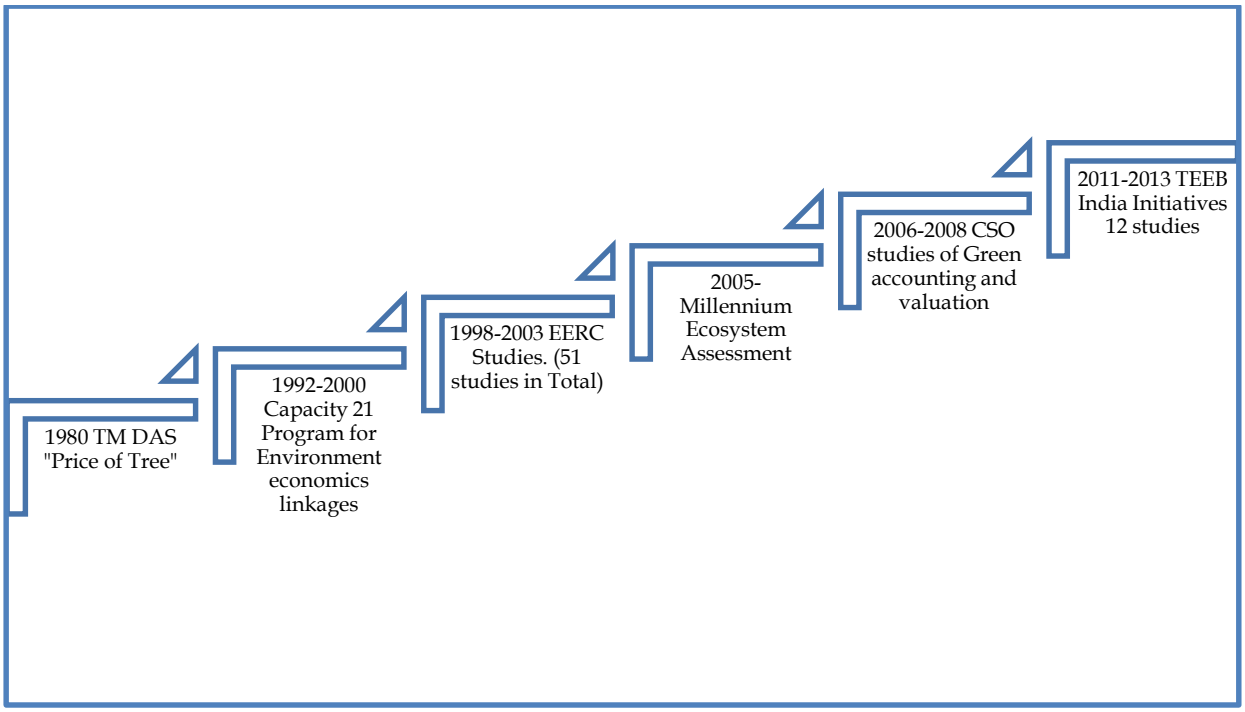


Figure 2: Milestones of environment studies in India

9. The studies conducted so far cover a wide range of issues – from application of economic principles and tools to environmental management in India for policies related to pollution control, modelling, resources management and biodiversity conservation and from quantifying the resourcefulness of India to highlighting the economic consequences of the loss of biological diversity and the associated decline in ecosystem services. But despite having vast richness of findings of these research studies, a full-fledged national account could not be compiled due to lack of comparability in the methods and definitions used in these studies which limited their aggregation.

10. In order to help the official system to come up with the environmental economic accounts, a high level Expert Group under the Chairmanship of Prof. Sir Partha Dasgupta, Frank Ramsey Professor Emeritus of Economics, University of Cambridge, U.K. was constituted by MOSPI in 2011 with the mandate of developing a framework for green national accounts of India and preparing a roadmap to implement the framework. The Expert Group submitted its report titled "Green National Accounts in India-A Framework" in 2013 which included a roadmap for implementing the Green Accounting Framework.

11. The central conclusion of the report is to judge the changes of the circumstances of an economy on the basis of their effect on the economy's wealth per-capita, where wealth represents the social value of an economy's stock of capital assets comprising of not just the **Reproducible or "Manufactured" Capital** or **Human Capital,** but also the **Natural Capital** and the per-capita estimates need to be duly adjusted to the distribution of wealth. Here, the term "**Reproducible Capital"** is used to refer to manufactured goods like roads, ports, cables, building machinery, equipment etc., while **Human Capital** indicates the population size, its composition, as also the quality indicators like education and health. **Natural Capital** refers to a class of natural goods comprising of ecosystems, land, water, sub-soil resources and the like.

12. The Expert Group in its report recommends compilation of the accounts envisaged in SEEA Central Framework (such as the Asset accounts and the Supply and Use tables). Since the compilation of these accounts entails rich datasets across multiple domains, especially for the compilation in monetary terms and final integration with national accounts, an Inter-Ministerial Group (IMG) constituted by MoSPI facilitates the assessment of datasets for the compilation of these accounts and makes the recommendations for the line of action. The Ministries of Environment, Forests and Climate Change; Water Resources, River Development & Ganga Rejuvenation; Agriculture and Farmers Welfare; Mines; Coal; Petroleum and Natural Gas; New & Renewable Energy; Power as well as Department of Land Resources and the National Remote Sensing Centre are represented in this Group and provide the impetus for the compilation of these accounts.

13. Adding another dimension to the work stream of the Ministry related to the compilation of environmental accounts, India is participating in the "Natural Capital Accounting and Valuation of Ecosystem Services" project launched by the United Nations Statistics Division (UNSD) in five piloted countries- the other countries being Brazil, China, South Africa and Mexico. This EU-funded project is under implementation as a partnership project between United Nations Statistics Division (UNSD), the United Nations Environment Programme (UNEP) and the Secretariat of the Convention of Biological Diversity and is likely to propel India on the path of compilation of ecosystem accounts. The general goal of ecosystem accounting is to encourage and enable greater consideration of natural assets, and the services they provide, in monitoring and planning relating to economic activity. Physical ecosystem accounts – which record the stocks and flow of services from environmental assets - go some way to supporting these activities, but monetary valuation provides a common

metric for assessing overall value and trade-offs concerning the provision of ecosystem services, and ready comparison with stocks and flows already included in the SNA. In this background, the main objective of the UNSD-led project is to mainstream natural capital accounting and the valuation of ecosystem services in data-driven decision and policy-making at the national, regional and local levels.

14. The Inter-Ministerial Group and the pilot project are expected to help in formulating a long-term National Plan for Advancing Environmental-Economic and Ecosystem Accounting. These accounts can then be mainstreamed into policy-making as they are capable of providing advice on: when, where and how natural assets are being used (un)sustainably; how government should prioritize action to protect and improve natural capital, so that public and private activity is focused where it will have greatest impact on improving wellbeing; and research priorities to improve future advice and decisions on protecting and enhancing natural capital.

Coverage of the publication

15. In order to make a gradual progression towards the compilation of these accounts, this supplement on "Environmental Accounts" of the publication "EnviStats-India" initiates the presentation of aggregate environment accounts for India with the asset accounts in physical terms of four natural resources – forest, land, minerals and water. State-wise information has been provided as far as possible so that policy makers could identified the areas warranting focused interventions for taking remedial actions and evaluation. A brief overview of the content of the different chapters is given in the following paragraphs:

Land

16. Land is a crucial natural resource and sustainable use and management of land resources is a necessity for the well-being of people of a country. The chapter contains the national and state-wise land cover accounts in physical terms as also the associated change matrix that have been compiled using the National Remote Sensing Centre's land cover data for the year 2005-06 and 2011-12.

Forest

17. The benefits provided by forest ecosystems, especially those in the context of climate change, are globally recognized and sustainable use of forests without compromising the forest's ability to provide those services is a pre-requisite to continue receiving these benefits. The chapter contains the asset account of forests and other wooded land compiled using the biennial publication of the Forest Survey of India, "India State of Forest Report". In addition, the chapter also contains national and state-wise estimates of growing stock and carbon stock which provides an assessment of tree wealth and the capability to combat and adapt to climate change.

Minerals

18. Minerals are the vital raw material for basic industries, the major source for development in any country. Demand for minerals is increasing world-wide with the increase in population and the associated increase in the consumption demand of individual people. The accelerated growth of mining is posing environmental concerns which need to be addressed so as to ensure its sustainability. India has huge resources of many metallic and non-metallic minerals. With the advancement of technology and its proper selection, these resources can be tapped to shift the country's trajectory of growth minus the environmental hazards. The chapter includes state-wise and mineral-wise reserves / resources for the years 2005, 2010 and 2015, mainly sourced from the National Mineral Inventory conducted by the Indian Bureau of Mines. The information in respect of coal, lignite, petroleum and natural gas has been obtained from the concerned Ministries.

Water

19. Water is one of the most essential natural resources for sustaining life. Aptly it is said: "Jal hi jivan hai". Availability of potable water has become critically scarce in many parts of the country due to continuous increase in demand on account of increase in population, industries and agricultural activities. In addition to the information on the status of water resources of the country compiled from the various publications of the Central Water Commission, the chapter also provides detailed information on groundwater, which is important in view of the predominant dependence on groundwater for irrigation and domestic use.

HIGHLIGHTS OF THE ASSET ACCOUNTS

- **Positive changes in respect of the natural assets**: Dispelling the popular notion that stock of natural assets is declining, a net positive increment was observed in the asset account in some cases. Possible change of fallow land to farmland, increases in forest cover, growing/carbon stock, proven reserves and new findings of resources of minerals - are some examples of such changes, some of which were observed in Andhra Pradesh, Gujarat, Jharkhand, Kerala, Maharashtra and Odisha.
- **Effect of climate change**: Evidences of climate change are also observed in these asset accounts, with a decline in the area of land under 'snow and glacier' in some States and increase in others as also significant fluctuations of 'wetlands/water bodies', examples of which are Himachal Pradesh, Sikkim and Jammu Kashmir.
- **Urbanization**: Built-up area has increased in almost all the States, a change that is now inevitable with the growing population and consequent urbanization. But what is worrisome is the change from farmland to built-up land which is likely to affect the productive capacity of the States. This phenomenon has been observed in Punjab, Haryana, Karnataka, Telangana and West Bengal.
- **Decline in resources**: With the country still being dependent on imports for wood and wood products for meeting its domestic demand, growing stock is a crucial forest resource, the decline of which may be a harbinger of trouble for the economy. Similarly, increase in the level of extraction of groundwater vis-à-vis the annual recharge signals unsustainability of groundwater resources. Such decline was seen in Tamil Nadu, Chhattisgarh, Goa, Odisha and Rajasthan.

20. No doubt the assessment of the natural capital of the States is challenging with mixed signals being observed in the different assets. In order to place these changes into perspective, the status of natural resources in the States could be analysed if these results could be aggregated in terms of an index or an estimate. One of the options available is to attribute a monetary value to the different natural assets. For instance, in the World Bank Report "The Changing Wealth of Nations 2018: Building a Sustainable Future"[1], four classes of environmental assets – energy and mineral resources, forest

[1] Lange, Glenn-Marie, Quentin Wodon, and Kevin Carey, eds. 2018. The Changing Wealth of Nations 2018: Building a Sustainable Future. Washington, DC: World Bank.

resources, agricultural land and protected areas – are considered and evaluated on the basis of their "Net Present Values" as an assessment of "Natural Capital". As all the basic materials for different economic activities emanate from these resources, these estimates provide an assessment of the future productive capacity of the States.

21. ***As an experimental illustration of the valuation***, the estimates of natural capital at constant prices have been compiled using the methodology adopted in World Bank report and the official datasets available for the States. Analysing the changes can help in assessing the aggregate changes in the cohort of environmental assets of States of India. An outline of the 'adapted' methodology is given below:

I. Energy and Mineral Resources

The Net Present Value (NPV) of the proven reserves of fossil energy, metallic and non-metallic minerals have been estimated as the sum of the present value of the stream of expected rents that may be extracted from the resource until it is exhausted. The minor minerals were excluded from valuation.

II. Forest Resources and Protected Areas

The Ministry of Environment, Forest and Climate Change got a study conducted for the "Revision of rates of NPV applicable for different class/category of forests" by the Centre for Ecological Services Management (CESM), Indian Institute of Forest Management (IIFM) Bhopal in collaboration with Forest Survey of India (FSI), the report of which was submitted in November 2014. Estimates of net-present values, duly classified by 14 physiographic zones and four forest cover density classes, as available in the report of the study, have been used to evaluate the forest resources.

III. Agricultural Land: Crop land and Pasture land

State-wise data on the rents for 25 major crops is available under the reports of the Cost of Cultivation Studies, conducted by the Ministry of Agriculture and Farmers Welfare. The information on the annual flow of rents the agricultural land generates has been used to estimate the present value of such rents in the future, assuming that the area of agricultural land is constant. The minimum value of rent per hectare estimated in the Cost of Cultivation for the State has been used for compiling the value of the pastureland.

22. The following table summarizes the state-wise changes between 2005 and 2015.

Level of change in natural capital during 2005-15	States
Increase greater than 5%	Madhya Pradesh, Maharashtra, Manipur and Rajasthan
Increase between 0-5%	Andhra Pradesh, Arunachal Pradesh, Chhattisgarh, Goa, Haryana, Himachal Pradesh, Jammu & Kashmir, Meghalaya, Nagaland, Odisha, Sikkim, Uttar Pradesh and West Bengal
Negative change	Assam, Bihar, Gujarat, Jharkhand, Karnataka, Kerala, Mizoram, Punjab, Tamil Nadu, Tripura and Uttarakhand

23. An analysis of these changes presents another angle to the economic development of the States. The average growth rate of GSDP during 2005-15 for almost all the States is around 7-8%. So the growth in natural capital, if any, is almost insignificant and the economic development seems to be happening at the cost of environment. Therefore, the States may not be able to sustain the rate of development for long. This, in turn, highlights the importance of monitoring the natural capital and making the assessment a basis for sustainable development.

24. It is in this background, the United Nations Statistical Commission "recognized SEEA as an important statistical framework for the post-2015 development agenda and the sustainable development goals indicators" in 2014. The SEEA-Central Framework helps provide a common conceptual approach across the goals by aiding in the development of coherent environmental-economic SDG indicators, which allow spatial and sectoral disaggregation to inform national policy.

25. Additional accounts of the SEEA-Central Framework will be included in the forthcoming issues of this supplement on "Environmental Accounts" of the publication "EnviStats-India". The publication "Envistats-India" intends to provide the technical 'push' to public policy imperatives in India, so that environmental information in mainstreamed to reshape government decision-making for a "better environment, better tomorrow".